2009 Explorer/Mountaineer/Explorer Sport Trac
Workshop Manual

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01: Body

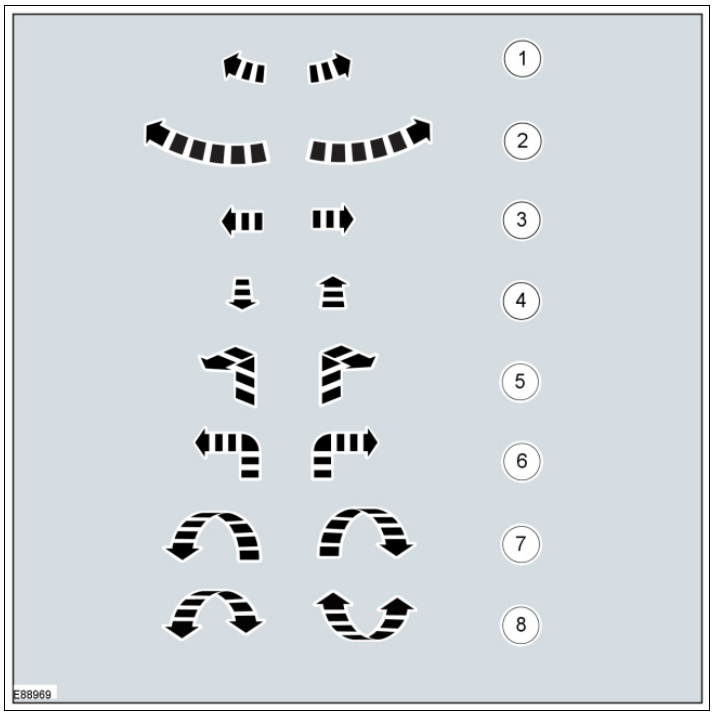
02: Frame and Mounting

Symbols Glossary

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

Movement Symbols

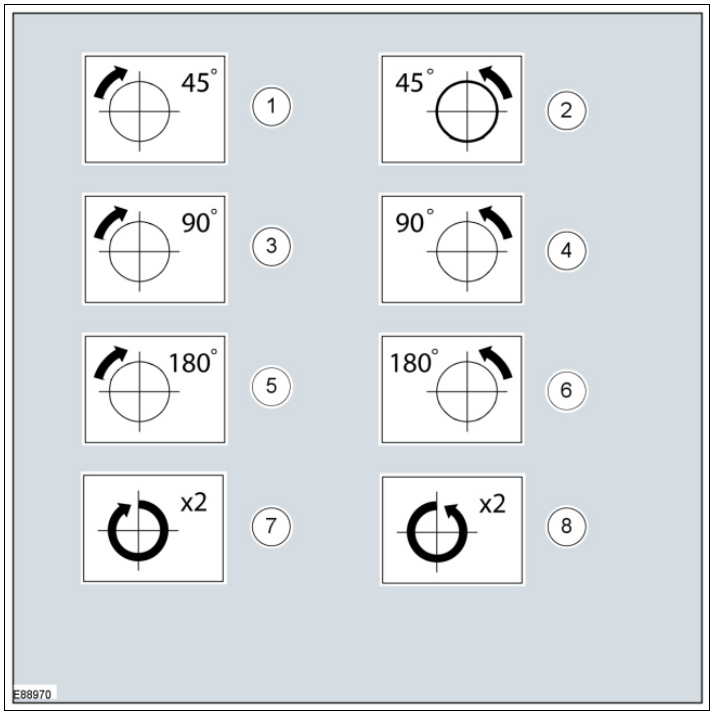
Movement symbols provide detailed information to a required component movement. These component movements can be rotational or 1-3 dimensional movements.



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

Turn Symbols

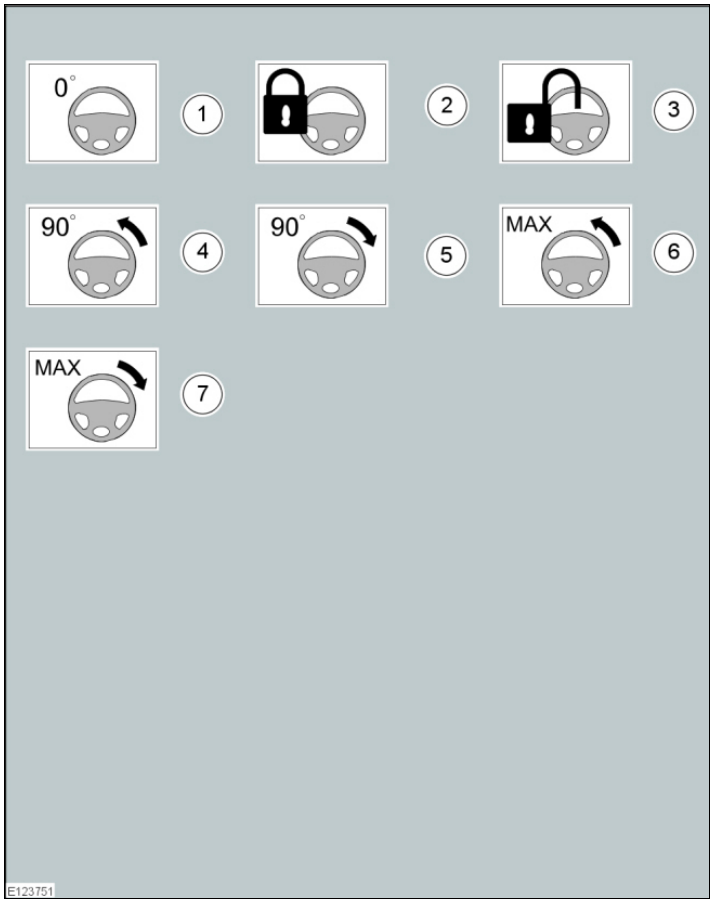
Turn symbols are used to provide further information on the direction or angle of component turns.



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

Steering Wheel Symbols

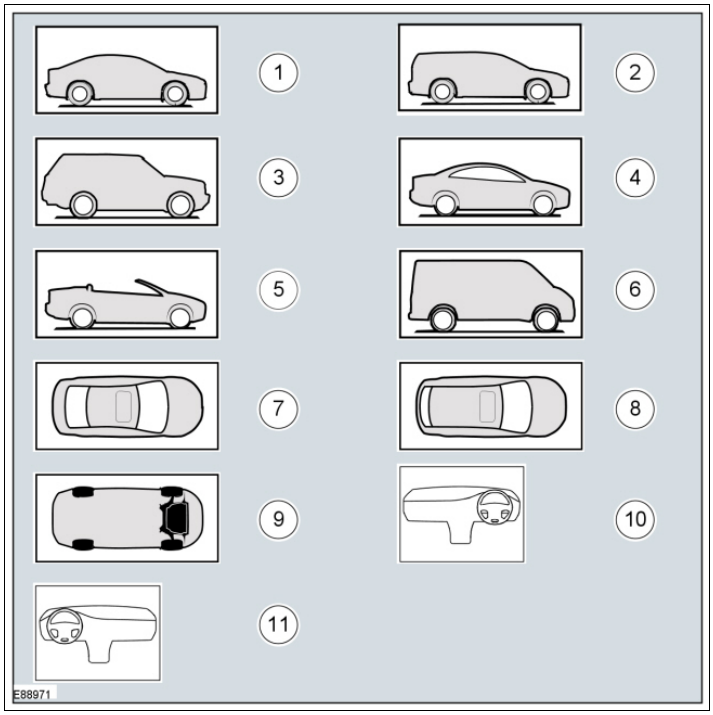
Steering wheel symbols are used to provide further information to a required steering wheel position or steering column lock status.



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

Body Types

Body type symbols are used to identify different body configurations.

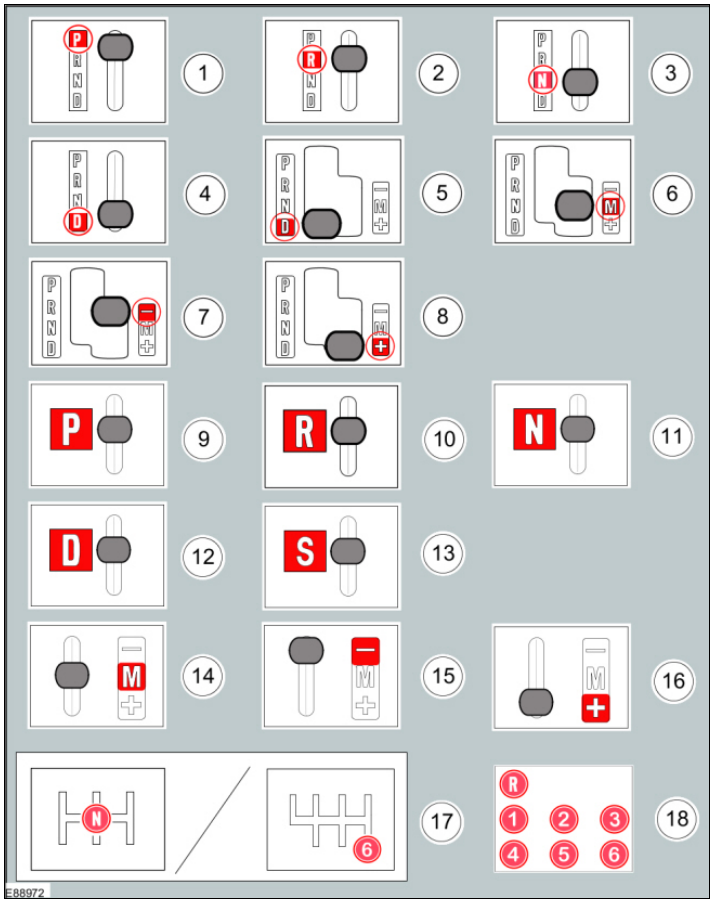


Item	Description
1	3, 4, 5-door body style
2	Wagon body style
3	Sport utility vehicle body style
4	Coupe body style
5	Convertible body style
6	Van body style
7	3, 4, 5-door body style - Top View
8	Wagon body style - Top View
9	Underbody view
10	Right-hand drive (RHD) vehicle
11	Left-hand drive (LHD)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

Gearshift lever and selector lever position symbols

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

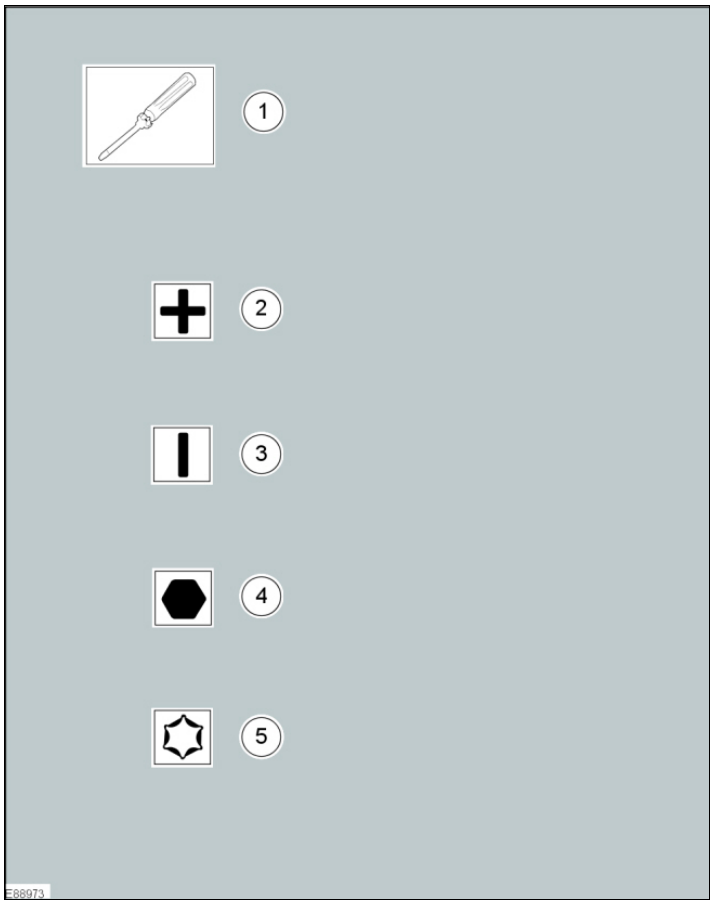
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Item	Description
1	Replaced by symbol 9
2	Replaced by symbol 10
3	Replaced by symbol 11
4	Replaced by symbol 12
5	Replaced by symbol 12
6	Replaced by symbol 14
7	Replaced by symbol 15
8	Replaced by symbol 16
9	Set the selector lever to the park (P)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

Screwdriver symbols

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

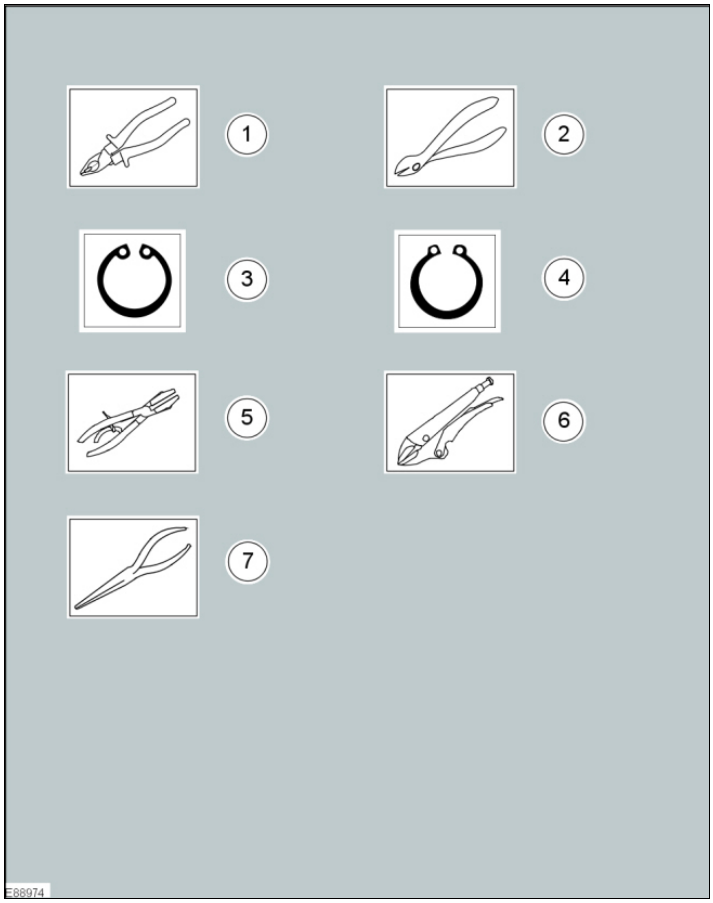


Item	Description
1	Screwdriver
2	Cross bladed screwdriver
3	Flat-bladed screwdriver
4	Hexagonal screwdriver
5	TORX screwdriver

Pliers Symbols

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

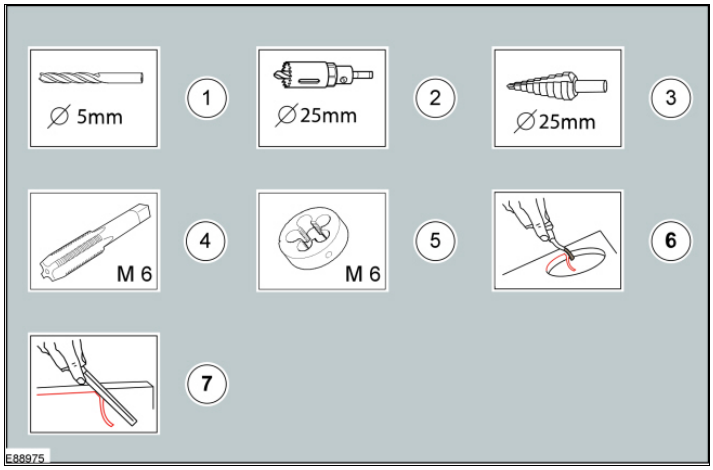
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Item	Description
1	Combination pliers
2	Side cutter pliers
3	Securing ring - inner
4	Securing ring - outer
5	Hose clamp pliers
6	Locking pliers
7	Long nose pliers

Drill Symbols

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

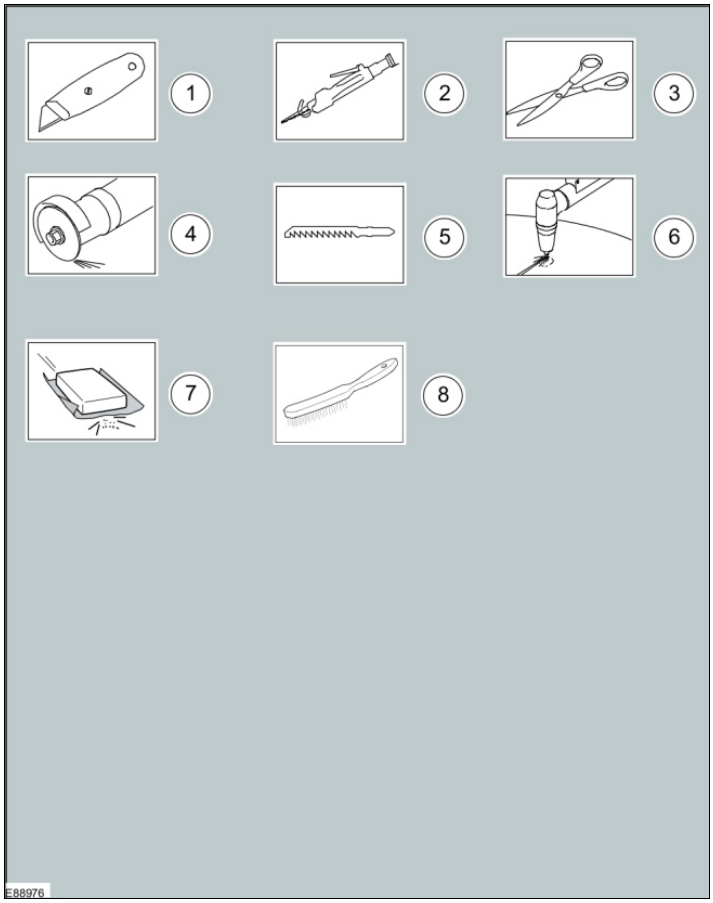


Item	Description
1	Drill bit with a specified diameter
2	Hole saw with a specified diameter
3	Stepped drill bit with a specified diameter
4	Tap with a specified diameter
5	Die with a specified diameter
6	Scraper for circular holes
7	Scraper for straight edges

Cutting Tool Symbols

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

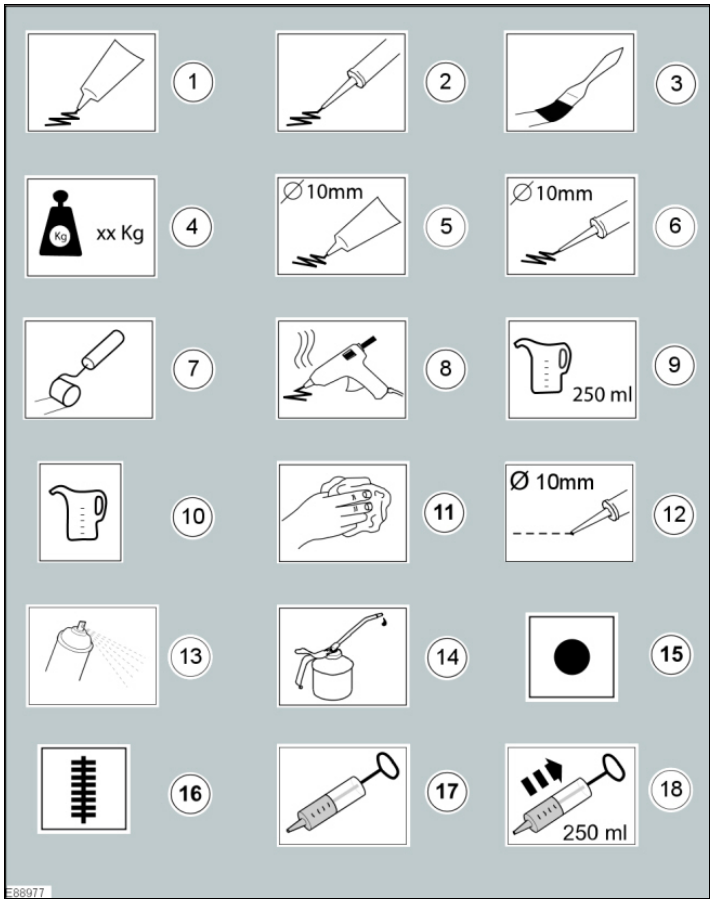
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Item	Description
1	Cutting knife
2	Air body saw
3	Scissors
4	Grinder
5	Jig saw
6	Plasma cutter
7	Sanding Paper
8	Wire brush

Apply Chemical or load symbols

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

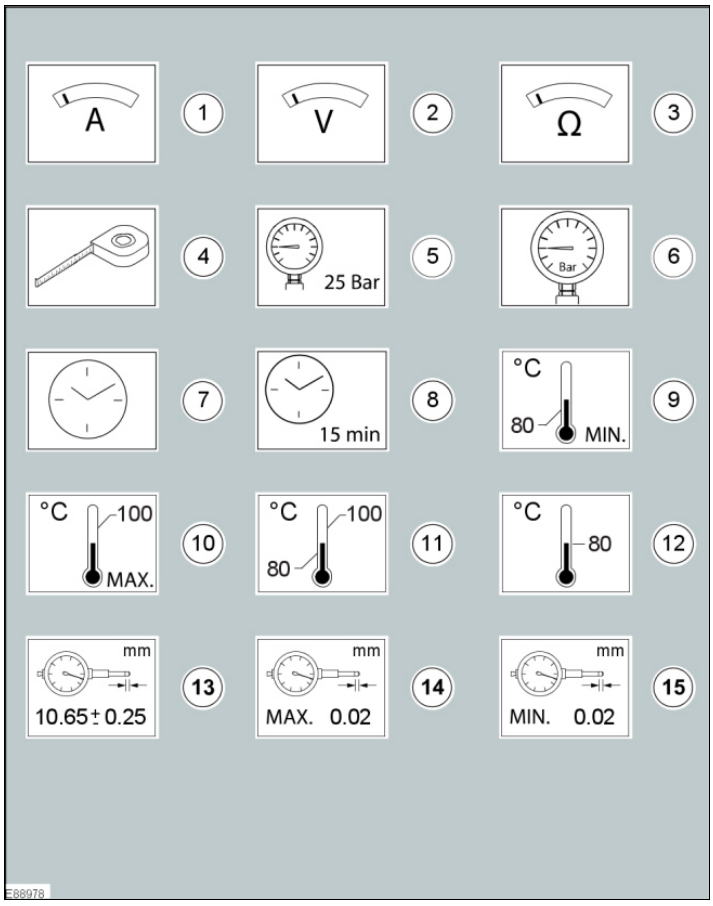


Item	Description
1	Apply the substance from the specified tube
2	Apply the substance from the specified cartridge
3	Apply the specified chemical with a brush
4	Apply the specified load to the specified component
5	Apply a bead with a specific diameter from the specified tube
6	Apply a bead with a specific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

Measurement Symbols

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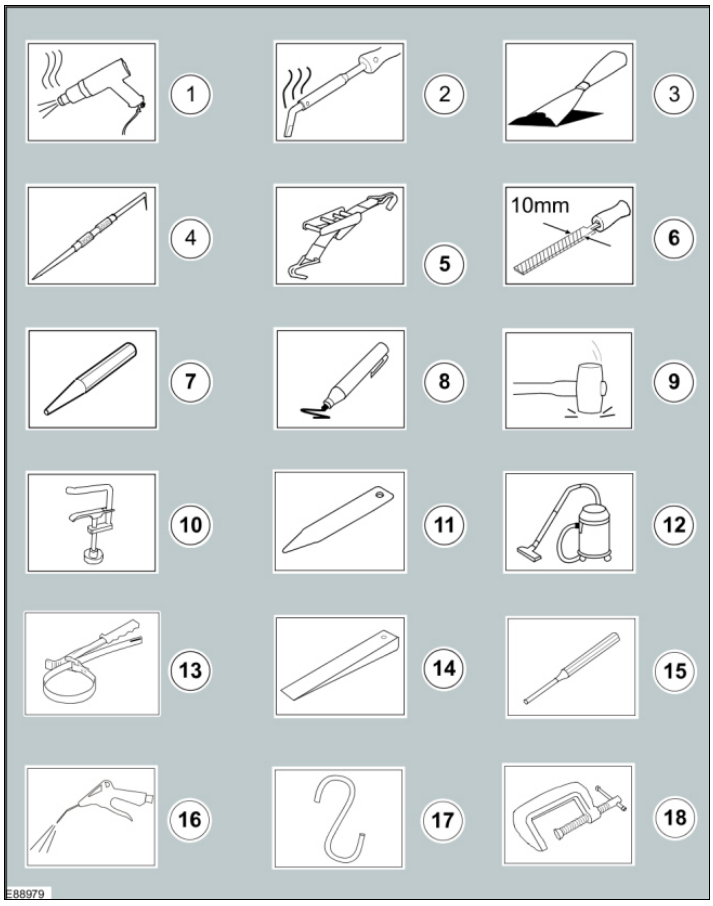
The measurement symbols are used to show where to measure which type of measurement to carry out a procedure step.



Item	Description
1	Measure the current using a digital multimeter
2	Measure the voltage using a digital multimeter
3	Measure the resistance using a digital multimeter
4	Measure the length/distance
5	Check that the specified pressure is available using a suitable pressure gauge
6	Measure the pressure at the specified port using a suitable pressure gauge
7	Measure the time using a suitable stopwatch
8	Wait for the specified period of time
9	The specified task requires the specified minimum temperature
10	The specified task requires the specified maximum temperature not to be exceeded
11	The specified task requires the specified temperature range
12	The specified task requires the specified temperature
13	Measure and check for the specified value using a dial indicator gauge
14	Measure and check for the specified MAX value using a dial indicator gauge
15	Measure and check for the specified MIN value using a dial indicator gauge

General equipment symbols

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

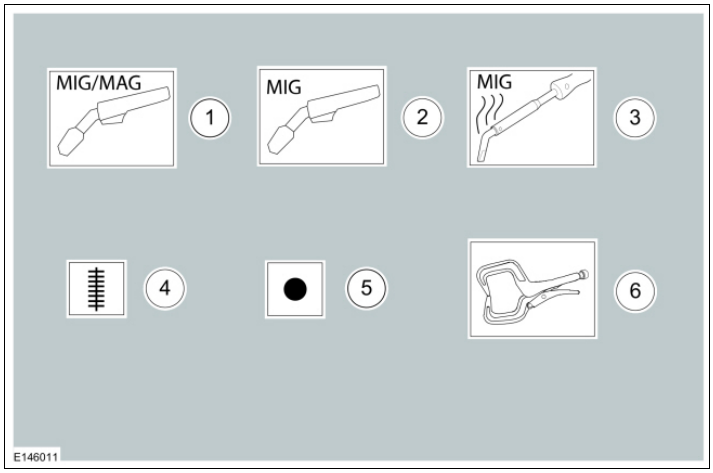


Item	Description
1	Hot air gun
2	Soldering iron
3	Scraper
4	Scriber
5	Securing strap
6	File with specified size
7	Center punch
8	Marker
9	Mallet
10	Hose clamp
11	Interior trim remover
12	Vacuum cleaner
13	Strap wrench
14	Wedge
15	Pin punch
16	Air blow gun
17	Relocate and support the component

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Welding Symbols

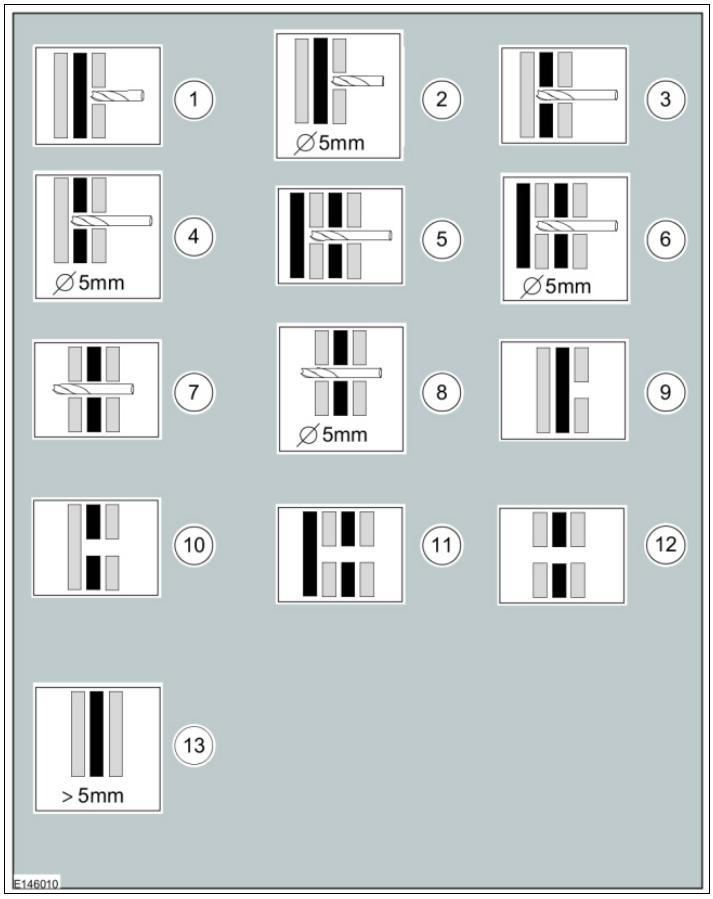
These symbols indicate the type of welding to be used.



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

Drilling and grinding symbols

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

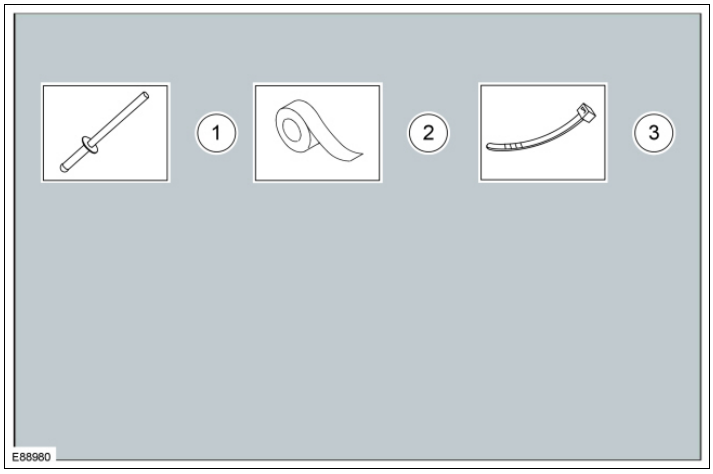


Item	Description
1	Drill through first body layer with a suitable diameter
2	Drill through first body layer with the specified diameter
3	Drill through the indicated number of body layers with a suitable diameter
4	Drill through the indicated number of body layers with the specified diameter
5	Drill through the indicated number of body layers with a suitable diameter
6	Drill through the indicated number of body layers with the specified diameter
7	Drill through all body layers with a suitable diameter
8	Drill through all body layers with the specified diameter
9	Grind one layer
10	Grind two layers
11	Grind to last layer
12	Grind all layers
13	Material thickness > Xmm

Material Symbols

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

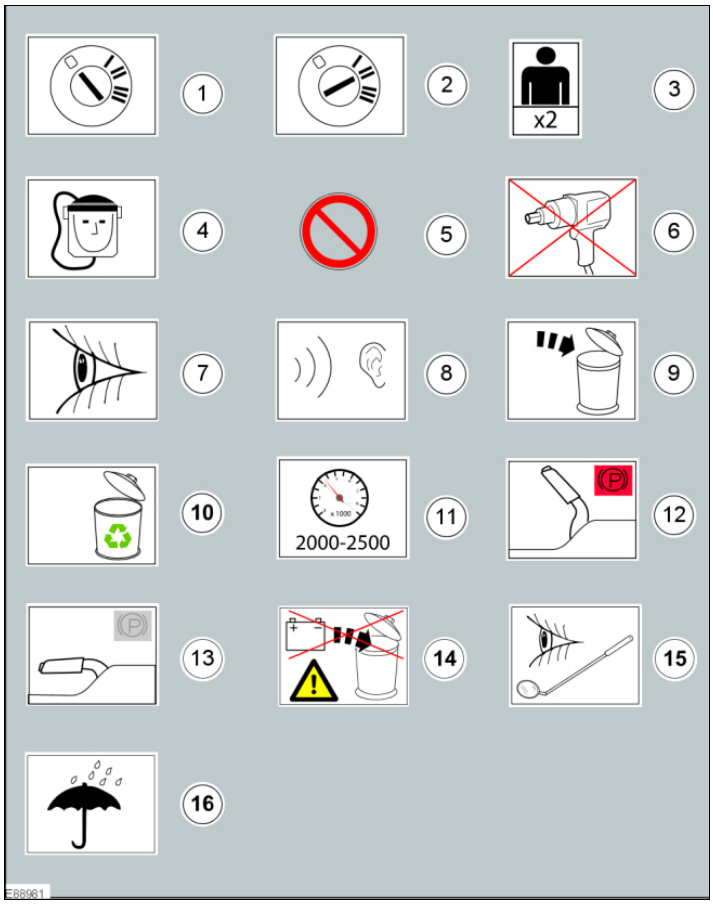
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Item	Description
1	Remove/Install the specified blind rivet
2	Apply tape to the specified component/area
3	Remove/Install the specified cable tie

Miscellaneous Symbols

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

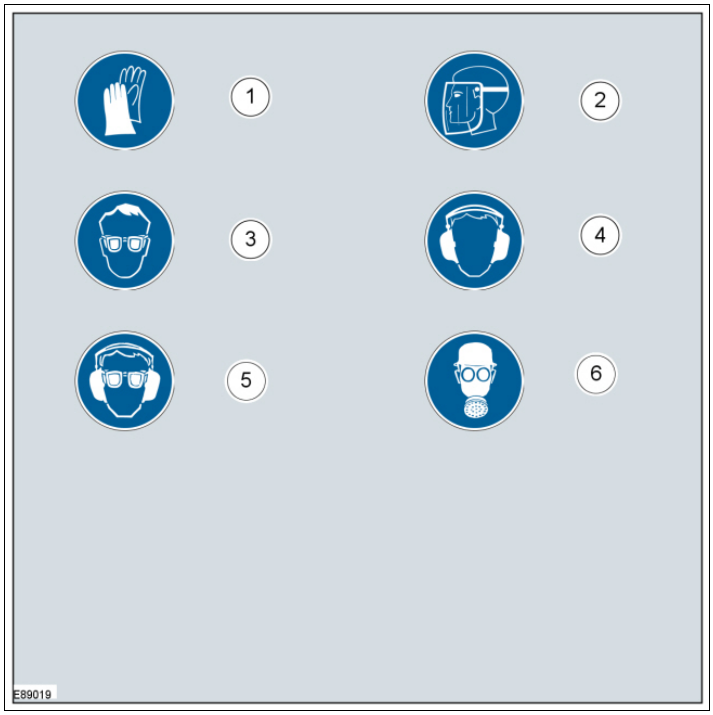


Item	Description

1	Set the ignition switch to the 0 position
2	Set the ignition switch to the II position
3	The procedure step requires the aid of the specified number of supporting technicians
4	Self contained breathing apparatus
5	General prohibition used in combination with another symbol
6	Do not use power tools
7	Visual check
8	Noise check
9	Dispose the specified component
10	Replaced by item 9 (Dispose the specified component)
11	Set the engine speed to the specified value
12	Fully apply the parking brake lever
13	Fully release the parking brake lever
14	Do not dispose of batteries into the waste bin
15	Visual check using a mirror
16	Area/component must be dry

Mandatory Protective Equipment - Health and safety symbols

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



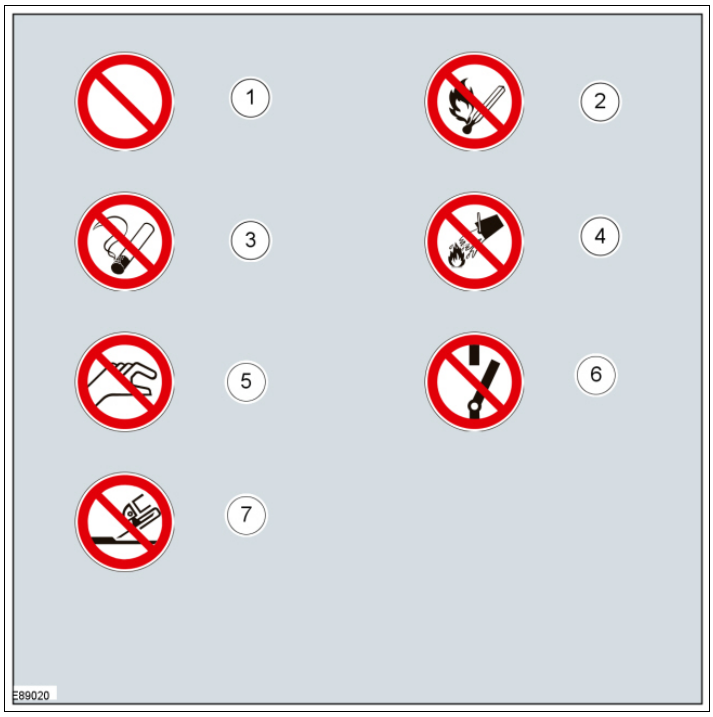
Item	Description
1	Wear protective gloves
2	Wear face guard
3	Wear safety goggles

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4	Wear ear protectors
5	Wear safety goggles and ear protectors
6	Wear a respirator

Prohibition - Health and safety symbols and component damage

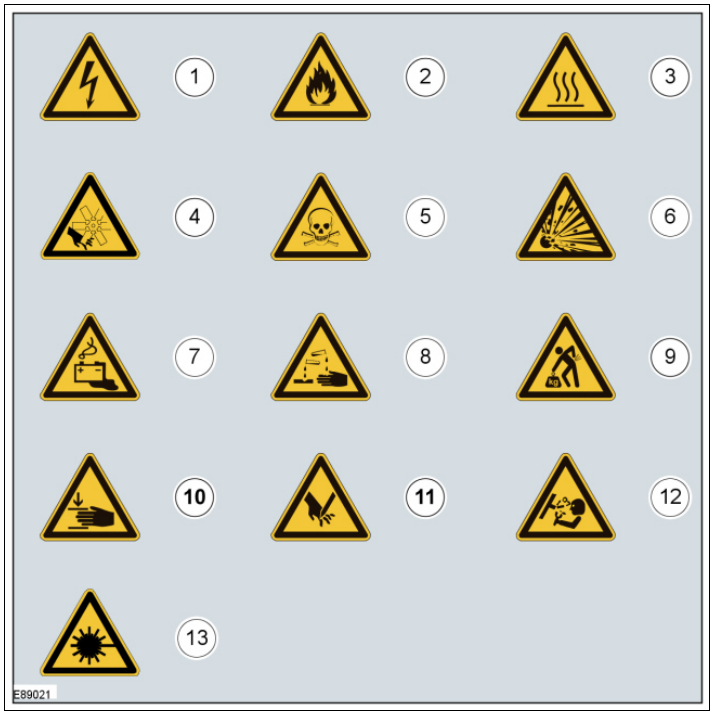
The prohibition symbols are used to prohibit the specified actions to avoid or at least reduce possible component damage and health and safety risks.



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

Warning Symbols - Health and Safety Warnings and Component damage

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

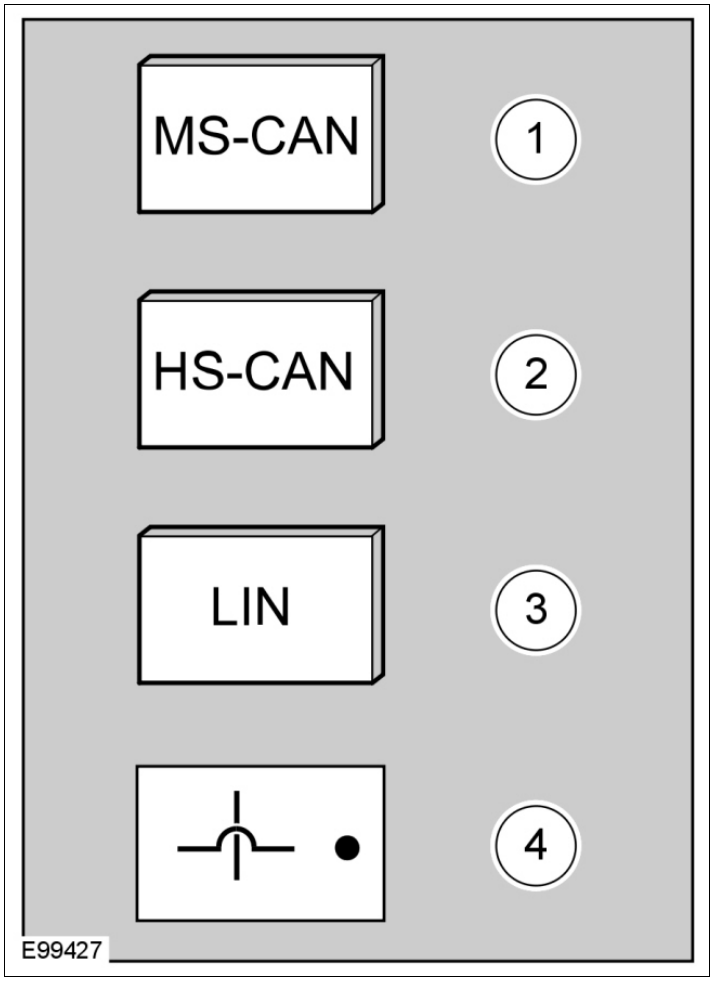


Item	Description
1	Hazardous voltage/Electrical shock/Electrocution
2	Fire hazard/Highly flammable
3	Burn hazard/Hot surface
4	Automatic start-up
5	Toxic
6	Explosive material
7	Battery hazard
8	Corrosive material
9	Lifting hazard
10	Hand crush/Force from above
11	Cutting of fingers or hand
12	Pressure hazard
13	Invisible laser radiation. Do not view directly with optical instruments (magnifiers). Class 1M laser product

Control Diagram symbols - Description and Operation procedures

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

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Item	Description
1	Medium Speed Controller Area Network
2	High Speed Controller Area Network
3	Local Interconnect Network
4	Wires cross but are not connected

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Using This Manual

Introduction

This manual describes and directs repair procedures for this vehicle model year. It includes diagnostics for all vehicle systems except driveability and emission control. Refer to the separate Powertrain Control/Emissions Diagnosis (PC/ED) manual for driveability and emission control diagnostics.

Information is organized into groups, with sections that have subsections dividing them.

Warnings, Notices, and Notes in This Manual

Warnings provide information to avoid personal injury and to make sure service actions on critical safety systems are performed correctly.

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

Notes provide information critical for a complete and effective repair.

Warnings that apply to an entire system or workshop manual section are located in section 100-00 Description and Operation Safety Warnings .

Warnings, Notices, or Notes that apply to an entire procedure will be placed at the beginning of the procedure.

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

Vehicle and Engine Orientation Identifiers

LH and RH vehicle designations are oriented from the driver's seat position looking forward. LH and RH engine designations are oriented from the flywheel position looking towards the crankshaft pulley.

How to Use Diagnostic Information

DTC and Symptom Charts

Module DTC Charts are used to begin and direct the diagnosis of a DTC. Symptom Charts contain concern symptoms and direct solutions either in the chart or in a linked Diagnostic Routine. Both DTC and Symptom Charts may provide the solution within the chart, or provide a link to the appropriate Diagnostic Routine.

In some sections, the Symptom Chart is preceded by a Preliminary Inspection which must be followed prior to using the Symptom Chart

Using Module DTC Charts

This Workshop Manual contains diagnostics for DTCs set by vehicle modules. Driveability and emission DTCs are covered in the separate Powertrain Control/Emissions Diagnosis (PC/ED) manual. If a PCM-set DTC is not listed in the Workshop Manual, it is serviced in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

DTC diagnostics are found in both on-line and printed publications and are used as follows:

- On-line publications: Using the left side menu, click on the Master DTC Chart link to view the vehicle module DTC charts. Each module has a chart with links or in-chart solutions for all DTCs diagnosed in the Workshop Manual.
- Printed publications: Use the DTC index in the rear of the book.

Diagnostic Methods

Diagnostic Methods provides information to support diagnosing Ford vehicles. Diagnostic strategies, diagnostic tool support information, and advanced circuit testing methods are included. REFER to Diagnostic Methods .

Diagnostic Routines

Diagnostic Routines provide information to determine the root cause of concerns addressed in either a DTC Chart or Symptom Chart. Each Diagnostic Routine contains:

- Diagnostic Overview
  - ♦ Wiring Diagram References (as applicable)
  - ♦ Normal Operation and Fault Conditions
  - ♦ Visual Inspection and Diagnostic Pre-checks
- Tool Table (as applicable)
- Material Table (as applicable)
- Pinpoint Test Steps

Component Tests

Component Tests are used to separately analyze a single common component in a system. The test will determine if the part is functioning correctly.

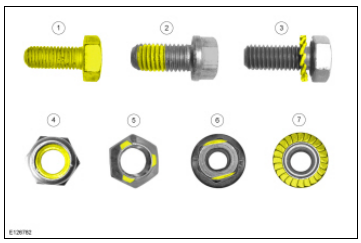
Mechanical Procedures Such As Removal and Installation

Reuse Of Fasteners, Seals, Or Gaskets

The following is a list of assumptions made in the reuse of fasteners, seals, or gaskets.

- Seals and gaskets must be replaced unless otherwise specified.
- Standard fasteners are reused unless otherwise specified.
- Fasteners with self-locking features must be replaced unless otherwise noted. Reminder text may or may not be included with the procedure step. Examples of fastener coatings or fasteners with mechanical locking (with the locking features highlighted yellow) are shown in illustration 1.
- Torque to yield bolts (bolts with more than one stage of tightening torque and a final torque angle specification) must be discarded and new torque to yield bolts installed unless otherwise stated within the procedure.

Illustration 1 - self-locking coatings or locking feature are highlighted yellow



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Graphics

Illustrations in this manual may be used to replace written step instructions. Color-coding (see color scheme in this document) is used to communicate the required step action or actions. Service action icons (see Symbols Glossary) are used to add additional information regarding the required action.

- The color scheme in a step graphic (an illustration used in removal or installation steps) indicates servicing information as follows:
  - Fasteners (including panel retainers) or electrical connectors - Magenta (Purple)
  - Target component that is to be removed - Blue
  - Components that must be removed prior to the target component shown in blue - Brown or Green
  - Components placed aside for access, but not removed; highlighted areas such as inspection areas, adjustments or measurements - Yellow
  - Essential Special Service Tools (ESSTs) and other tools - Pale Blue
  - Chemical or Sealer apply areas - Alternating blue and white dashes (see illustration 4)
  - Sectioned or cut-away areas - Red
  - Remaining components - Grey

Callouts in graphics indicate removal (or tightening) order, or identify individual instructions in substeps of the same number (such as different torque values).

Arrows containing x numbers (Illustration 2) indicate the number of identical fasteners or connectors to be removed or installed in the graphic.

In Illustration 2, two identical fasteners are indicated by the x2 arrow, with another arrow illustrating a third fastener of a different type. Because the different fasteners require different torques, callouts are used to identify those two torque values in the associated step text. The hose clamp is another fastener to be removed. The yellow coloring of the hose indicates it is to be moved aside (not removed).

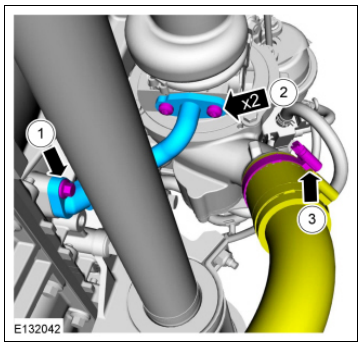
The following written steps would be necessary if the illustration did not have color coding:

1. Remove the engine oil pipe fastener at the engine connection.

2. Remove the two engine oil pipe fasteners from the turbocharger and remove the pipe.

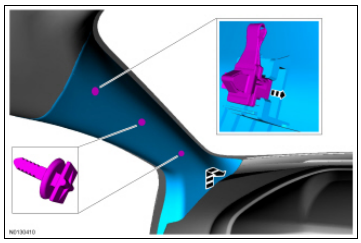
3. Remove the air inlet hose from the turbocharger and position aside.

Illustration 2



Hidden fasteners, such as panel retainers, are identified in the illustration by a magenta disc. An inset detail view illustrating the fastener type may be included (Illustration 3).

Illustration 3 - Note motion arrow at panel bottom; it indicates to lift panel up, then move inward to remove



Symbols

Symbols may be used inside graphics or in the text area to communicate service actions. The following examples demonstrate the use of some of these symbols. REFER to Symbols Glossary for a complete symbols list with explanations.

In the Illustration 4 example, service action symbols are shown as used to direct the application of sealer, lubricant, weight, tape or cleaning detergent to a component. In this example a bead diameter of "xx" millimeters is prescribed. The blue and white dashes indicate where the material is applied.

Illustration 4

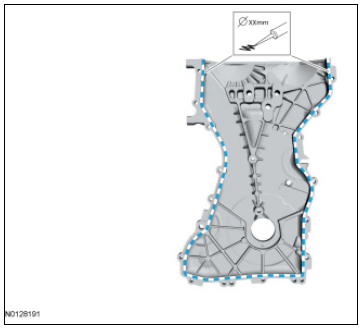


Illustration 5 is an example of location symbols used to show the location of a component or system within the vehicle.

Illustration 5

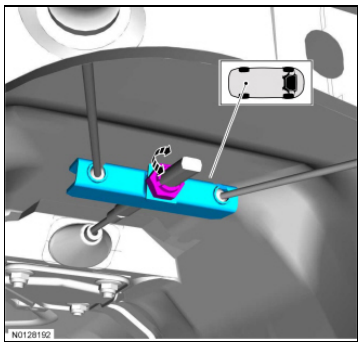
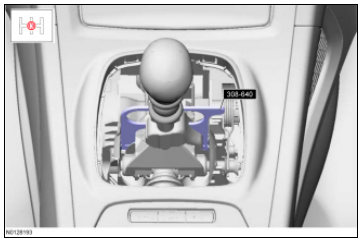


Illustration 6 shows how gearshift lever or selector lever position symbols may be used to indicate the gearshift lever or selector lever position required. The required Essential Special Service Tool to align the shift mechanism is shown in pale blue and identified by ESST number.

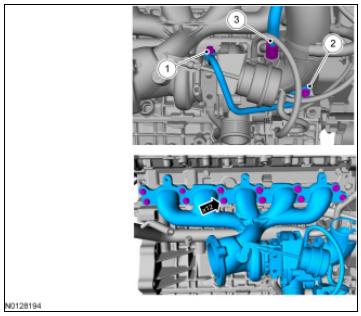
Illustration 6

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Callouts or arrows may be used to identify components for supporting special information, such as a required sequence or to indicate a number of identical components. Illustration 7 shows a removal order in the top graphic and the bottom graphic indicates 12 identical bolts.

Illustration 7



Standard tool symbols direct the use of standard tools to perform a service action, such as the cutting of carpet shown in Illustration 8. Tool symbols may include dimensional values (for example, a drill with a specified diameter).

Illustration 8

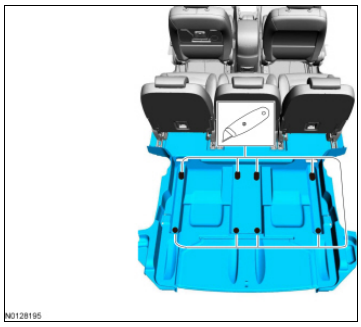


Illustration 8

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Safety Warnings

Review carefully the General Service Health and Safety Precautions below before beginning any repair. Following these general service warnings are specific system warnings that must be carefully reviewed before beginning work on any listed system.

General Service Health and Safety Precautions

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

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

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

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

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

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

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

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

⚠ WARNING: Disconnect the window regulator motor connector before working inside the vehicle doors. Service actions inside the door (such as door latch, handle or lock cylinder service) or operating the remote keyless entry (RKE) fob may activate the windows on vehicles equipped with global open/close. Serious injury to hands or arms may occur if a window motor is activated during service.

Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.

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

⚠ WARNING: Use only a type-D fire extinguisher to extinguish magnesium fires. Never attempt to use a type-A, -B, -C extinguisher, or water, as these items are ineffective and may accelerate a magnesium fire. Failure to follow these instructions may result in serious personal injury.

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

⚠ WARNING: Always verify that the lockpin on a bench-mounted holding fixture is correctly secured to help prevent unexpected component rotation. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For emergency medical information seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

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

Carefully review the following system safety warnings before beginning any service or repair work.

High Voltage System Health and Safety Precautions

⚠ WARNING: To prevent the risk of high-voltage shock, always follow precisely all warnings and service instructions, including instructions to depower the system. The high-voltage system utilizes approximately 300 volts DC, provided through high-voltage cables to its components and modules. The high-voltage cables and wiring are identified by orange harness tape or orange wire covering. All high-voltage components are marked with high-voltage warning labels with a high-voltage symbol. Failure to follow these instructions may result in serious personal injury or death.

⚠ WARNING: Never install the service disconnect plug when a high-voltage service cover is removed. Always install the cover prior to connecting the service disconnect plug. The cover prevents inadvertent contact with the high voltage which is present at several points under the cover. Failure to follow these instructions may result in serious personal injury or death.

⚠ WARNING: Turn OFF the ignition switch for a minimum of 5 minutes before removing high-voltage cables. High-voltage cables and wiring are orange in color. The nominal high-voltage traction battery voltage (HVTB) is 330 V DC. Failure to follow these instructions may result in serious personal injury or death.

Climate Control System Health and Safety Precautions

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⚠ WARNING: Air conditioning R-134a liquid refrigerant is capable of harming eyes or freezing skin. Always wear safety goggles and avoid contact with liquid refrigerant. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Air conditioning R-134a refrigerant gas is capable of displacing the air necessary for breathing in a confined space and can produce toxic gasses if burned at high temperatures. Do not release a large quantity of R-134a gas within a confined space or allow it to be exposed to a high temperature flame (such as a torch). Consult the Material Safety Data Sheet for further information. Failure to follow these instructions may result in serious personal injury or death.

⚠ WARNING: Use extreme care and observe all safety and service precautions related to the use of refrigerants as outlined on refrigerant tank and on recovery and charging equipment. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before disconnecting any heater water hoses, shut OFF the engine and wait until engine is fully cool. Failure to comply with this warning may result in serious injury or burns from hot liquid escaping from the engine cooling system.

⚠ WARNING: The electric booster heater may become hot during use and can burn unprotected skin. Allow enough time for the heater to cool before servicing. Failure to follow this instruction may result in serious personal injury.

Battery and Battery Charging System Health and Safety Precautions

⚠ WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

⚠ WARNING: Battery posts, terminals and related accessories contain lead and lead components. Wash hands after handling. Failure to follow these instructions may result in serious personal injury.

Brake System Health and Safety Precautions

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

Body Repair Health and Safety and General Precautions

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

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

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

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

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

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

Engine Cooling System Health and Safety Precautions

⚠ WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

Gasoline and Gasoline-Ethanol Fuel System Health and Safety Precautions

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

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⚠ WARNING: Clean all fuel residue from the engine compartment. If not removed, fuel residue may ignite when the engine is returned to operation. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Avoid contact with fuel during a visual inspection for fuel leaks with the engine running. Do not work on the fuel system until the pressure has been released and the engine has cooled. Fuel in the high-pressure fuel system is hot and under very high pressure. High-pressure fuel may cause cuts and contact with hot fuel may cause burns. Failure to follow these instructions may result in serious personal injury.

Diesel Fuel System Health and Safety Precautions

⚠ WARNING: Contact with exposed fuel injector wiring, if energized, may result in electric shock. Use care when working on or around energized fuel injector wiring. Fuel injector wiring supplies high voltage to operate the fuel injectors. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not work on the fuel system until the pressure has been released and the engine has cooled. Fuel in the high-pressure fuel system is hot and under very high pressure. High-pressure fuel may cause cuts and contact with hot fuel may cause burns. Failure to follow these instructions may result in serious personal injury.

Safety Belt and Supplemental Restraint System (SRS) Health and Safety Precautions

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not bleach or re-dye the safety belt webbing, as the webbing may weaken. Failure to

follow this instruction may increase the risk of serious personal injury or death in a crash.

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

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

⚠ WARNING: Anytime the Safety Canopy or side air curtain module has deployed, a new headliner and new A-, B-, C-, and/or D-pillar upper trim panels and attaching hardware must be installed. Make sure the headliner includes the word AIRBAG where it meets each B-pillar trim panel. Remove any other damaged components/hardware, and install new components/hardware as required. Always use new torque-prevailing type J-nuts when installing the Safety Canopy. Failure to follow these instructions may result in the Safety Canopy or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Do not repair or service restraint component connector terminals. If restraint connector terminals need repair, replace with the service connector pigtails. Failure to follow this instruction may result in incorrect operation of the vehicle safety restraint, which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Never disassemble or tamper with seat belt deployable components, including pretensioners, load limiters and inflators. Never back probe deployable device electrical connectors. Tampering or back probing may cause an accidental deployment and result in personal injury or death.

⚠ WARNING: Never tamper with, repair, or modify a Restraints Control Module (RCM) or any other Supplemental Restraint System (SRS) component. Failure to follow this instruction may result in incorrect operation of the Supplemental Restraint System (SRS), which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Never probe the electrical connectors on airbag, Safety Canopy® or side air curtain assemblies. Failure to follow this instruction may result in the accidental deployment of these assemblies, which increases the risk of serious personal injury or death.

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Do not obstruct or place objects in the deployment path of the Safety Canopy or side air curtain assembly. Never insert any type of fastener or tie strap around any portion of the Safety Canopy, side air curtain assembly, or related interior trim panel. Failure to follow this instruction may result in the Safety Canopy or side airbag curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Occupant Classification System (OCS) parts are calibrated as an assembly and must only be replaced in the configuration they are sold. Never separate parts of an assembly. Failure to

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follow this instruction may result in incorrect operation of the OCS and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Never allow oil, grease, water or foreign contaminants to get on/in the occupant classification system (OCS) components or electrical connectors. Failure to follow this instruction may result in incorrect operation of the OCS and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

⚠ WARNING: Always carry or place a live Safety Canopy®, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: Always carry out the Zero Seat Weight Test whenever the passenger seat has been removed from the vehicle or any seat component has been removed from the seat. Never drive a vehicle with any seat components removed from an occupant classification system (OCS) equipped seat. Failure to follow these instructions may result in incorrect operation of the occupant classification system (OCS), which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Do not paint any airbag trim covers or deployment doors. Paint may cause the airbag to deploy incorrectly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

Wheel and Tire Health and Safety Precautions

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

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

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

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

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

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

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Diagnostic Methods

Effective Diagnostic Techniques

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

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

Diagnostic Scan Tool Testing

Network Test

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

Recommended Practice: REFER to Symptom Chart in Section 418-00 to diagnose a network outage or no response from an individual module (or modules).

DTC Retrieval

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

Continuous Memory Diagnostic Trouble Codes (CMDTCs)

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

Ford On-Demand DTCs

Ford Motor Company modules have a unique feature that performs a special diagnostic program at the request of the technician (using a scan tool). This "On-demand" diagnostic program can exercise system outputs not normally running when the car is parked and record observed faults. These diagnostic codes are communicated to the scan tool; they are not recorded in module memory. An on-demand test is an effective tool for evaluating real input and output conditions during module activity - activity that might not normally be occurring during service bay conditions. For example, an air suspension module on-demand test can run the compressor, vent the system, and observe the report from the height sensor even when the car is already at correct trim height and not requiring height adjustment.

Network Communication DTCs

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

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

DTC Nomenclature (SAE J2012 and ISO 14229)

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

Integrated Diagnostic System (IDS) Scan Tool Usage

If The IDS Scan Tool Does Not Communicate With The VCM

1. Check the VCM power; examine the connection to the vehicle.
   - The VCM LED illumination prove-out confirms power and ground from the DLC are provided to the VCM .
   - **Recommended Practice:** REFER to Section 418-00 , No Power to the Scan Tool, to diagnose no power to the VCM .
2. Check the scan tool connection to the VCM .
3. Follow scan tool instructions to retry.

If The IDS Scan Tool Does Not Communicate With The Vehicle

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

1. Verify the scan tool operation with a known good vehicle.
2. Verify the ignition is ON.
3. If an IDS session cannot be established with the vehicle (IDS may state "No communication can be established with the PCM"):

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- Choose "NO" when the scan tool prompts to retry communication.
- Enter either a PCM part number, tear tag, or calibration number to identify the vehicle and start a session.
    - The PCM part number can be determined from OASIS -- choose "HVBoM" from the OASIS page and search for the PCM part number
    - The PCM part number and 4-character tear tag are printed on the PCM label.
- Establish a session based on the PCM information (above).

4. Using the tool box menu, run the network test.
    - Determine if all modules on the network are unresponsive or if only the PCM does not communicate.
    - **Recommended practice:** REFER to Symptom Chart in Section 418-00 to diagnose the network outage or no response from the PCM.

Measuring Automotive Circuits

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

- To avoid wiring pin (terminal) damage, Rotunda Flex Probes NUD105-R025D or equivalent must be used to connect test equipment or jumper wires to pins (terminals).
- Male to female pin (terminal) fit is critical for correct connection and durability.
    - Pin (terminal) fit may be checked by using the mating pin (terminal) to test for normal separation force (a damaged pin or terminal will have very low separation force from the mating pin or terminal)
    - Correctly checking the separation force of small pins (terminals) may require removal of the connector terminal guide/retainer if it adds drag to the pin (terminal) insertion or removal
- Replace damaged connectors or pins (terminals).
    - Use the Wiring Diagram connector view (cell 150) to identify the correct replacement connector with pigtail.
    - Use the Wire Harness Terminal Repair Guide to identify and order the correct replacement pin and pigtail. Available through Ford Dealers, REFER to FMC dealer website, or REFER to www.fcs.dealerconnection.com/wire .

Checking Power-Providing Circuits

- Measuring a power wire with the intended load disconnected using a DMM will only find open circuits (open fuse or wire).
- **Recommended practice:** Circuits carrying approximately 200-1000 mA* may be loaded with the specified test light SGT27000. Measure circuit voltage with a DMM while the test light is connected and illuminated. A reduction in the voltage present during test-light-loading indicates excessive circuit resistance.
- **Recommended practice:** Circuits carrying more than one ampere* should be loaded with a device requiring similar current (e.g., a headlamp bulb may be effective). A reduction in the voltage present during loading indicates excessive resistance.
- *Circuit current is matched to wire gauge/size; Examples:
    - Conductor sizes of 24 gauge (.5 mm) or smaller are generally used to carry approximately 1 ampere (1000 mA) or less. Use of the test light to load these circuits is appropriate.
    - Conductor sizes of 20 gauge (.8 mm) or larger are generally used to carry approximately 5 amperes (5000 mA) or more. Match the substitute load (measure substitute load current first as necessary) to this current level.

Checking Ground-Providing Circuits

- The best method of checking ground circuits is to measure the circuit voltage drop during component

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

Checking Circuit Continuity

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

Checking For Unintended Continuity (Shorts) To Other Circuits

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

Checking Circuits By Back-Probing A Connector

- Back-probing should be a testing method of last resort. It should only be employed where a diagnostic step requires a circuit to be tested under actual operating conditions. Back-probing is a risky testing method due to the uncertainty of the probe connection and the possibility of damaging terminals.
- Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors and subsequent electrical faults.
    - Use Rotunda Back-Probe Pins POMA6411 to assist in making a good test connection and to prevent connector or terminal damage during back-probing.
- Do not test for the presence of voltage at a single point where zero volts is a possible result (you cannot tell the difference between a bad probe contact and a zero volt result).
- Do not test for continuity/opens (using a DMM ohmmeter) between two points (you cannot tell the difference between bad probe contacts and an open circuit).
- Back-probing may be used where the circuit must be analyzed with the voltage-drop method (if the circuit carries greater than 5 amperes and no other means of testing will definitively eliminate circuit

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

Circuit Analysis Using Jumper Wires (Creating Substitute Circuits)

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

Checking Modules

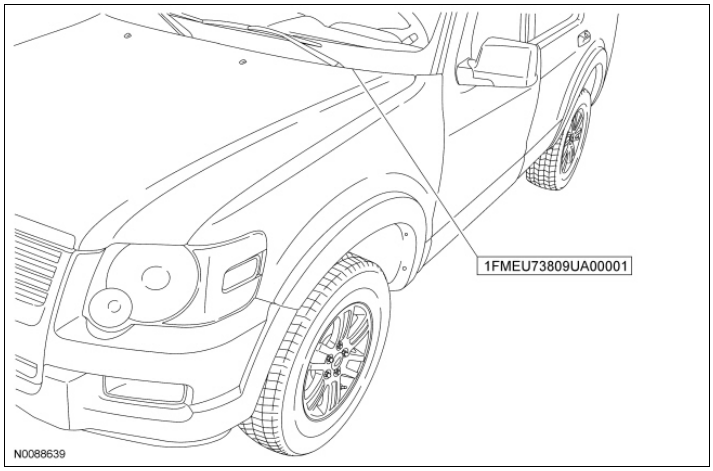
- Generally, module failure rate is very low and therefore replacement modules usually do not resolve the root cause. Incorrect replacement of a module is often the result of inadequate testing.
  - ♦ Understand the correct module function.
  - ♦ Make sure programmable parameters are set correctly for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

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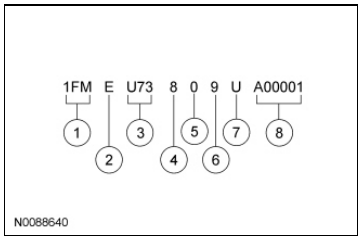
Identification Codes

Vehicle Identification Number (VIN)

Vehicle Identification Number (VIN) Tag Locator

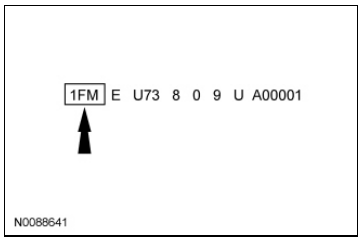


The Vehicle Identification Number (VIN) is a 17-digit combination of letters and numbers. The VIN is stamped on a metal tab riveted on the instrument panel, top upper left of the dash. The VIN is also found on the Vehicle Certification (VC) label. If the VIN plate requires replacement, authorized dealers must contact their respective regional office.



Item	Description
1	World Manufacturer Identifier (WMI)
2	Restraint type and Gross Vehicle Weight Rating (GVWR)
3	Vehicle line, series, body type
4	Engine type
5	Check digit
6	Model year
7	Assembly plant
8	Production sequence number

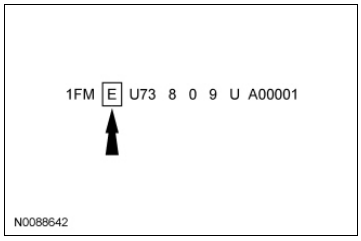
World Manufacturer Identifier (WMI)



The first 3 VIN positions are the World Manufacturer Identifier (WMI).

- 1FM - Ford Motor Company, USA, Multi-Purpose Vehicle (MPV)
- 4M2 - Ford Motor Company (Mercury), USA, MPV

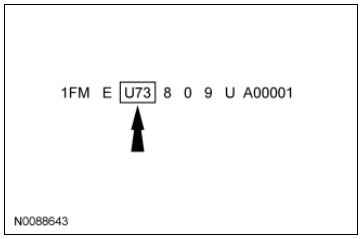
Restraint Type and Gross Vehicle Weight Rating (GVWR)



The fourth VIN position is the restraint brake type and Gross Vehicle Weight Rating (GVWR) code.

- E - 6,001-7,000 pounds GVWR with driver and front passenger air bags and side impact air canopy

Line, Series and Body Type



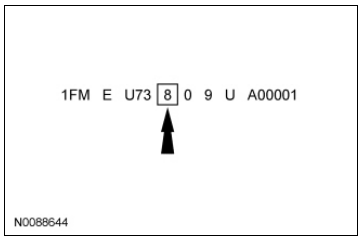
VIN positions 5 through 7 indicate the vehicle line, series and body type.

- U23 - Explorer Sport Trac, All-Wheel Drive (AWD), Limited
- U31 - Explorer Sport Trac, Rear Wheel Drive (RWD), XLT
- U33 - Explorer Sport Trac, RWD , Limited
- U37 - Mountaineer, RWD , Luxury
- U38 - Mountaineer, RWD , Premier
- U47 - Mountaineer, AWD , Luxury
- U48 - Mountaineer, AWD , Premier
- U51 - Explorer Sport Trac, Four-Wheel Drive (4WD), XLT
- U53 - Explorer Sport Trac, 4WD , Limited
- U63 - Explorer, RWD , XLT
- U64 - Explorer, RWD , Eddie Bauer
- U65 - Explorer, RWD , Limited
- U73 - Explorer, 4WD , XLT
- U74 - Explorer, 4WD , Eddie Bauer
- U75 - Explorer, 4WD , Limited

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- U83 - Explorer, AWD , XLT
- U84 - Explorer, AWD , Eddie Bauer
- U85 - Explorer, AWD , Limited

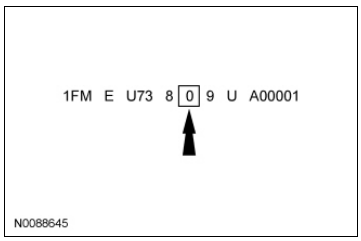
Engine Type



The eighth VIN position is the engine type (displacement and number of cylinders).

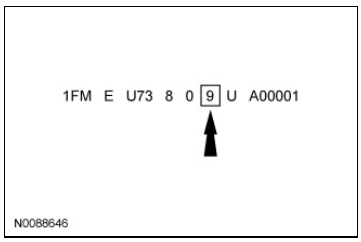
- E - 4.0L, SOHC, V6, electronic fuel injection (Cologne)
- 8 - 4.6L, 3-valve, V8, electronic fuel injection

Check Digit



The ninth VIN position is a government-assigned, computer-generated check digit.

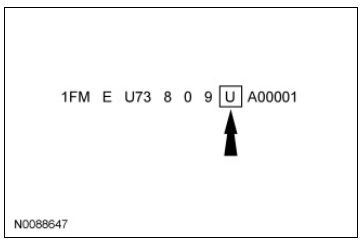
Model Year



The tenth VIN position is the model year code.

- 9 - 2009

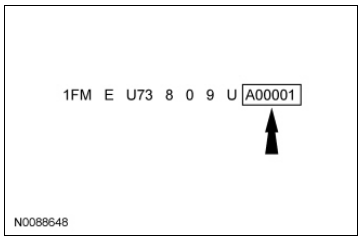
Assembly Plant



The eleventh VIN position is the assembly plant code.

- U - Louisville, Kentucky

Build Sequence

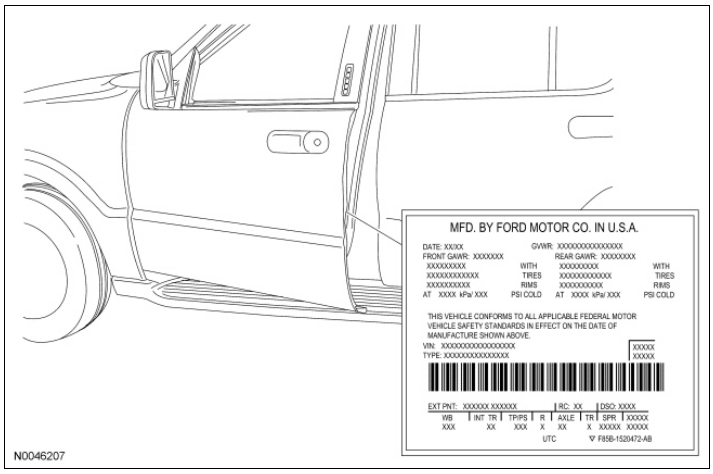


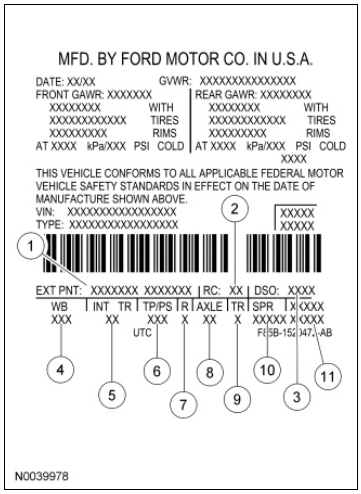
VIN positions 12 through 17 are an alphanumeric code for the vehicle build sequence. This is also the vehicle serial and warranty number. This serial number can also be found on the engine block, transmission and frame.

- A00001-E99999 - Ford
- J00001-L99999 - Mercury

Vehicle Certification (VC) Codes

Vehicle Certification (VC) Label Locator





Item	Description

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1	Exterior paint code
2	Region code
3	District Special Order (DSO)
4	Wheelbase code
5	Interior trim code
6	Tape/paint stripe code
7	Radio code
8	Axle code
9	Transmission code
10	Spring code
11	Powertrain calibration information

The Vehicle Certification (VC) label contains information on the manufacturer name, the month and year of manufacture, the certification statement and the Vehicle Identification Number (VIN). This label also includes Gross Vehicle Weight Rating (GVWR) information.

If a vehicle requires replacement of the VC label and is 4 years old or less, an authorized dealer must submit the VIN to their respective regional office. The regional office will submit a web form to the assembly plant for the replacement label. Once the label has been printed, a representative from the regional office will deliver the label to the dealer and witness installation on the vehicle. If a vehicle is more than 4 years old and requires a replacement label, the dealer must submit a request to the Department of Motor Vehicles.

Exterior Paint



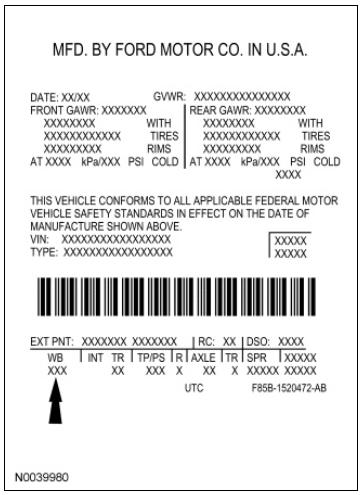
Exterior paint codes may be listed as a 2-part code. The first set of characters identify the primary body color. The second set of characters (if applicable) identify the vehicle accent or 2-tone body color. All colors are base coat/clear coat.

Primary Exterior Color Codes

- D3 - Colorado Red - Explorer/Explorer Sport Trac
- JV - Sangria Red - Explorer/Mountaineer/Explorer Sport Trac
- PV - White Chocolate (tri-coat) - Explorer/Mountaineer
- T5 - Dark Copper - Explorer/Explorer Sport Trac
- T9 - Monterrey Gray - Explorer/Mountaineer/Explorer Sport Trac
- U1 - Sport Blue - Explorer/Mountaineer/Explorer Sport Trac
- UA - Ebony - Explorer/Mountaineer/Explorer Sport Trac

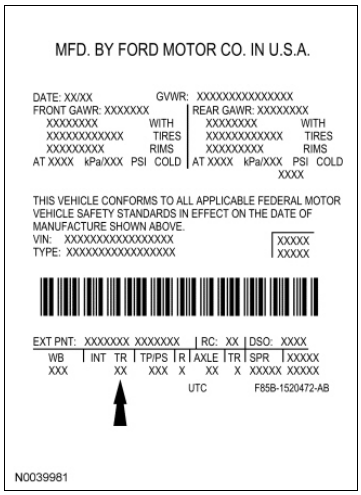
- UI - Brilliant Silver Metallic - Explorer/Mountaineer/Explorer Sport Trac
- WS - White Suede - Explorer/Mountaineer/Explorer Sport Trac
- YZ - Oxford White - Explorer

Wheelbase



- 114 - 2,895 mm (114 in) - Explorer/Mountaineer
- 131 - 3,327 mm (131 in) - Explorer Sport Trac

Interior Trim



Interior trim codes are listed as a 2-part code. The first character identifies the interior trim type. The second character identifies the interior trim color.

Interior Trim Type

- M - Seat kit 15, leather trim - Explorer Sport Trac Adrenalin
- R - Seat kit 1, value cloth - Explorer XLT
- S - Seat kit 2, premium cloth - Explorer XLT/Mountaineer
- T - Seat kit 5, leather trim - Explorer Sport Trac Limited
- T - Seat kit 4, leather trim - Explorer XLT
- U - Seat kit 12, cloth bucket seats - Explorer Sport Trac XLT
- V - Seat kit 3, leather trim, Explorer XLT
- W - Seat kit 13, cloth bucket seats - Explorer Sport Trac XLT/Limited
- Z - Seat kit 8, leather - Explorer Eddie Bauer
- 3 - Seat kit 7, perforated leather - Mountaineer

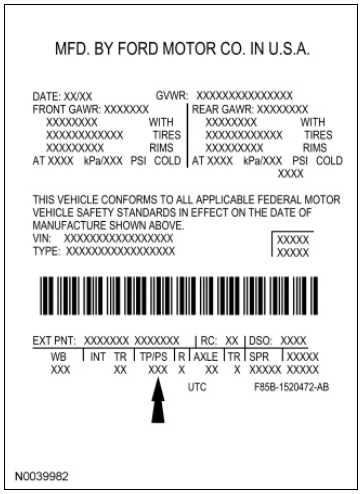
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- 4 - Seat kit 10, leather - Mountaineer
- 5 - Seat kit 9, leather - Mountaineer
- 8 - Seat kit 11, embossed leather - Mountaineer

Interior Trim Color

- C - Camel - Explorer/Mountaineer/Explorer Sport Trac
- W - Charcoal Black - Explorer/Mountaineer/Explorer Sport Trac

Tape/Paint Stripe



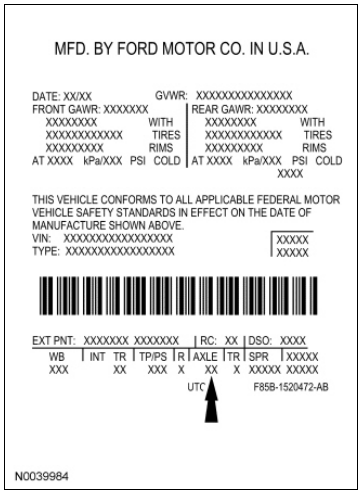
Tape and paint stripe codes do not apply.

Radio Type



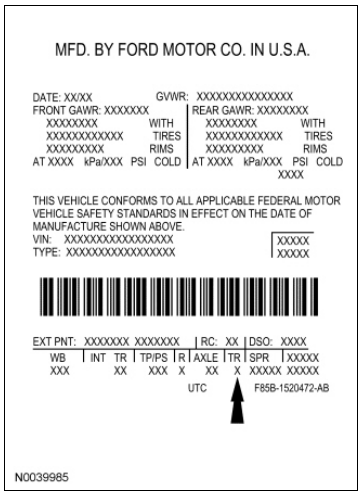
- 3 - AM/FM stereo, 6-disc in-dash CD changer with MP3 capability
- A - AM/FM stereo, CD player with MP3 capability
- Q - AM/FM stereo, 6-disc in-dash CD changer and navigation system

Axle Type



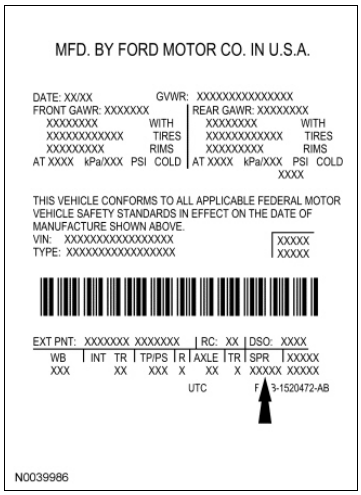
- 45 - 3.55 non-limited slip
- 46 - 3.73 non-limited slip

Transmission Type



- V - 5-speed automatic, 5R55S
- 6 - 6-speed automatic, 6R80

Spring Code



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Spring codes are listed as a 2-part code. The first characters listed identifies the front springs. The second character listed identifies the rear springs.

Front Springs

- AA - 9LT-18B036-A - Explorer/Mountaineer
- BB - 9LT-18B036-B - Explorer/Mountaineer
- CC - 9LT-18B036-C - Explorer/Mountaineer
- AA - 9A24-18B036-A - Explorer Sport Trac
- BB - 9A24-18B036-B - Explorer Sport Trac
- CC - 9A24-18B036-C - Explorer Sport Trac
- DD - 9A24-18B036-D - Explorer Sport Trac
- EE - 9A24-18B036-E - Explorer Sport Trac
- FF - 9A24-18B036-F - Explorer Sport Trac

Rear Springs

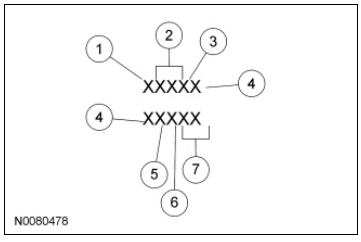
- AA - 8L24-18W002-A - Explorer/Mountaineer
- BB - 8L24-18W002-B - Explorer/Mountaineer
- BB - 8A24-18W002-B - Explorer Sport Trac
- DD - 8A24-18W002-A - Explorer Sport Trac
- FF - 8A24-18W002-C - Explorer Sport Trac

Powertrain Calibration Information



NOTE: Powertrain calibration information is limited to a maximum of 5 characters per line on the Vehicle Certification (VC) label. Because of this, calibration identification consisting of more than 5 characters will wrap to the second line on the VC label.

Powertrain calibration information is printed in the lower right corner of the VC label. Only base calibration information is printed. Revision levels will not appear, however, they can be obtained through a scan tool using the most current software revision.



Item	Description
1	Model year (model year in which calibration strategy was first introduced)
2	Vehicle code
3	Transmission code
4	Unique calibration (designates different hardware to similar vehicles). Example: tires or drive ratios
5	Fleet code (describes fleet to which the vehicle belongs). Example: 6 - Evaporative Emission (EVAP)
6	Certification region (lead region where multiple regions are included in one calibration). Example: A - U.S. federal
7	Revision level (will advance as revisions occur). Not printed on label

The following offers a more detailed explanation of the coding strategy used.

Model Year

- 1 - 2001
- 2 - 2002
- 3 - 2003
- 4 - 2004
- 5 - 2005
- 6 - 2006
- 7 - 2007
- 8 - 2008
- 9 - 2009

Vehicle Line

- U5 - Explorer/Mountaineer
- UK - Explorer Sport Trac

Transmission

- 1 - Automatic transmission

Unique Calibration

The Emissions/Corporate Average Fuel Economy/CO2 Compliance Department is responsible for assigning these calibration numbers. Unique calibration identifications are assigned to cover similar vehicles to differentiate tires, drive configurations, final drive ratios and other calibration-significant factors.

These 2 characters are chosen by the analyst to provide identifiable information unique to each calibration. For example, using the number 2 to denote a 2-valve engine versus using the number 4 to denote a 4-valve engine, offers an easily identifiable difference.

Fleet Code

- 1 - Heavy Duty Gas Engine/Dyno
- 2 - Fast - Automobile Manufacturers Association, U.S.
- 3 - Alternative Durability Protocol, U.S.
- 4 - Not assigned
- 5 - Not assigned
- 6 - Evaporative Emission (EVAP)
- 7 - Mileage Accumulation, Aging Endurance Durability
- 8 - On-Board Diagnostic (OBD)
- 9 - Not assigned

Certification Region

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- 5 - U.S. 50 states
- A - U.S. federal, including altitude, may include Canada and/or Mexico
- B - U.S. California, includes U.S. green states
- C - Canada
- D - China
- E - European Community (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom)
- F - Extended European Community (E plus Croatia, Czech Republic, Estonia, Hungary, Norway, Poland, Romania, Russian Federation, Slovakia, Slovenia, Switzerland, Yugoslavia)
- G - Gulf Cooperative Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE)
- H - Hong Kong
- J - Japan
- K - Korea
- L - Malaysia
- M - Mexico
- N - New Zealand
- P - Australia
- Q - South America (Brazil)
- S - Singapore
- T - Taiwan
- V - Vietnam
- X - Rest Of World (ROW)
- Y - Military
- Z - Israel

Revision Level (not printed on label)

- 91-99 - Hardware calibration levels
- 01-04 - Preliminary levels
- 00 - Job 1 production (initial calibration)
- 05-09 - Pre-job 1 revisions to calibrations
- 10-89 - Post-job 1 revisions to calibrations
- 0B - Durability test level
- BD - On-Board Diagnostic (OBD) intermediate level (pre-05)

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Jacking and Lifting

⚠ WARNING: Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: When jacking or lifting the vehicle, block all wheels remaining on the ground. Set the parking brake if the rear wheels will remain on the ground. These actions help prevent unintended vehicle movement. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Never get underneath a vehicle that is supported only by a jack. The jack could unintentionally lower. Always support vehicle with floor stands. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Only raise the vehicle when positioned on a hard, level surface. Attempting to raise the vehicle on an uneven or soft surface may result in vehicle slipping or falling from the jack or jackstand. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Identify the correct jacking points by locating the triangle stamped into the uni-body sheet metal or vehicle frame. Raising a vehicle in any other location may result in vehicle shifting or falling. Failure to follow this instruction may result in serious personal injury.

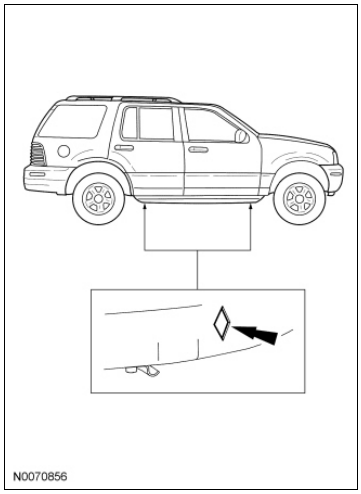
NOTICE: **The jack provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to hoist the vehicle for any other purpose.**

NOTICE: **To prevent possible damage to the underbody, do not drive the vehicle onto the drive-on lift without first checking for possible interference.**

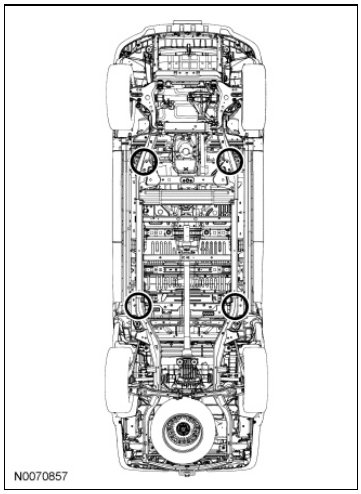
NOTICE: **When raising a vehicle on a twin-post hoist, use care when positioning the vehicle so that the hoisting forks do not interfere with the suspension components, mounting brackets or stabilizer mounting brackets, if equipped. In addition, use care in hoist positioning to avoid possible damage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

NOTICE: **Damage to the suspension, exhaust or steering linkage components may occur if care is not exercised when positioning the hoist adapters prior to lifting the vehicle.**

Jacking Points



Lifting Points



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Maintenance Schedules - Gasoline Engines

The maintenance schedule is designed to protect against major repairs resulting from neglect or inadequate maintenance and to prolong the life of the vehicle.

General Maintenance Information

NOTE: This is a generic maintenance schedule for all Ford, Lincoln and Mercury vehicles. There may be items listed that do not apply to all vehicles.

The Normal Schedule applies to operation of the vehicle under typical, everyday driving conditions. The maintenance frequency in this schedule typifies what the vast majority of vehicles will require. The listed services should be carried out at specified mileage, time or hours of operation, whichever occurs first. There are, however, additional services required that only the noted vehicles require.

If the vehicle is operated in one or more of the following special operating conditions, those additional services will be required. The special operating conditions are:

- Towing a trailer or using a camper or car-top carrier.
- Extensive idling and/or low-speed driving for long distances as in heavy commercial use such as delivery, taxi, patrol car or livery.
- Driving in dusty conditions such as unpaved or dusty roads.
- Off-road operation.
- Use of E85 fuel 50% of the time or greater (flex fuel vehicles only).

There are also exceptions to the Normal Schedule which will require more frequent maintenance for some components. Those exceptions are:

- Vehicle axle - maintenance and lubrication.
- Police and taxi vehicles - maintenance and lubrication.
- Engine oil and coolant - time-based and mileage-based intervals.
- Change brake fluid every 2 years (Class A Motorhome).

Engine Hour Meter

The vehicle may be equipped with an engine hour meter that registers the accumulated time the engine has been running. The engine hour meter is incorporated with the vehicle odometer. Depressing the odometer reset button once will display the trip odometer (miles followed by a T for trip odometer). Depressing the odometer reset button a second time will display the engine hour meter (hours followed by an H for hours). Displayed time is cumulative for the vehicle and it cannot be reset to zero. Emergency vehicles, such as police/fire and fleet vehicles, often experience long periods of idling, during which time the engine oil will continue to break down but mileage is not accumulated on the odometer.

To assist fleet managers in maintaining proper oil change intervals, the engine hour meter will help determine when an oil change is required. For every hour that the vehicle idles or runs, it has accumulated the equivalent of approximately 53 km (33 mi) of driving. Using the combination of the vehicle odometer and the engine hour meter allows the fleet manager to better determine when the oil needs to be changed.

Engine hour meter calculation:

- idle hours x 33 = miles equivalency
- miles driven + miles equivalency = oil change interval

Example: In metric units, this calculation would be 4,828 km + 3,233 (61 idle hours x 53 km/idle hour) = 8,061 km. When the odometer has accumulated 3,000 miles + 2,013 (61 hours x 33 miles/idle hour) = 5,013 mi, the oil change interval will have been reached.

Special Operating Condition Requirements

When towing a trailer or using a camper or car-top carrier:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Change automatic transmission/transaxle fluid (not required on 6R60/6R75/6R80/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Change transfer case fluid every 96,000 km (60,000 mi).
- Change manual transmission fluid every 96,000 km (60,000 mi).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings as required.
- Replace wheel bearing grease and install new grease seals on Rear Wheel Drive (RWD) front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).

Extensive idling and/or low speed driving for long distances, as in heavy commercial use such as delivery, taxi, patrol car or livery:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Install a new cabin air filter as required (if equipped).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Inspect brake system every 8,000 km (5,000 mi).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings every 8,000 km (5,000 mi) or 6 months (if equipped).
- Install a new fuel filter every 24,000 km (15,000 mi) (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Change automatic transmission fluid (not required on 6R60/6R75/6R80/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Install new spark plugs every 96,000 km (60,000 mi).
- Change transfer case fluid every 96,000 km (60,000 mi).

When operating in dusty conditions such as unpaved or dusty roads:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Install a new cabin air filter as required (if equipped).

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- Install a new engine air filter as required.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings every 8,000 km (5,000 mi) or 6 months (if equipped).
- Install a new fuel filter every 24,000 km (15,000 mi) (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Change automatic transmission fluid (not required on 6R60/6R75/6R80/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Change manual transmission fluid every 80,000 km (50,000 mi).
- Change rear axle lubricant every 80,000 km (50,000 mi) (E-450 and F-450/550 only).
- Change transfer case fluid every 96,000 km (60,000 mi).

When operating in off-road conditions:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Install a new cabin air filter as required (if equipped).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings as required.
- Change automatic transmission fluid (not required on 6R60/6R75/6R80/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Change manual transmission fluid every 80,000 km (50,000 mi).
- Change rear axle lubricant every 80,000 km (50,000 mi) (E-450 and F-450/550 only).
- Change transfer case fluid every 96,000 km (60,000 mi).

Use of E85 fuel 50% of the time or greater (flex fuel vehicles only):

- Fill fuel tank with a full tank of regular unleaded fuel every 4,800 km (3,000 mi).
- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

Checks and Services

Certain basic maintenance checks and inspections should be carried out at specified intervals. Any recognized adverse condition should be corrected as soon as possible.

Multi-Point Inspection

The following inspections are recommended at every service interval:

- Check and top off fluid levels for brakes, coolant, manual and automatic transmission (if equipped with a underhood fluid level indicator), power steering and window washer fluids.
- Inspect tires for wear and correct air pressure, including spare tire.
- Check exhaust system for leaks, damage, loose parts and foreign material.
- Check battery performance.
- Check operation of horn, exterior lamps, turn signals and hazard warning lights.
- Check radiator, coolers, heater and air conditioning hoses.
- Inspect windshield wiper spray and wiper operation.
- Check windshield for cracks, chips and pitting.
- Inspect for oil and fluid leaks.
- Inspect halfshaft dust boots (if equipped).
- Check shocks, struts and other suspension components for leaks and damage.
- Inspect steering and linkage.
- Inspect accessory drive belt(s).
- Inspect clutch operation (if equipped).

In-Line, Service-Installed Transmission Fluid Filter

Some vehicles may be equipped with an in-line, service-installed transmission fluid filter. This filter is installed in the transmission fluid cooler return line. If equipped, install a new in-line filter during transmission fluid change intervals.

Maximum Oil Change Interval (Normal Schedule)

- 12,000 km (7,500 mi) or 6 months.

Maximum Oil Change Interval (Special Operating Conditions)

- 8,000 km (5,000 mi), 6 months or 200 hours of engine operation.

Engine Coolant Change Interval

- 6 years or 169,000 km (105,000 mi).
- After initial change: 3 years or 73,000 km (45,000 mi).

Monthly Checks

Check each of the following items every month:

- All interior and exterior lights for correct operation.
- Tires for wear and correct air pressure, including spare tire.
- Engine oil fluid level.
- Windshield washer solvent fluid level.

Six Month Checks

Check each of the following items at least every 6 months:

- Lap/shoulder belts and seat latches for wear and function.
- External mounted spare tire is stowed correctly (tight to body).
- Power steering fluid level.
- Washer spray, wiper operation and clean all wiper blades (install new wiper blades as necessary).

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- Parking brake for correct operation.
- Lubricate all hinges, latches, door check straps and outside locks.
- Lubricate upper and lower sliding door tracks (if equipped).
- Clean sliding door contact switches (if equipped).
- Lubricate door rubber weatherstrips.
- Clean body and door drain holes.
- Safety warning lamps (brake, ABS, air bag, safety belt) for correct operation.
- Coolant system fluid level and correct strength.
- Battery connections. Clean if necessary.
- Clutch fluid level, if equipped.

Normal Schedule

The following check procedures should be carried out for all cars, minivans, light trucks, sport utilities, vans and Four-Wheel Drive (4WD) vehicles.

- Retighten the wheel nuts to the specified torque at 160 km (100 miles) after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).
- On vehicles equipped with dual rear wheels, retighten the wheel nuts to the specified torque at 160 km (100 mi) and again at 800 km (500 mi) of new vehicle operation or after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).

12,000 Km (7,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

24,000 Km (15,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Inspect engine air filter (except Focus with the Partial Zero Emissions Vehicle (PZEV) engine).
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect brake pads, rotors, brake linings, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.

36,000 Km (22,500 Mi)

- Change engine oil and install a new oil filter.

- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

48,000 Km (30,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Focus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Inspect automatic transmission/transaxle fluid level using the fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect brake pads, rotors, brake linings, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.

60,000 Km (37,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

72,000 Km (45,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.

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- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.

84,000 Km (52,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

96,000 Km (60,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Install a new engine air filter (except Focus with the PZEV engine).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Focus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Inspect automatic transmission/transaxle fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift® transmission.
- Install a new internal TorqShift® transmission fluid filter located inside the transmission bottom pan.
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.

108,000 Km (67,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

120,000 Km (75,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).

- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.

132,000 Km (82,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

144,000 Km (90,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Focus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Install new spark plugs.
- Inspect automatic transmission/transaxle fluid level using the fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect brake pads, brake linings, rotors, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect accessory drive belt(s).
- Inspect exhaust system and heat shields.

156,000 Km (97,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise.

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Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

168,000 Km (105,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Install a PCV valve on all cars and light trucks under 6,000 lb GVW (except 3V engines).
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Change rear axle fluid on vehicles equipped with DANA axles which use synthetic lubricants.
- Inspect brake pads, rotors, brake linings, drums, brake lines, hoses and parking brake system.
- Change engine coolant.
- Inspect engine coolant system and hoses.
- Inspect exhaust system and heat shields.

180,000 Km (112,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

192,000 Km (120,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Focus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Install a new PCV valve on all cars and light trucks over 6,000 lb GVW (except 3V engines).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift® transmission.
- Install a new internal TorqShift® transmission fluid filter located inside the transmission bottom pan.
- Inspect automatic transmission/transaxle fluid level on all other vehicles (if equipped with an underhood fluid level indicator).

- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect brake pads, rotors, brake linings, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect accessory drive belts.
- Inspect exhaust system and heat shields.

204,000 Km (127,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

216,000 Km (135,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Install a new cabin air filter (if equipped).
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Inspect brake pads, rotors, brake linings, drums, brake lines, hoses and parking brake system.
- Inspect engine cooling system and hoses.
- Inspect exhaust system and heat shields.

228,000 Km (142,500 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

240,000 Km (150,000 Mi)

- Change engine oil and install a new oil filter.
- Perform multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor

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training must be done.
- Install a new cabin air filter (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus, Focus, Sable, E-Series, Expedition and Navigator with short wheelbase, F-150, Flex, MKS, Escape and Mariner).
- Inspect PVC for flow (3V engines).
- Change automatic transmission/transaxle fluid (except TorqShift®).
- Install a new automatic transmission/transaxle filter (except for 6F35, 6F50, AWF-21, FNR5, and TorqShift® transmissions).
- Change manual transmission fluid (if equipped) (except Escape).
- Change transfer case fluid, 4WD (if equipped).
- Change front differential fluid, 4WD (if equipped).
- Replace rear axle lubricant on all RWD vehicles.
- Inspect and lubricate control arms, steering linkage, steering ball joints, U-joints and driveshaft with zerk fittings (if equipped).
- Inspect halfshaft boots (if equipped).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Install new front wheel bearings (if not sealed units).
- Inspect brake pads, rotors, brake linings, drums, brake lines, hoses and parking brake system.
- Change engine coolant.
- Inspect engine cooling system and hoses.
- Install a new accessory drive belt(s) (if a new belt(s) has not been installed within the last 160,000 km (100,000 mi).
- Inspect exhaust system and heat shields.

Exceptions To Normal Schedule

Maximum Oil Change Interval

- Normal schedule: 12,000 km (7,500 mi) or 6 months, whichever occurs first.
- Special operating conditions: 8,000 km (5,000 mi), 6 months or 200 hours of operation, whichever occurs first.

Motorcraft Coolant

- Change engine coolant at 6 years or 168,000 km (105,000 mi) of the vehicle's life, whichever occurs first.
- After the initial change, change coolant every 3 years or 72,000 km (45,000 mi) thereafter.

Normal Vehicle Axle Maintenance

Rear axles and transfer case/Power Transfer Unit (PTU) containing synthetic lubricant and light duty trucks equipped with Ford-design axles are lubricated for life. These lubricants are not to be checked or changed unless service is required, or if a leak is suspected or the axle assembly has been submerged in water.

The axle and transfer case/ PTU fluid should be changed anytime they have been submerged in water. Non-synthetic rear axle lubricants should be installed new every 4,800 km (3,000 mi) or 3 months, whichever occurs first, during extended trailer tow operation above 21°C (70°F) ambient and Wide Open Throttle (WOT) for extended periods above 72 km/h (45 mph).

The 3,000 mile lube change interval may be waived if the axle was filled with 75W-140 synthetic gear

lubricant. Add 118 ml (4 oz) of additive friction modifier for complete refill of Traction-Lok rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

Police and Taxi Vehicle Axle Maintenance

Install new rear axle lubricant every 160,000 km (100,000 mi). Rear axle lubricant change may be waived if the axle was filled with 75W-140 synthetic gear lubricant. Add 118 ml (4 oz) of additive friction modifier for complete refill of Traction-Lok rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

California Fuel Filter replacement

If the vehicle is registered in California, the California Air Resources Board has determined that the failure to perform this maintenance item will not nullify the emission warranty or limit recall liability prior to the completion of the vehicle's useful life. Ford Motor Company, however, urges you to have all recommended maintenance services performed at the specified intervals and to record all vehicle service.

Class A Motorhome

- Every 2 years - change brake fluid.
- Every 96,000 km (60,000 mi) change automatic transmission fluid.

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Noise, Vibration and Harshness (NVH)

Noise is any undesirable sound, usually unpleasant in nature. Vibration is any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down. Harshness is a ride quality issue where the vehicle's response to the road transmits sharply to the customer. Harshness normally describes a firmer than usual response from the suspension system. NVH is a term used to describe these conditions, which result in varying degrees of dissatisfaction. Although a certain level of NVH caused by road and environmental conditions is normal, this section is designed to aid in the diagnosis, testing and repair of NVH symptoms.

Acceptable NVH

All internal combustion engines and drivelines produce some noise and vibration; operating in a real world environment adds noise that is not subject to control. Vibration isolators, mufflers and dampers reduce these to acceptable levels. A driver who is unfamiliar with a vehicle can think that some sounds are abnormal when actually the sounds are normal for the vehicle type. As a technician, it is very important to be familiar with vehicle features and know how they relate to NVH symptoms and their diagnosis. For example, if the vehicle has automatic overdrive, it is important to test drive the vehicle both in and out of overdrive mode.

Glossary of Terms

Amplitude

The quantity or amount of energy produced by a vibrating component (G-force). An extreme vibration has a high amplitude. A mild vibration has a low amplitude. See Intensity.

Boom

Low frequency or low pitched noise often accompanied by a vibration. Also refer to Drumming.

Buffet/Buffeting

Strong noise fluctuations caused by gusting winds. An example would be wind gusts against the side glass.

Buzz

A low-pitched sound like that from a bee. Often a metallic or hard plastic humming sound. Also describes a high-frequency vibration. Vibration feels similar to an electric razor.

Chatter

A pronounced series of rapidly repeating rattling or clicking sounds.

Chirp

A short-duration, high-pitched noise associated with a slipping drive belt.

Chuckle

A repetitious, low-pitched sound. A loud chuckle is usually described as a knock.

Click

A sharp, brief, non-resonant sound, similar to actuating a ball point pen.

Clonk

A hydraulic knocking sound. Sound occurs with air pockets in a hydraulic system. Also described as hammering.

Clunk/Driveline Clunk

A heavy or dull, short-duration, low-frequency sound. Occurs mostly on a vehicle that is accelerating or decelerating abruptly. Also described as a thunk.

Conductor

The components that carry (transmit) a vibration frequency from the originator to the reactor.

Cycles Per Second

Cycles per second. Same as hertz (Hz).

Cracks

A mid-frequency sound, related to squeak. Sound varies with temperature conditions.

Creak

A metallic squeak.

Cycle

The process of a vibrating component going through a complete range of motion and returning to the starting point.

Decibel (dB)

A unit of measurement, referring to sound pressure level, abbreviated dB.

Drone

A low-frequency, steady sound, like a freezer compressor. Also described as a moan.

Drumming

A cycling, low-frequency, rhythmic noise often accompanied by a sensation of pressure on the ear drums. Also described as a low rumble, boom or rolling thunder.

Flutter

Mid to high intermittent sound due to air flow. Similar to a flag flapping in the wind.

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Frequency

The rate at which a cycle occurs within a given time.

G-force

The additional load or weight produced in an object during acceleration. When measuring the level or amplitude of a vibration without sound, the unit G is added to associate the force of the vibration to gravity. This is similar to measuring the weight of an object, which is also a function of gravity.

Gravelly Feel

A grinding or growl in a component, similar to the feel experienced when driving on gravel.

Grind

An abrasive sound, similar to using a grinding wheel, or rubbing sand paper against wood.

Hertz (Hz)

A unit of measure used to describe noise and vibration concerns expressed in cycles per second.

Hiss

Steady, high-frequency noise. Vacuum leak sound.

Hoot

A steady, low-frequency tone, sounds like blowing over a long neck bottle.

Howl

A mid-range frequency noise between drumming and whine. Also described as a hum.

Hum

Mid-frequency steady sound, like a small fan motor. Also described as a howl.

Intensity

The physical quality of sound that relates to the strength of the vibration (measured in decibels). The higher the sound's amplitude, the higher the intensity and vice versa. See Amplitude.

Knock

A heavy, loud, repetitious sound, like a knock on the door.

Moan

A constant, low-frequency tone. Also described as a hum.

Ping

A short-duration, high-frequency sound, which has a slight echo.

Pitch

The physical quality of sound that relates to its frequency. Pitch increases as frequency increases and vice versa.

Pumping Feel

A slow, pulsing movement.

Rattle

A random and momentary or short-duration noise.

Reactor

The component, or part, that receives a vibration from an originator and conductor and reacts to the vibration by moving.

Roughness

A medium-frequency vibration. A slightly higher frequency than a shake. This type of vibration is usually related to drivetrain components.

Rustling

Intermittent sound of varying frequency, sounds similar to shuffling through leaves.

Shake

A low-frequency vibration, usually with visible component movement. Usually relates to tires, wheels, brake drums or brake discs if it is vehicle speed sensitive, or engine if it is engine speed sensitive. Also referred to as a shimmy or wobble.

Shimmy

An abnormal vibration or wobbling, felt as a side-to-side motion of the steering wheel in the driveshaft rotation. Also described as waddle.

Shudder

A low-frequency vibration that is felt through the steering wheel or seat during light brake application.

Slap

A resonance from flat surfaces, such as safety belt webbing or door trim panels.

Squeak

A high-pitched transient sound, similar to rubbing fingers against a clean window.

Squeal

A long-duration, high-pitched noise.

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Tap

A light, rhythmic or intermittent hammering sound, similar to tapping a pencil on a table edge.

Thump

A dull beat caused by 2 items striking together.

Tick

A rhythmic tap, similar to a clock noise.

Tip-In Moan

A light moaning noise heard during light vehicle acceleration, usually between 40-100 km/h (25-65 mph).

Transient

A noise or vibration that is momentary, a short duration.

Vibration

Any motion, shaking or trembling, that can be felt or seen when an object moves back and forth or up and down.

Whine

A constant, high-pitched noise. Also described as a screech.

Whistle

High-pitched noise with a very narrow frequency band. Examples of whistle noises are a turbocharger or air flow around an antenna.

Wind Noise

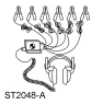
Any noise caused by air movement in, out or around the vehicle.

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Noise, Vibration and Harshness (NVH)

Special Tool(s)

 ST2311-A	Electronic Vibration Analyzer (EVA) 100-F027 (014-00344) or equivalent
 ST2312-A	EngineEAR 107-R2100 or equivalent
 ST2048-A	EngineEAR/ChassisEAR 107-R2102 or equivalent
 ST3025-A	Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018 or equivalent
 ST3108-A	Squeak and Rattle Repair Kit 164-R4900
 ST2314-A	Ultrasonic Leak Detector 134-R0135 or equivalent

Diagnostic Theory

The shortest route to an accurate diagnosis results from:

- system knowledge, including comparison with a known good system.
- system history, including repair history and usage patterns.
- condition history, especially any relationship to repairs or sudden change.
- knowledge of possible sources.
- using a systematic diagnostic method that divides the system into related areas.

The diagnosis and correction of NVH symptoms requires:

- a road or system test to determine the exact nature of the symptom.
- an analysis of the possible causes.
- testing to verify the cause.
- repairing any symptoms found.
- a road test or system test to make sure the cause has been corrected or brought back to within an acceptable range.

Diagnostic Procedure Overview

Qualifying the symptom by the particular sensation present can help narrow down the cause. Always use the

"symptom" to "system" to "component" to "cause" diagnosis technique. This diagnostic method divides the problem into related areas to correct the customer concern.

- Verify the "symptom".
- Determine which "system(s)" can cause the "symptom" using the diagnostic tools described in this section.
- After determining the possible "system(s)", refer to the appropriate section in this manual to identify the worn or damaged "components".
- After identifying the "components", identify the "cause" of the failure.

Tools and Techniques

The diagnostic tools allow for a systematic collection of information that is necessary to accurately diagnose and repair NVH problems. Remember that the vibrating source component (originator) may only generate a small vibration. This small vibration can in turn cause a larger vibration/noise to emanate from another receiving component (reactor), due to contact with other components (transfer path). For the best results, carry out the test as follows:

a. Test drive the vehicle with the vibration sensor inside the vehicle.
b. Place the sensor in the vehicle according to feel.
    - ♦ If the condition is felt through the steering wheel, the source is most likely in the front of the vehicle.
    - ♦ A vibration that is felt in the seat or floor only will most likely be found in the driveline, drive axle or rear wheels and tires.
c. Record the readings. Also note when the condition begins, when it reaches maximum intensity and if it tends to diminish above/below a certain speed.
    - ♦ If a vibration symptom is vehicle speed related, the tire and wheel rpm/frequency and driveshaft frequency should be calculated.
    - ♦ If a vibration symptom is engine speed related, the engine, engine accessory and engine firing frequencies should be calculated.
    - ♦ Frequencies with an amplitude reading of 0.06 Gs or less are barely perceptible NVH levels. No corrective action is necessary.
d. Place the vibration sensor on or near the suspect area outside the vehicle.
e. Continue the road test, driving the vehicle at the speed the symptom occurs and take another reading.
f. Compare the readings.
    - ♦ A match in frequency indicates the problem component or area.
    - ♦ An unmatched test could indicate the symptom is caused by the engine, torque converter or engine accessory. Use the diagnostic tools in the rpm mode and check if symptom is rpm related.

The following diagnostic tools and techniques can be used separately or in conjunction with each other to aid in the diagnosis of NVH symptoms. They are listed in order of preference for ease in their use for locating these symptoms.

NVH Analyzer (Vetronix)

The Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) and the MTS 4100 NVH analyzers are tools to aid in the identification and isolation of a noise, vibration or harshness symptom in a vehicle. They measure noise and vibration data and compare it with data obtained from the vehicle's PCM as well as vehicle variants that were entered by the user such as pulley size, axle ratio and tire size in order to provide possible sources. The Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) and the MTS 4100 have the following characteristics:

- Interface with the vehicle's computer system

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- Support and store vibration data input from 1 or 2 accelerometers
- Support and store noise data input from 2 microphones
- Provide a photo-tachometer for operation of the driveshaft balancing function
- Provide a strobe output capable of driving a standard timing light
- Contain a real-time clock circuit that provides time and date information which is used for tagging test data
- Have the capability to print to an external printer and interface with a PC
- Can be powered from a variety of power sources: cigarette lighter, AC power or the internal battery pack

The Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) and the MTS 4100 NVH analyzers have 4 main operating modes. The first is for vibration diagnosis. This mode measures data from 1 or 2 accelerometers simultaneously while obtaining data from the vehicle. Then it carries out a frequency analysis on the accelerometer information and compares the vibration frequencies with the frequencies associated with various rotating components within the vehicle. The data can be presented in 4 different display modes: principle component, bar chart, frequency spectrum or waterfall. All display mode formats contain the same common elements, such as amplitude.

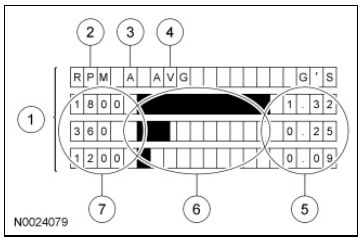
The second is for noise diagnosis. This mode measures noise from 1 or 2 microphones simultaneously. All noise measurements are in decibels (dBs). All frequency bands used for noise measurements are the same as for the vibration measurements, up to 1,000 Hz.

The third is driveshaft balancing. Driveshaft balancing is done using 1 or 2 accelerometers and a photo-tachometer. The accelerometers measure the vibration at both ends of the driveshaft, while the photo-tachometer measures the rotation speed and position reference. Refer to Section 205-00 .

The fourth is the strobe. A strobe or standard timing light can be connected to an analyzer, to provide a means for measuring rotation speed. The strobe function is used for isolating the source of a vibration.

Electronic Vibration Analyzer (EVA)

The Electronic Vibration Analyzer (EVA) is a hand-held electronic scan tool which will assist in locating the source of unacceptable vibrations. The vibration sensor can be remotely mounted anywhere in the vehicle for testing purposes. The unit displays the 3 most common vibration frequencies and their corresponding amplitudes simultaneously. A bar graph provides a visual reference of the relative signal strength (amplitude) of each vibration being displayed and its relative G-force. The keypad is arranged to make the EVA simple to program and use. Some of the functions include the ability to average readings as well as record, play back and freeze readings. The EVA has a strobe balancing function that can be used to detect imbalance on rotating components such as a driveshaft or engine accessories.



Item	Description
1	Electronic Vibration Analyzer (EVA) screen
2	Frequency mode displayed in rpm or Hz
3	Active sensor input (A or B)
4	Current active mode

5	G-force indicators or the strongest frequencies in descending strength of each vibration
6	Strength of each vibration
7	Frequency in rpm/Hz of each vibration

Record the readings taken with the diagnostic tool.

- ♦ Frequencies should be read in the "average" mode.
- ♦ Frequencies have a range of plus or minus 2 Hz. A reading of 10 Hz can be displayed as an 8 Hz through 12 Hz.

Vibrate Software®

Vibrate Software® (Rotunda tool number 215-00003) is a diagnostic aid which will assist in pinpointing the source of unacceptable vibrations. The engine's crankshaft is the point of reference for vibration diagnosis. Every rotating component will have an angular velocity that is faster, slower or the same as the engine's crankshaft. Vibrate Software® calculates the angular velocity of each component and graphically represents these velocities on a computer screen and on a printed vibration worksheet. The following steps outline how Vibrate Software® helps diagnose a vibration symptom:

- Enter the vehicle information. Vibrate will do all the calculations and display a graph showing tire, driveshaft and engine vibrations.
- Print a Vibration Worksheet graph. The printed graph is to be used during the road test.
- Road test the vehicle at the speed where the vibration is most noticeable. Record the vibration frequency rpm and the engine rpm on the worksheet graph. The point on the graph where the vibration frequency rpm reading and the engine rpm reading intersect indicates the specific component group causing the symptom.
    - ♦ A frequency measurement tool capable of measuring vibration frequency and engine rpm will be needed.
- Provides graphics of diagnostic procedures to aid in testing components.

Reed Tachometer

The Reed tachometer is a hand-held vibration sensor which will assist in locating the source of unacceptable vibrations. The vibration sensor can be placed anywhere in the vehicle for testing purposes. The Reed tachometer contains several reeds that are tuned to vibrate or resonate at different frequencies ranging from 10 to 80 Hz or 600 to 4,800 rpm. Though the Reed tachometer is able to measure multiple frequencies, it does not measure amplitude.

Sirometer

The Sirometer measures frequency in hertz and rpm. To use the Sirometer, place it on any vibrating component and slowly scroll the wire out by turning the knob. As the length of wire changes, so does its natural frequency. Find the length of wire that vibrates with the highest amplitude. This frequency will match that of the vibrating component. Read the frequency for that length of wire.

Combination EngineEAR/ChassisEAR

An electronic listening device used to quickly identify noise and the location under the chassis while the vehicle is being road tested. The ChassisEARs can identify the noise and location of damaged/worn wheel bearings, CV joints, brakes, springs, axle bearings or driveshaft carrier bearings.

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EngineEAR Basic Unit

An electronic listening device used to detect even the faintest noises. The EngineEARs can detect the noise of damaged/worn bearings in generators, coolant pumps, A/C compressors and power steering pumps. They are also used to identify noisy lifters, exhaust manifold leaks, chipped gear teeth and for detecting wind noise. The EngineEAR has a sensing tip, amplifier and headphones. The directional sensing tip is used to listen to the various components. Point the sensing tip at the suspect component and adjust the volume with the amplifier. Placing the tip in direct contact with a component will reveal structure-borne noise and vibrations, generated by or passing through, the component. Various volume levels can reveal different sounds.

Mechanic's Stethoscope

A mechanic's stethoscope is an inexpensive tool for locating noises in engines and other moving parts. It can be used to help diagnose piston slap, worn gears, faulty valves, coolant pump failure, damaged gaskets, defective bearings and body squeaks.

Squeak and Rattle Repair Kit

The Squeak and Rattle Repair Kit (Rotunda tool number 164-R4900) contains lubricants and self-adhesive materials that can be used to eliminate interior and exterior squeaks and rattles. The kit consists of the following materials:

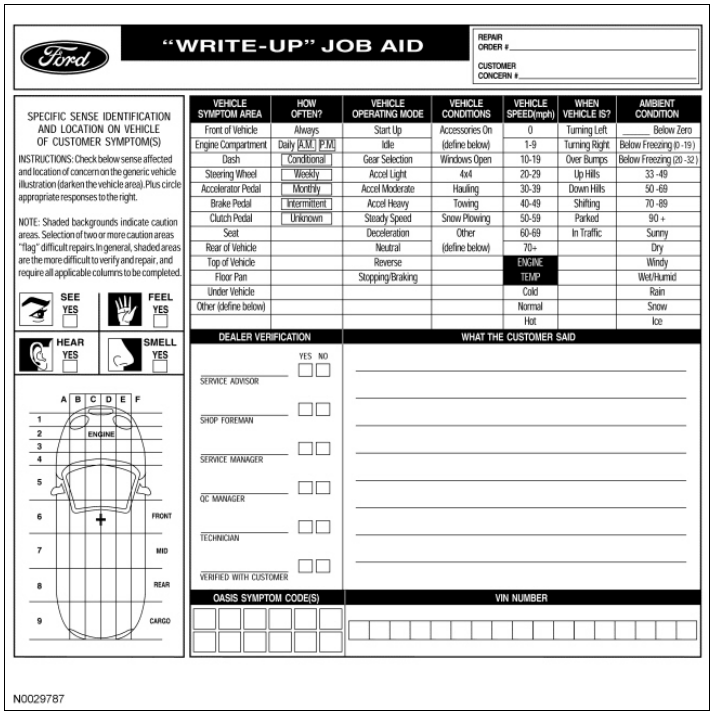
- PVC (soft foam) tape
- Urethane (hard foam) tape
- Flocked (black fuzzy) tape
- UHMW (frosted) tape
- Squeak and rattle oil tube
- Squeak and rattle grease tube

Ultrasonic Leak Detector

The Ultrasonic Leak Detector is used to detect wind noises caused by leaks and gaps in areas where there is weatherstripping or other sealing material. It is also used to identify A/C leaks, vacuum leaks and evaporative emission noises. The Ultrasonic Leak Detector includes a multi-directional transmitter (operating in the ultrasonic range) and a hand-held detector. The transmitter is placed inside the vehicle. On the outside of the vehicle, the hand-held detector is used to sweep the area of the suspected leak. As the source of the leak is approached, a beeping sound is produced which increases in both speed and frequency.

Write-Up Job Aid

To assist the service advisor and the technician, a Write-Up Job Aid used during the interview process is included with this material. The Write-Up Job Aid serves as a place to record all important symptom information.



1: Customer Interview

The diagnostic process starts with the customer interview. The service advisor must obtain as much information as possible about the symptom and take a test drive with the customer. There are many ways a customer will describe NVH symptoms and this will help minimize confusion arising from descriptive language differences. It is important that the symptom is correctly interpreted and the customer descriptions are recorded. During the interview, complete the write-up job aid and ask the following questions:

- When was it first noticed?
- Did it appear suddenly or gradually?
- Did any abnormal occurrence coincide with or precede its appearance?

Use the information gained from the customer to accurately begin the diagnostic process.

2: Pre-Drive Check

It is important to do a pre-drive check before road testing the vehicle. A pre-drive check verifies that the vehicle is relatively safe to drive and eliminates any obvious faults on the vehicle.

The pre-drive check consists of a brief visual inspection. During this brief inspection, take note of anything that will compromise safety during the road test and make those repairs/adjustments before taking the vehicle on the road.

3: Preparing for the Road Test

Observe the following when preparing for the road test:

- Review the information recorded on the write-up job aid. It is important to know the specific symptom the customer has with the vehicle.
- Do not be misled by the reported location of the noise/vibration. The cause can actually be some

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distance away.
- Conduct the road test on a quiet street where it is safe to duplicate the vibration/noise. The ideal testing route is an open, low-traffic area where it is possible to operate the vehicle at the speed in which the condition occurs.
- While observing that they are not related to the symptom, eliminate the following:
    - ♦ If possible, lower the radio antenna in order to minimize turbulence.
    - ♦ Identify anything that could potentially make noise or be a source of wind noise.
    - ♦ Inspect the vehicle for add-on items that create vibration/noise.
    - ♦ Turn off the radio and the heating and cooling system blower.
- The engine speed is an important factor in arriving at a final conclusion. Therefore, connect a diagnostic tool, Vetronix, or an accurate tachometer to the engine, even if the vehicle has a tachometer. This will make sure of an exact engine speed reading.

4: Verify the Customer Concern

Verify the customer concern by carrying out a road test, an engine run-up test or both.

The decision to carry out a road test, an engine run-up test or both depends on the type of NVH symptom. A road test may be necessary if the symptom relates to the suspension system or is sensitive to torque. A Drive Engine Run-Up (DERU) or a Neutral Engine Run-Up (NERU) test identifies noises and vibrations relating to engine and drivetrain rpm. Remember, a condition will not always be identifiable by carrying out these tests, however, they will eliminate many possibilities if carried out correctly.

5: Road Test

NOTE: It may be necessary to have the customer ride along or drive the vehicle to point out the symptom. During the road test, take into consideration the customer's driving habits and the driving conditions. The customer's concern just may be an acceptable operating condition for that vehicle.

The following is a brief overview of each test in the order in which it appears. A review of this information helps to quickly identify the most appropriate process necessary to make a successful diagnosis. After reviewing this information, select and carry out the appropriate test(s), proceeding to the next step of this process.

- The Slow Acceleration Test is normally the first test to carry out when identifying an NVH symptom, especially when a road test with the customer is not possible.
- The Heavy Acceleration Test helps to determine if the symptom is torque-related.
- The Neutral Coast Down Speed Test helps to determine if the symptom is vehicle speed-related.
- The Downshift Speed Test helps to determine if the symptom is engine speed-related.
- The Steering Input Test helps to determine how the wheel bearings and other suspension components contribute to a vehicle speed-related symptom.
- The Brake Test helps to identify vibrations or noise that are brake related.
- The Road Test Over Bumps helps isolate a noise that occurs when driving over a rough or bumpy surface.
- The Engine Run-Up Tests consist of the Neutral Engine Run-Up (NERU) Test and the Drive Engine Run-Up (DERU) Load Test. These tests help to determine if the symptom is engine speed-related.
- The Neutral Engine Run-Up (NERU) Test is used as a follow-up test to the Downshift Speed Test when the symptom occurs at idle.
- The Drive Engine Run-Up (DERU) Load Test helps to identify vibration/noise sensitive to engine load or torque. It also helps to reproduce engine speed-related symptoms that cannot be duplicated when carrying out the Neutral Engine Run-Up (NERU) Test or the Neutral Coast Down Test.
- The Engine Accessory Test helps to locate faulty belts and accessories that cause engine speed-related

symptoms.
- The Vehicle Cold Soak Procedure helps to identify symptoms occurring during initial start-up and when an extended time lapse occurs between vehicle usage.

Slow Acceleration Test

To carry out this test, proceed as follows:

- Slowly accelerate to the speed where the reported symptom occurs. Note the vehicle speed, the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify from what part of the vehicle the symptom is coming.
- Attempt to identify the source of the symptom.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Heavy Acceleration Test

To carry out this test, proceed as follows:

- Accelerate hard from 0-64 km/h (0-40 mph).
- Decelerate in a lower gear.
- The symptom is torque-related if duplicated while carrying out this test.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Neutral Coast Down Speed Test

To carry out this test, proceed as follows:

- Drive at a higher rate of speed than where the symptom occurred when carrying out the Slow Acceleration Test.
- Place the transmission in NEUTRAL and coast down past the speed where the symptom occurs.
- The symptom is vehicle speed-related if duplicated while carrying out this test. This eliminates the engine and the torque converter as sources.
- If the symptom was not duplicated while carrying out this test, carry out the Downshift Speed Test to verify if the symptom is engine speed related.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Downshift Speed Test

To carry out this test, proceed as follows:

- Shift into a lower gear than the gear used when carrying out the Slow Acceleration Test.
- Drive at the engine rpm where the symptom occurs.
- The symptom is engine speed related if duplicated while carrying out this test. This eliminates the tires, wheels, brakes and the suspension components as sources.

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- If necessary, repeat this test using other gears and NEUTRAL to verify the results.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Steering Input Test

To carry out this test, proceed as follows:

- Drive at the speed where the symptom occurs, while making sweeping turns in both directions.
- If the symptom goes away or gets worse, the wheel bearings, hubs, U-joints (contained in the axles of Four-Wheel Drive (4WD) applications), and tire tread wear are all possible sources.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Brake Test

To carry out this test, proceed as follows:

- With the brake released, accelerate the vehicle. While coasting (brake pedal released) to a stop in NEUTRAL, note any abnormal rate of deceleration. Abnormal deceleration could indicate a parking brake or service brake that is not fully releasing.
- Warm the brakes by slowing the vehicle a few times from 80-32 km/h (50-20 mph) using light braking applications.
- Accelerate to 89-97 km/h (55-60 mph). Moderately apply the brakes and slow the vehicle to a stop.
- A brake vibration can be felt in the steering wheel, seat or brake pedal. A brake noise can be heard upon brake application and should diminish when the brake is released. For vehicles with separate park brake shoes, noise or vibration from the parking brake system will not be affected by applying the hydraulic brakes. On these systems, the parking brake system requires inspection if a parking brake concern is suspected.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate brake section(s) for further diagnosis and repair. If the source has not been identified, continue with the road test.

Road Test Over Bumps

To carry out this test, proceed as follows:

- Drive the vehicle over a bump or rough surface one wheel at a time to determine if the noise is coming from the front or the back and the left or the right side of the vehicle.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Neutral Engine Run-Up (NERU) Test

To carry out this test, proceed as follows:

- Install a tachometer.

- Increase the engine rpm up from an idle to approximately 4,000 rpm while in PARK on Front Wheel Drive (FWD) vehicles with automatic transmissions, or NEUTRAL for all other vehicles. Note the engine rpm and, if possible, determine the vibration frequency.
- Attempt to identify what part of the vehicle the symptom is coming from.
- Attempt to identify the source of the symptom.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Drive Engine Run-Up (DERU) Load Test

To carry out this test, proceed as follows:

⚠ **WARNING: Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.**

NOTICE: **Do not carry out the Engine Load Test for more than 5 seconds or damage to the transmission or transaxle may result.**

- Block the front and rear wheels.
- Apply the parking brake and the service brake.
- Install a tachometer.
- Shift the transmission into DRIVE, and increase and decrease the engine rpm between an idle to approximately 2,000 rpm. Note the engine rpm and, if possible, determine the vibration frequency.
- Repeat the test in REVERSE.
- If the vibration/noise is duplicated when carrying out this test, inspect the engine and transmission or transaxle mounts.
- If the symptom is definitely engine speed-related, carry out the Engine Accessory Test to narrow down the source.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Engine Accessory Test

To carry out this test, proceed as follows:

⚠ **WARNING: Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.**

NOTICE: **Limit engine running time to one minute or less with belts removed or serious engine damage will result.**

NOTE: Use a frequency measurement tool to pinpoint accessory vibrations. A listening device, such as an EngineEAR, will also help to identify noises from specific accessories.

- Remove the accessory drive belt(s).
- Increase the engine rpm to where the symptom occurs.
- If the vibration/noise is duplicated when carrying out this test, the belt(s) and accessories are not sources.

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- If the vibration/noise was not duplicated when carrying out this test, install the accessory belt(s), one at a time, to locate the source.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Vehicle Cold Soak Procedure

To carry out this procedure, proceed as follows:

- Test preparations include matching customer conditions (if known). If not known, document the test conditions: gear selection and engine rpm. Monitor the vibration/noise duration with a watch for up to 3 minutes.
- Park the vehicle where testing will occur. The vehicle must remain at or below the symptom temperature (if known) for 6-8 hours.
- Before starting the engine, conduct a visual inspection under the hood.
- Turn the key on, but do not start the engine. Listen for the fuel pump, ABS and air suspension system noises.
- Start the engine.
- Isolate the vibration/noise by carefully listening. Move around the vehicle while listening to find the general location of the vibration/noise. Then, search for a more precise location by using a stethoscope or EngineEAR.
- If the source of the symptom has been identified as a result of this test, proceed to the appropriate section for further diagnosis and repair. If the source has not been identified, continue with the road test.

Classify NVH Symptom

For NVH concerns, it is necessary to classify the customer's concern into one of the 3 categories: noise, vibration or harshness. The reason for this is that a customer concern may consist of a combination of symptoms involving noise and vibration, or vibration and harshness. In cases where there are combination symptoms, determine which diagnostic path to follow: noise, vibration or harshness. For example, if a customer has a concern involving a noise and a vibration, and it is determined that it is vehicle speed-related, follow the vibration diagnostic path.

Noise Symptoms

Once a symptom is classified as a noise, the particular conditions under which the noise occurs need to be identified. These conditions are identified and verified during the road test. For example, a noise may only occur while turning. The next step is to determine which systems on the vehicle are related to that condition. In this case, the steering system and wheel/tire system may be suspect. After identifying possible systems, a preliminary inspection of these systems should be done. If the source of noise is still unidentified, use a listening device (such as the ChassisEAR) to pinpoint the source. Once the source has been identified, determine if this source is related to the suspected system previously identified. If it is related, then complete the repair to resolve the customer concern. If it is unrelated, then it is possible that the source of the noise is a reactor to a noise being transmitted through a transfer path. If this is the case, repairing the reactor will not resolve the customer concern. The transfer path must be identified and a determination made if the noise is normal, but accentuated by the transfer path (conductor), or if the originator is the fault causing excessive noise to transfer to another component through a conductor. There is a relationship between systems identified as related to conditions and the noise transfer path. In some cases, the condition under which the noise occurs has nothing to do with the identified source. This relationship is important in the diagnosis of noise concerns.

It is the first clue that the identified source of noise might be a reactor and that further investigation is needed to diagnose a possible noise transfer path concern. Based on the results from the road test, make a determination of which action in the symptom chart to take first.

Vibration Symptoms

Most vibrations consist of movements back and forth or up and down that repeat. Every time the vibrating component goes through its complete range of motion and returns to the starting point is called a cycle. The rate at which these cycles occur within a given time is called the frequency. Frequency is measured in cycles per second or Hertz (Hz). One cycle per second equals one Hz. Once the frequency of a vibration is known, calculations can be done to determine the system that is the source of the concern.

Order of Vibration

The order of a vibration refers to how often the vibration is present in one revolution of the component. For example, a vibration that is present once each revolution of a component would be a first order vibration. A vibration present twice each revolution of the component would be a second order vibration. Vibration orders do not have to be whole numbers, they can have decimal values such as 1.5 order vibration or 3.08 order vibration.

The concept of order of vibration is important to remember when the measured frequency of a vibration does not seem to match the frequency calculations of any of the likely systems or components. As the order increases, the frequency of the vibration will also increase by a multiple of that number.

For example, vibration may be present where the frequency is measured at 14 Hz. After doing the necessary calculations it is determined the first order tire and wheel frequency is 7 Hz and the first order driveshaft frequency is 22 Hz. Based on this information it can be determined the vibration is most likely a second order tire and wheel vibration: 7 Hz (first order tire and wheel frequency) multiplied by 2 (second order) equals 14 Hz (second order tire and wheel frequency).

Relationship of Vibration Frequency to Order of Vibration

After carrying out the road test as described in this section, the vibration was determined to be either vehicle-speed related or engine-speed related. That determination will identify the vibration frequency calculations that should be done.

Vibration Type	Calculate
Vehicle-speed related	Tire-speed vibration frequency Driveshaft-speed vibration frequency
Engine-speed related	Engine vibration frequency Engine accessory vibration frequency Engine firing vibration frequency

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In calculating and using frequency readings, it is important to remember the direct relationship between Hz and rpm. One Hz is equal to 60 rpm. This is easy to remember; think of Hz as cycles per second. There are 60 seconds in a minute, therefore multiply Hz reading by 60 to get rpm. Conversely, divide rpm by 60 to get Hz.

Use the Frequency and RPM Calculations Worksheet to calculate system/component frequencies. The worksheet provides the necessary steps to determine each system/component group frequency.

Frequency Calculations

Calculating Tire and Wheel Frequency

For a vibration concern, use the vehicle speed to determine tire/wheel frequency and rpm. Calculate tire and wheel rpm and frequency by carrying out the following:

- Measure the diameter of the tire.
- Record the speed at which the vibration occurs.
- Obtain the corresponding tire and wheel rpm and frequency from the Tire Speed and Frequency Chart.
- If the vehicle speed is not listed, calculate the tire and wheel frequency as follows:
    - Divide the vehicle speed at which the vibration occurs by 16 km/h (10 mph). Multiply that number by the 16 km/h (10 mph) tire rpm listed for that tire diameter in the chart. Then divide that number by 60.
    - For example, if calculating the frequency based on vehicle speed in km/h for a 64 km/h vibration with 835 mm tires, divide 64 km/h by 16 km/h = 4. Multiply 4 by 105 rpm = 420. Divide 420 by 60 seconds = 7 Hz at 64 km/h.
    - If calculating the frequency based on vehicle speed in mph for a 40 mph vibration with 33 inch tires, divide 40 mph by 10 mph = 4. Multiply 4 by 105 rpm = 420. Divide 420 by 60 seconds = 7 Hz at 40 mph.
    - The calculated frequency of 7 Hz is the first order tire and wheel vibration; the second order tire and wheel vibration would be twice this number at 14 Hz; the third order tire and wheel vibration would be 21 Hz; and so on.

Tire Speed and Frequency Chart

Tire Diameter	Tire RPM/Hz	Tire RPM/Hz	Tire RPM/Hz	Tire RPM/Hz
mm (in)	@ 16 km/h (10 mph)	@ 80 km/h (50 mph)	@ 97 km/h (60 mph)	@ 113 km/h (70 mph)
483 (19)	182	910/15	1,092/18	1,274/21
508 (20)	173	865/14	1,038/17	1,211/20
533 (21)	165	825/14	990/16	1,155/19
560 (22)	158	790/13	948/16	1,106/18
585 (23)	151	755/13	906/15	1,057/18
610 (24)	145	725/12	870/14	1,015/17
635 (25)	139	695/12	834/14	973/16
660 (26)	134	670/11	804/13	938/16
685 (27)	129	645/11	774/13	903/15

710 (28)	124	620/10	744/12	868/14
735 (29)	119	595/10	714/12	833/14
760 (30)	115	575/10	690/11	805/13
785 (31)	111	555/9	666/11	777/13
810 (32)	108	540/9	648/11	756/13
835 (33)	105	525/9	630/10	735/12
864 (34)	102	510/8	612/10	714/12

Calculating Driveshaft Frequency

Knowing the tire and wheel frequency allows for easy calculation of driveshaft frequency. The driveshaft drives the tires through the rear axle. Therefore, to determine driveshaft frequency, multiply tire and wheel frequency by the ratio of the rear axle. Calculate driveshaft frequency by performing the following steps:

- Obtain the axle ratio of the vehicle. Suppose the vehicle has a vibration problem at 64 km/h (40 mph) and a rear axle ratio of 2.93:1.
- Multiply the tire and wheel frequency of 7 Hz (calculated previously) with the rear axle ratio of 2.93:1. This results in a driveshaft frequency of 21 Hz at a vehicle speed of 64 km/h (40 mph).

The calculated frequency of 21 Hz is the first order driveshaft frequency; the second order frequency of the driveshaft is twice this number, or 42 Hz; and so on.

Calculating Engine Frequency

Use the engine rpm where the vibration symptom occurs to determine engine frequency. Calculate engine frequency by dividing the engine rpm by 60 (the number of seconds in a minute). For example, if the corresponding engine rpm of a vibration concern on a vehicle is 2,400 rpm, the resulting engine frequency is 40 Hz. Therefore, a 40 Hz vibration is a first order engine vibration. For purposes of vibration diagnosis, the engine also includes the torque converter and exhaust system.

Calculating Engine Accessory Frequency

Belt-driven engine accessories often produce vibrations at different frequencies than the engine itself. This is because the drive ratio created by the different size pulleys causes them to rotate at different speeds. Determining engine accessory frequency is comparable to calculating driveshaft frequency.

Calculate engine accessory frequency by performing the following steps:

- Determine the size ratio factor between the accessory pulley and the crankshaft pulley. For example, if the diameter of the crankshaft pulley is 6 inches and the accessory pulley diameter is 2 inches, the accessory pulley rotates 3 times for every crankshaft rotation (6 divided by 2).
- Multiply the engine rpm where the vibration condition occurs by the number of times the accessory pulley is rotating per crankshaft revolution. For example, if the engine rpm is 2,400 rpm, the accessory is rotating at 7,200 rpm (2,400 rpm multiplied by 3).
- Divide the accessory rpm by 60 (the number of seconds in a minute). In this example, the engine accessory frequency is 120 Hz (7,200 divided by 60).

Calculating Engine Firing Frequency

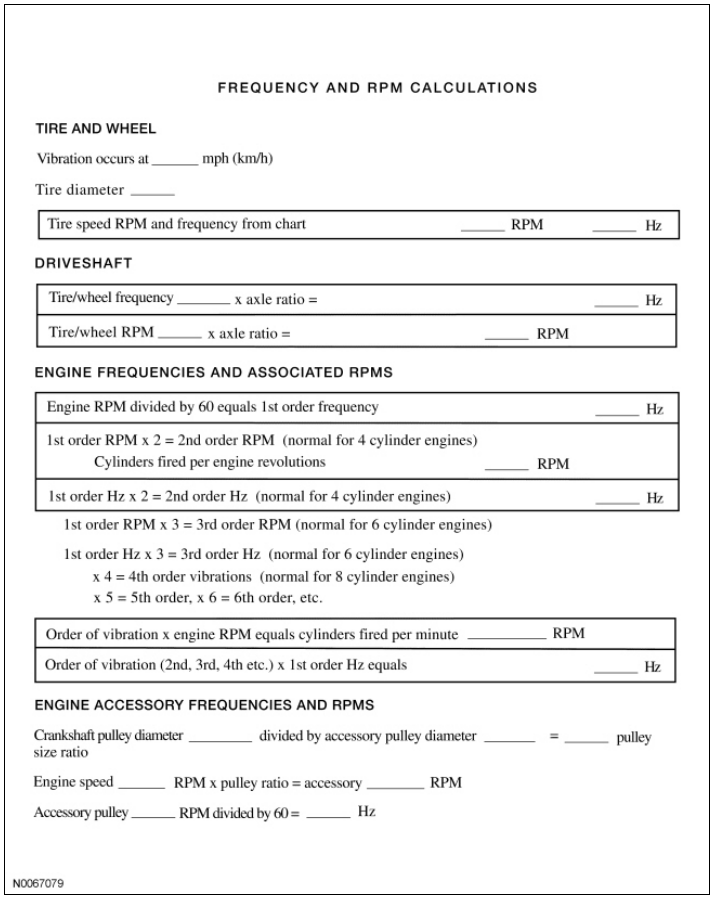
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Engine firing frequency is a term used to describe the pulses an engine creates from the firing of the cylinders. Engine firing frequency depends on how many cylinders an engine has. The number of times an engine fires a cylinder with each crankshaft revolution is equal to one-half the number of cylinders. A 4-cylinder engine fires 2 cylinders with each crankshaft revolution. Two revolutions of the crankshaft fire all 4 cylinders. A 6-cylinder engine fires 3 cylinders with each crankshaft revolution. An 8-cylinder engine fires 4 cylinders for each crankshaft revolution.

Calculate engine firing frequency by performing the following steps:

- Multiply the engine rpm where the vibration symptom occurs by the number of cylinders fired with each crankshaft revolution. For example, a vehicle with a 6-cylinder engine experiences a vibration concern at 2,400 rpm. The engine is firing the cylinders at 7,200 times per minute (3 multiplied by 2,400).
- Divide this number by 60 (the number of seconds in a minute) to obtain the engine firing frequency. In this example, the engine firing frequency is 120 Hz (7,200 divided by 60) at 2,400 rpm.

Frequency and RPM Calculations Worksheet



FREQUENCY AND RPM CALCULATIONS

TIRE AND WHEEL

Vibration occurs at _____ mph (km/h)

Tire diameter _____

Tire speed RPM and frequency from chart	_____ RPM	_____ Hz

DRIVESHAFT

Tire/wheel frequency _____ x axle ratio =	_____ Hz
Tire/wheel RPM _____ x axle ratio =	_____ RPM

ENGINE FREQUENCIES AND ASSOCIATED RPMS

Engine RPM divided by 60 equals 1st order frequency	_____ Hz
1st order RPM x 2 = 2nd order RPM (normal for 4 cylinder engines) Cylinders fired per engine revolutions	_____ RPM
1st order Hz x 2 = 2nd order Hz (normal for 4 cylinder engines)	_____ Hz

1st order RPM x 3 = 3rd order RPM (normal for 6 cylinder engines)

1st order Hz x 3 = 3rd order Hz (normal for 6 cylinder engines)
x 4 = 4th order vibrations (normal for 8 cylinder engines)
x 5 = 5th order, x 6 = 6th order, etc.

Order of vibration x engine RPM equals cylinders fired per minute	_____ RPM
Order of vibration (2nd, 3rd, 4th etc.) x 1st order Hz equals	_____ Hz

ENGINE ACCESSORY FREQUENCIES AND RPMS

Crankshaft pulley diameter _____ divided by accessory pulley diameter _____ = _____ pulley size ratio

Engine speed _____ RPM x pulley ratio = accessory _____ RPM

Accessory pulley _____ RPM divided by 60 = _____ Hz

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Harshness Symptoms

Harshness is customer perception which gives the impression of no isolation from the tire/wheel and suspension system. Harshness may be caused by road conditions, temperature changes, component damage and/or incorrect customer modifications on original components/specifications. Customers usually experience harshness when the vehicle is driving over bumps or potholes and in cold weather conditions. Harshness can also be experienced with excessive tire pressure, sporty tires, heavy-duty springs and shocks, or other vehicle modifications. Some aftermarket tires, even with the correct size, may change vehicle behavior and produce

customer concerns. The first step in diagnosing a harshness concern is to determine if the concern was experienced only in certain specific operating conditions, such as large potholes or extremely cold weather. In these cases, harshness should be considered normal. A known good vehicle can be driven under the same conditions and the rides can be compared to determine whether the concern is normal or vehicle specific. The second step is to check tire pressure and make sure it was set within vehicle specifications. The third step is to inspect for aftermarket or modified components and determine if they are the cause of the harshness complaint. If the harshness concern persists after the above steps, it is possible that some components are damaged. Based on the results from the road test, make a determination of which action in the symptom chart to take first.

NVH Symptom Chart Categories

A good diagnostic process is a logical sequence of steps that lead to the identification of a causal system. Use the symptom and possible system categories as follows:

- Identify the operating condition that the vehicle is exhibiting.
- Match the operating condition to the symptom.
- Verify the symptom.
- Calculate the frequency and order of the symptom.
- Identify which category or system(s) could cause the symptom.
- Refer to the section indicated to identify and diagnose the symptom or confirm that the system is not the source of the condition.

Use the diagnostic instructions in this section along with the necessary listed tools to identify the vibration order and to isolate the symptom and the possible systems associated with that symptom. Then based on the results from the road test, make a determination of which action in the symptom chart to take first. Since it is possible any one of multiple systems may be the cause of the symptom, it may be necessary to use a process of elimination type diagnostic approach to pinpoint the concern. Refer to the section(s) indicated to identify and isolate the cause or rule that system out as being the causal system for the symptom.

Vehicle-Speed Related Vibrations

NOTE: Any assembly that is out of balance will only cause a first order vibration, it will not cause a higher order vibration.

When a vehicle-speed related vibration is present, both tire-speed related vibration and driveshaft-speed related vibration calculations should be carried out.

Symptom Chart - Tire-Speed Related Vibrations

Symptom Chart - Tire-Speed Related Vibrations

Symptom Chart - Driveshaft-Speed Related Vibrations

Symptom Chart - Driveshaft-Speed Related Vibrations
NOTE: Any assembly that is out of balance will only cause a first order vibration, it will not cause a higher order vibration.

ConditionPossible SourcesAction

- First order driveshaft vibration

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- Driveshaft
- REFER to Section 205-00 .
- Rear drive axle/differential
- REFER to Section 205-00 .
- Second order driveshaft vibration
- U-joint
- REFER to Section 205-00 .
- Output shaft bushing in transmission/transaxle
- Refer to the appropriate section in Group 307 for the procedure. Refer to the appropriate section in Group 308 for the procedure. GO to the Symptom Chart in the appropriate section.
- Third order driveshaft vibration
- Rear drive axle/differential
- REFER to Section 205-00 .

Symptom Chart - Engine-Speed Related Vibrations

Symptom Chart - Engine-Speed Related Vibrations
NOTE: When an engine-speed related vibration is present, engine, engine accessory and engine firing calculations should be carried out.

NOTE: Any assembly that is out of balance will only cause a first order vibration, it will not cause a higher order vibration.

NOTE: Some engine-speed related vibrations are normal though they should not be felt in the passenger compartment.

ConditionPossible SourcesAction

- 0.5 order engine vibration
- Engine
- REFER to Section 303-00 .
- First through sixth order engine vibration
- Engine
- REFER to Section 303-00 .
- Transmission/transaxle

- Refer to the appropriate section in Group 307 for the procedure. Refer to the appropriate section in Group 308 for the procedure. GO to the Symptom Chart in the appropriate section.
- Engine mounts
- REFER to Section 303-00 .
- Transmission/transaxle mounts
- Refer to the appropriate section in Group 307 for the procedure. Refer to the appropriate section in Group 308 for the procedure. GO to the Symptom Chart in the appropriate section.
- Exhaust system
- REFER to Section 309-00 .
- Belt driven accessory speed vibration
- Engine pulley
- REFER to Section 303-00 .
- Coolant pump
- REFER to Section 303-00 .
- Generator
- REFER to Section 414-00 .
- A/C compressor
- REFER to Section 412-00 .
- Power steering pump
- REFER to Section 211-00 .
- Vacuum pump
- REFER to Section 303-00 .
- Accessory drive belt
- REFER to Section 303-00 .

Symptom Chart - Noise, Air Leaks or Water Leaks

Symptom Chart - Noise, Air Leaks or Water Leaks

Symptom Chart - Harshness

Symptom Chart - Harshness

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Material

Item	Specification	Fill Capacity
3MTM Strip Caulk - Black 051135-08578	WSB-M4G32-C	-
Seam Sealer TA-2	-	-
Clear Silicone Rubber TA-32	ESB-M4G92-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Silicone Spray Lubricant XL-6	ESR-M13P4-A	-
Trim and Weatherstrip Adhesive TA-14-A	-	-

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Insulation

Insulation is used as a sound-deadener to reduce exterior road and powertrain noises from the interior of the vehicle. Mastic insulators are also used as insulation. For information on the location of the mastic insulators, refer to Section 501-35 . Insulation is installed:

- under the hood.
- in front of the instrument panel.
- over and under the tunnel.
- over the front and rear floor pans.
- inside the B-, C- and D-pillars.
- on the wheel house/quarter panel.
- on the engine side dash insulator (behind the engine-car rearward).

It has heat-bondable mastic deadeners for improved NVH characteristics.

Body Sealer Types And Applications

Seam Sealer

Seam Sealer TA-2 or equivalent:

- is a heavy-bodied, non-sag adhesive/sealer for use on standing cosmetic seams, truck bed seams, tooled door skin seams and floor pans.
- can be used on water leaks and noise concerns.

Clear Silicone Rubber

Clear Silicone Rubber TA-32 or equivalent meeting Ford Specification ESB-M4G92-A:

- does not run.
- is fast drying.
- remains semi-elastic.
- can be used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

Silicone Gasket and Sealant

Silicone Gasket and Sealant TA-30 or equivalent meeting Ford specification WSE-M4G323-A4:

- is a form-in-place gasket and multi-purpose adhesive/sealant.
- is a room temperature curing silicone rubber.

Caulking Cord

3MTM Strip Caulk-Black 051135-08578 or equivalent meeting Ford specification WSB-M4G32-C:

- is a heavy-bodied, plastic base with a filler.
- is commonly known as perma-gum.
- is used on spot-weld holes and between surfaces not sealed with a gasket.

Weatherstrip Adhesive

Trim and Weatherstrip Adhesive TA-14-A or equivalent:

- is a quick drying, strong adhesive designed to hold weatherstripping onto all body panels and surrounding metal.

Silicone Lubricant

Silicone Spray Lubricant XL-6 or equivalent meeting Ford specification ESR-M13P4-A:

- is used to keep the door and the window weatherstrip pliable and soft.
- makes the door easier to close.
- retards weatherstrip squeaks.
- retards weatherstrip wear.

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- helps retain door window alignment by reducing friction between the glass frame and the rubber weatherstrip.
- should not be used prior to painting.

Body System

Material

Item	Specification
Seam Sealer TA-2	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Inspection and Verification

Dust and Water Leaks

Most dust and water leaks occur due to missing or mis-installed body sealer or components. The source of the leak is detected by:

- pressurizing the vehicle and testing with soapy water.
  - ♦ Locate and tape off the body vents.
  - ♦ Turn the blower motor on the high position.
  - ♦ Turn the air recurculation to the off mode.
  - ♦ Close the windows and doors.
  - ♦ Open the hood and spray soapy water along body seams and grommets. Make sure to test the areas arround the A-pillar at the fender and the hood hinge area.
  - ♦ Check for bubbles.
- inspecting for a dust pattern or water path near and above the area in question.
- removing any trim or carpet in the general area of the leak.
- road testing or water-hose testing the vehicle.
- placing a bright light under the vehicle, removing any necessary trim or carpet and inspecting the interior of the body at joints and weld lines.

Wind Noise

Most wind noise leaks occur at the corners of the windows or in the doors. Wind noise is detected by driving the vehicle at highway speeds or at speeds as specified by the customer. The vehicle should be driven in 4 different directions, with all the windows CLOSED, the radio OFF and the A/C blower motor OFF.

Squeak and Rattle

Squeak and rattle noises are generally caused by loose parts, contact or relative movement between 2 surfaces or loose wires and connectors. The source of the noise can be detected by stopping movement of the suspect part by hand or by using dampening or low friction materials.

Symptom Chart - NVH

Symptom Chart - NVH

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NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible that any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Draft/wind noise and water leak around door perimeter
- Loose fit seal
- PINCH seal carrier to improve retention on seal flange.
- Seal installed incorrectly
- REINSTALL the seal.
- Door misaligned
- REALIGN the door. CHECK door gaps and fit in door opening and ADJUST as necessary. REFER to Section 501-03 .
- Scuff plate installed incorrectly
- REINSTALL the scuff plate.
- Seal or seal pushpins damaged
- INSTALL a new seal/pushpins.
- Sheet metal joints in door or door opening
- SEAL leaks with Silicone Gasket and Sealant.
- Draft/wind noise and water leak around glass run
- Door glass misaligned
- ADJUST door glass.
- Glass run installed incorrectly
- REINSTALL glass run. INSERT foam in glass run carrier if necessary.
- Leak path behind glass run
- INSTALL foam rope behind glass run.
- Glass run channel spread wide
- PINCH glass run channel to reduce size of opening.
- Glass run damaged

- INSTALL a new glass run.
- Draft/wind noise and water leak at inner belt line
- Belt line seal installed incorrectly on flange
- ADJUST seal. (Do not bend the flange.)
- No contact with side glass
- ADJUST door glass.
- No contact with glass runs at both ends of belt line seal
- ADJUST belt line seal or ADD foam at seal ends.
- Belt line seal damaged
- INSTALL a new seal.
- Draft/wind noise and water leak at outer belt line
- Belt line seal installed incorrectly on flange (no glass contact)
- ADJUST seal.
- Belt line seal does not contact the glass
- ADJUST door glass.
- No contact with glass runs at both ends of belt line seal
- ADJUST belt line seal or ADD foam at seal ends.
- Belt line seal damaged
- INSTALL a new seal.
- Draft/wind noise at inner door handle/speaker opening
- Hole in weathershield
- SEAL hole with suitable tape.
- Weathershield misaligned
- REALIGN weathershield. INSTALL a new weathershield if pressure sensitive adhesive fails.
- Exterior door handle seal misaligned/damaged
- REALIGN or INSTALL a new seal as necessary. REFER to Section 501-14 .
- Speaker or speaker seal missing or damaged

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- REPAIR speaker seal or INSTALL a new door speaker.
- Draft/wind noise and water leaks at floor pan and grommets
- Missing or damaged plugs/grommets
- CHECK plugs/grommets for correct installation or damage. INSTALL new plugs/grommets if necessary.
- Road noise
- Missing mastic insulators
- CHECK for missing mastic insulators. REFER to Section 501-35 .
- Missing body insulators
- CHECK for missing body insulators.
- Rattles in body/doors and instrument panel
- Loose wires/cables
- CHECK that all wires/cables are correctly routed and inserted in correct retainers.
- Loose objects/components in door wells, pillars quarter trim panels
- CHECK doors by carefully striking underside of doors with a rubber mallet while listening for rattles in doors and pillars. REMOVE or TIGHTEN loose objects/components.
- Buzz from instrument panel components
- IDENTIFY which components of the instrument panel are buzzing. SECURE/FASTEN components as necessary, ADD foam or felt as needed if rattle persists.
- Door drain holes collecting water
- Holes clogged with mud or road tar
- CLEAN drain holes of foreign material with a punch or screwdriver. CHECK drain holes regularly.
- Wind noise from exterior rear view mirror
- Exterior mirror housing misaligned
- REALIGN with edges shingled to airflow, with no gaps.
- Mirror sail gasket folded/misaligned
- REINSTALL with gasket unfolded and aligned correctly.
- Mirror housing trim cap installed incorrectly
- REINSTALL with edges shingled to airflow.

- Air leak through mirror housing hinge
- Fully ENGAGE mirror into its operating position. USE foam to block air path through hinge.
- Inner sail trim installed incorrectly
- REINSTALL sail trim. ADJUST door trim.
- Inner sail gasket/barrier installed incorrectly
- REINSTALL trim cover with gasket/barrier aligned correctly.
- Air path through wiring bundle/fastener access holes
- BLOCK air path(s) with foam/tape.
- Exposed fastener access hole on mirror housing/sail
- INSTALL a new cap if missing.
- Rattle/vibration from exterior rear view mirror
- Mirror glass adjustment screws loose
- REMOVE mirror glass and TIGHTEN mirror glass adjustment motor screws. REFER to Section 501-09 .
- Mirror mounting nuts loose
- TIGHTEN mirror mounting nuts. REFER to Section 501-09 .
- Aftermarket air deflector/stone shields
- If possible, REMOVE aftermarket air deflector/stone shield, then ROAD TEST vehicle. If concern is no longer present, ADVISE customer that aftermarket component was causing concern.
- If equipped with power fold mirrors, power fold mirrors folded/unfolded manually or are not synchronized
- If equipped with power fold mirrors, SYNCHRONIZE power fold mirrors. REFER to Section 501-09 .
- Draft/wind noise and water leak around perimeter of all fixed glass
- Gaps in the sealant bead
- APPLY approved sealant.
- Air traveling up windshield molding along A-pillar
- INSTALL foam rope full length of the A-pillar.
- Gaps in sealant bead of windshield/rear glass

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- RESEAL windshield/rear glass. REFER to Section 501-11 .
- Windshield misaligned or not installed correctly
- REINSTALL windshield glass. REFER to Section 501-11 .
- Rear hood seal at base of windshield misaligned/damaged
- REALIGN or INSTALL a new seal as necessary.
- Draft noise at cowl
- Cowl seal misaligned/damaged
- REALIGN or INSTALL a new seal as necessary.
- Draft/wind noise and water leak around liftgate perimeter
- Loose fit seal
- PINCH seal carrier to improve retention on seal flange or INSERT foam in carrier.
- Seal misaligned or installed incorrectly
- REINSTALL seal.
- Liftgate misaligned
- REALIGN liftgate. CHECK liftgate fit in body opening and ADJUST as necessary.
- Scuff plate misaligned
- REINSTALL scuff plate.
- Seal or seal pushpins damaged
- INSTALL a new seal.
- Draft/water leak or noise from roof opening panel
- Roof opening panel/components
- REFER to Section 501-17 for diagnosis.
- Wind noise created by airflow over or behind body panels
- Fender splash shield misaligned
- REALIGN fender splash shield.
- Body panel misaligned (exposed edge)
- REALIGN appropriate body panel.

- Hood misaligned (front margin)
- CHECK hood gaps and fit. ADJUST hood as necessary.
- Front grille edge noise
- APPLY foam in hollow areas behind louvers.
- Wind noise created by grille opening panel
- Grille relationship to leading edge on hood
- If possible, ADJUST grille opening panel forward to eliminate wind noise.
- Sharp edges due to material imperfections
- REMOVE sharp edges (no damage to visible surface).
- Wind noise from air extractor (body vent)
- Roof rack rails or crossbars loose
- TIGHTEN fasteners.
- Roof rack fasteners missing
- INSTALL approved fasteners.
- Roof rack crossbars installed backward
- REINSTALL crossbars.
- Roof rack rub strips partially lifting from roof
- REAPPLY adhesive or fasteners or INSTALL new rub strips as necessary.
- Roof rack gaskets loose or misaligned
- REINSTALL gasket.
- Wind noise from bug shield/exterior windshield sun visor
- Turbulence created by location and shape
- Determine if an OEM part or aftermarket. If aftermarket advise customer accordingly. If OEM, verify correctly installed. If noise is abnormal repair or replace as required.
- Rattle from Sport Trac tailgate
- Loose tailgate latch
- If possible. ADJUST the tailgate latch. TIGHTEN the tailgate latch bolts. REFER to Section 501-14 .
- Loose or worn tailgate latch striker sleeve

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- TIGHTEN or REPLACE the tailgate striker.

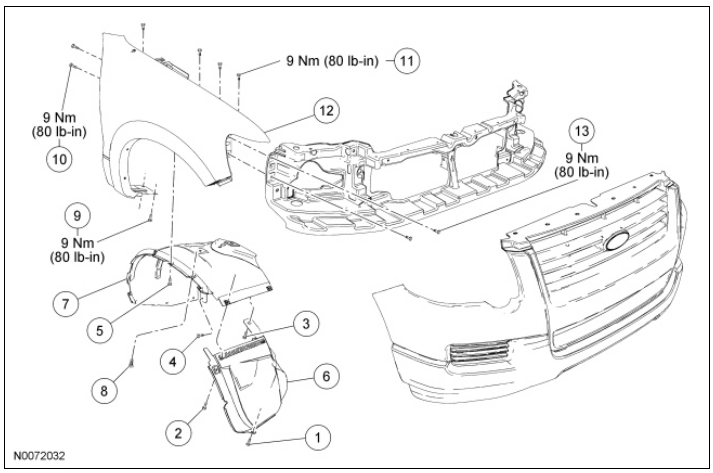
Torque Specifications

Description	Nm	lb-ft	lb-in
Grille opening panel bolts	9	-	80
Hood hinge-to-body bolts	9	-	80
Hood hinge-to-hood bolts	9	-	80
Hood striker bolts	12	-	106
Lower A-pillar inner fender bolts (Explorer/Explorer Sport Trac)	9	-	80
Lower A-pillar inner fender bolts (Mountaineer)	8	-	71
Running board bolts	23	17	-
Top fender bolts (Explorer/Explorer Sport Trac)	9	-	80
Top fender bolts (Mountaineer)	8	-	71
Upper A-pillar inner fender bolts	9	-	80

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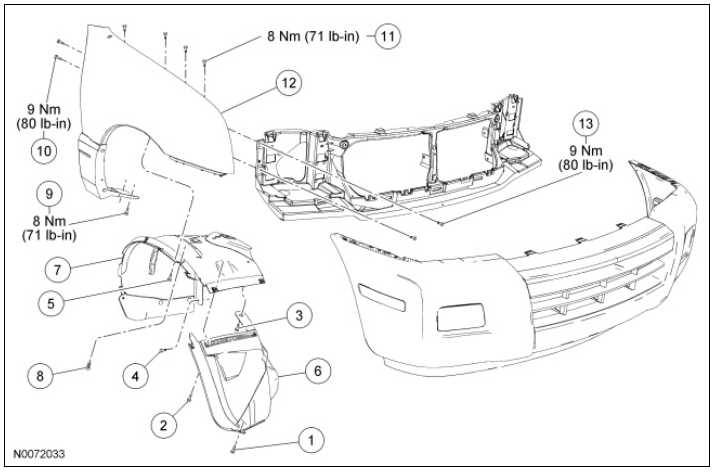
Front End Body Panels - Exploded View

Explorer/Explorer Sport Trac



Item	Part Number	Description
1	W712067	Front splash shield pushpin
2	W706805	Front splash shield screw (3 required)
3	N804379	Splash shield pin-type retainer (2 required)
4	16034	Splash shield pin-type retainer (5 required)
5	N808650	Splash shield screw (3 required)
6	16184	Front splash shield
7	16054	Front fender rear splash shield
8	N806113	Front fender rear splash shield pushpin (2 required)
9	W706599	Lower A-pillar inner fender bolt (2 required)
10	W706599-S	Upper A-pillar inner fender bolt (2 required)
11	W706599-S	Top fender bolt (4 required)
12	16006 LH/ 16005 RH	Fender
13	W503925-S	Grille opening panel bolt (2 required)

Mountaineer



Item	Part Number	Description
1	W712067	Front splash shield screw
2	W706805	Front splash shield screw (3 required)
3	N804379	Splash shield pin-type retainer (2 required)
4	16034	Splash shield pin-type retainer (5 required)
5	N808650	Splash shield screw (3 required)
6	16D072	Front splash shield
7	16054	Front fender rear splash shield
8	N806113	Front fender splash shield pushpin (2 required)
9	W503925-S	Lower A-pillar inner fender bolt (2 required)
10	W706599-S	Upper A-pillar inner fender bolt (2 required)
11	W706599-S	Top fender bolt (4 required)
12	16006 LH/ 16005 RH	Fender
13	W503925-S	Grille opening panel bolt (2 required)

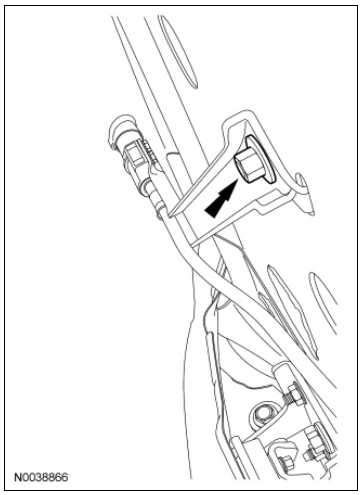
1. For additional information, refer to the procedures in this section.

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Fender

Removal and Installation

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .
2. Remove the front fender splash shield. For additional information, refer to Fender Splash Shield in this section.
3. Remove the headlamp assembly. For additional information, refer to Section 417-01 .
4. If removing the right front fender, remove the antenna mast and bolt, and position the antenna cable aside.



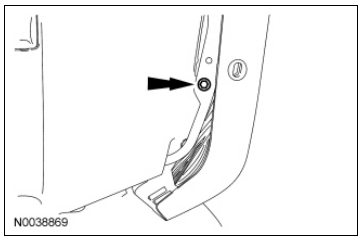
5. Remove the 2 grille opening panel bolts.
   - To install, tighten to 9 Nm (80 lb-in).
6. Remove the 4 top fender bolts.
   - For Explorer/Explorer Sport Trac, tighten to 9 Nm (80 lb-in).
   - For Mountaineer, tighten to 8 Nm (71 lb-in).
7. Remove the 2 upper A-pillar inner fender bolts.
   - To install, tighten to 9 Nm (80 lb-in).
8. Remove the 2 lower A-pillar inner fender bolts.
   - For Explorer/Explorer Sport Trac, tighten to 9 Nm (80 lb-in).
   - For Mountaineer, tighten to 8 Nm (71 lb-in).
9. Remove the fender.
10. To install, reverse the removal procedure.

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Fender Splash Shield

Removal and Installation

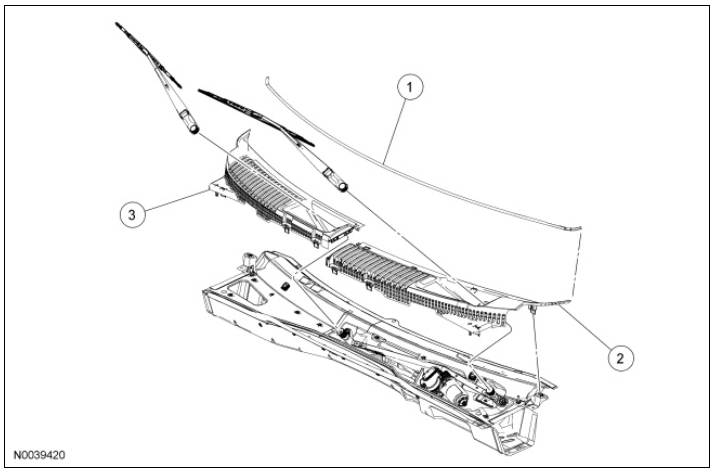
1. Loosen the running board bolts and lower the running board to access the front fender moulding pin-type retainer.
    - To install, tighten to 23 Nm (17 lb-ft).
2. Remove the lower pin-type retainer from the front fender moulding.
3. Remove the 2 rear pin-type retainers from the front fender moulding.
4. Position the front fender moulding aside and remove the splash shield lower screw.



5. Remove the front splash shield screws.
6. Remove the front splash shield pin-type retainers.
7. Remove the front splash shield.
8. Remove the front fender splash shield.
9. To install, reverse the removal procedure.

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Cowl Panel Grille



Item	Part Number	Description
1	02824	Cowl panel seal
2	022A68	Cowl panel LH
3	022A68	Cowl panel RH

1. Remove the wiper pivot arms. For additional information, refer to Section 501-16 .

NOTICE: **To avoid breaking the retaining clips on the cowl panel, do not pull up on the rear of the cowl panel.**

2. Pry up on the front of the cowl panel to release it from the retaining clips.

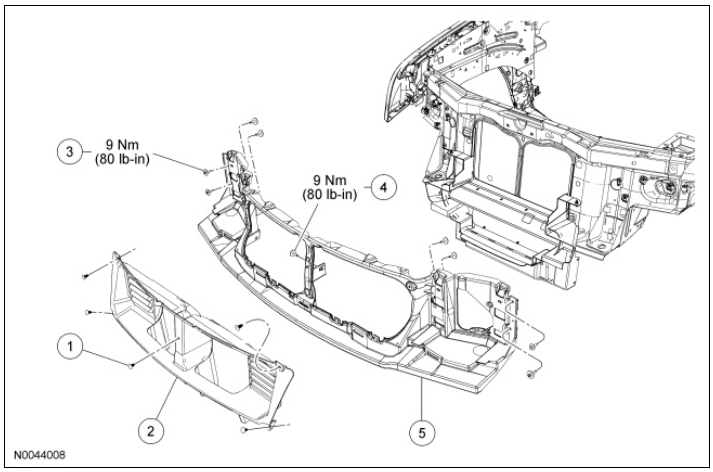
3. Remove the cowl panel grille.

4. Separate the left cowl panel from the right cowl panel by releasing the retaining clips.

5. To install, reverse the removal procedure.

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Radiator Grille Opening Panel



Item	Part Number	Description
1	W705589	Grille panel deflector pin-type retainer (5 required)
2	8C299	Grille panel deflector
3	W503925-S	Grille opening panel bolt (9 required)
4	W503925-S	Grille opening panel center bolt
5	8190	Grille opening panel

Removal and Installation

1. Remove the headlamp assemblies. For additional information, refer to Section 417-01 .

2. Remove the front bumper cover. For additional information, refer to Section 501-19 .

3. Remove the 5 grille panel deflector pin-type retainers.

4. Remove the grille panel deflector.

5. Remove the 8 grille opening panel bolts.
   - To install, tighten to 9 Nm (80 lb-in).

6. Remove the grille opening panel center bolt.
   - To install, tighten to 9 Nm (80 lb-in).

7. Remove the grille opening panel.

8. To install, reverse the removal procedure.

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General Specifications

Item	Specification
Body Closures	
Door clearance front and rear	3.0-7.0 mm (0.118-0.275 in) parallel top to bottom within 1.0 mm (0.04 in)
Door flushness	-1.0-0.0 mm (-0.04-0.00 in)
Top of door-to-roof clearance	3.0-7.0 mm (0.118-0.275 in) parallel front to back

Torque Specifications

Description	Nm	lb-ft	lb-in
Door latch striker plate screws	25	18	-
Front door hinge-to-body fasteners	30	22	-
Front door hinge-to-front door fasteners	30	22	-
Front door lower hinge nut	30	22	-
Front safety belt retractor bolt	40	30	-
Liftgate hinge-to-body bolt	32	24	-
Liftgate hinge-to-body nut	35	26	-
Liftgate hinge-to-liftgate bolts	12	-	106
Liftgate striker screws	30	22	-
Liftgate strut ball stud nut-to-liftgate	55	41	-
Liftgate strut ball stud nut-to-liftgate	30	22	-
Rear door hinge-to-body fasteners	30	22	-
Rear door hinge-to-rear door fasteners	30	22	-

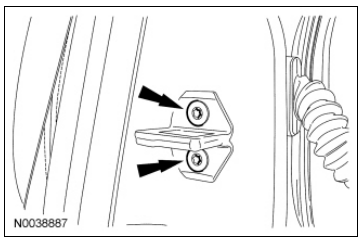
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Door Alignment

Front and rear door

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to Section 501-20B .

2. Remove the door latch striker plate.

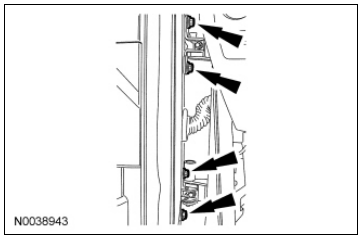


Front door in and out, up and down adjustment

3. **NOTE:** The bolts securing the 2 hinge halves together are not to be removed or serviced. Remove the hinge-to-door or hinge-to-body bolts when removing or adjusting the front or rear doors.

   NOTE: Driver side shown, passenger side similar.

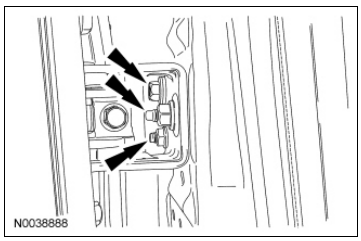
   Loosen, but do not remove, the front door hinge-to-front door fasteners enough to allow door adjustment.



Front door fore, aft and tilt adjustment

NOTE: Driver side shown, passenger side similar.

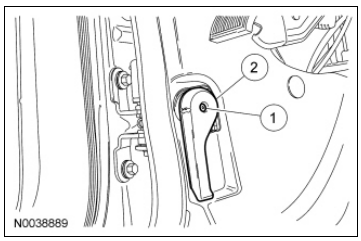
4. Loosen, but do not remove, the upper front door hinge-to-body fasteners enough to allow door adjustment.



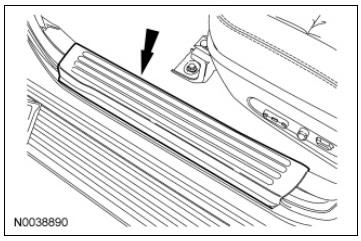
5. If adjusting the driver side, remove the hood release lever.
   1. Remove the screw.

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2. Position the hood release lever.



6. Remove the front door scuff plate.

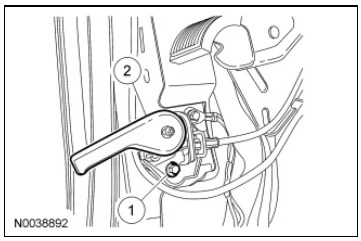


7. Partially remove the front door weatherstrip.

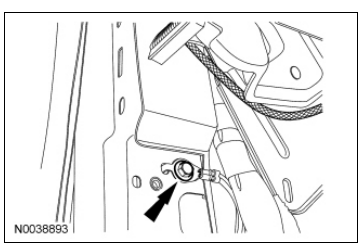
8. Remove the lower cowl trim panel.
    1. Remove the pin-type retainer.
    2. Remove the lower cowl trim panel.



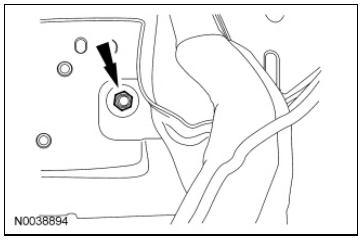
9. If adjusting the driver side, remove the hood release mechanism.
    1. Remove the screw.
    2. Position the hood release mechanism.



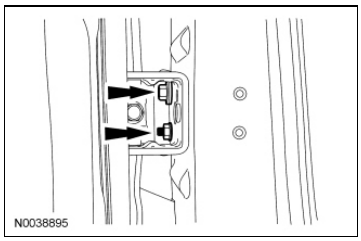
10. Disconnect the ground wires.



11. Position the weather shield and loosen, but do not remove, the front door lower hinge nut.

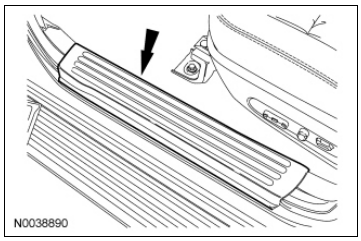


12. Loosen, but do not remove, the lower front door hinge-to-body fasteners enough to allow door adjustment.

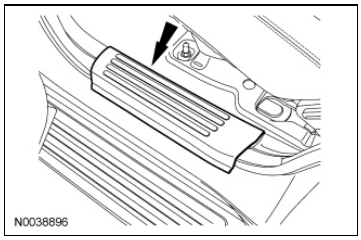


Rear door fore, aft and tilt adjustment

13. Remove the front door scuff plate.



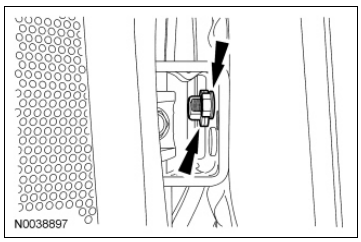
14. Remove the rear door scuff plate.



15. Remove the lower B-pillar trim panel. For additional information, refer to Section 501-05 .

16. Remove the front safety belt retractor.
    - Remove the front safety belt retractor bolt.
        - ♦ To install, tighten to 40 Nm (30 lb-ft).
    - Remove the safety belt retractor and position aside.

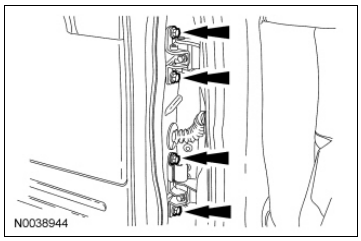
17. Loosen, but do not remove, the rear door hinge-to-body fasteners enough to allow door adjustment.



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Rear door in and out, up and down adjustment

18. Loosen, but do not remove, the rear door hinge-to-rear door fasteners enough to allow door adjustment.



Front and rear door

19. Adjust the door. For additional information, refer to Section 501-35 .

20. Tighten the door fasteners.
    - Tighten the front door hinge-to-front door fasteners to 30 Nm (22 lb-ft).
    - Tighten the front door hinge-to-body fasteners to 30 Nm (22 lb-ft).
    - Tighten the front door lower hinge nut to 30 Nm (22 lb-ft).
    - Tighten the rear door hinge-to-rear door fasteners to 30 Nm (22 lb-ft).
    - Tighten the rear door hinge-to-body fasteners to 30 Nm (22 lb-ft).

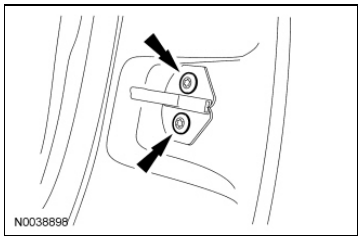
21. Reassemble the system.

22. Install and adjust the door striker as necessary.
    - Tighten the door latch striker plate screws to 25 Nm (18 lb-ft).

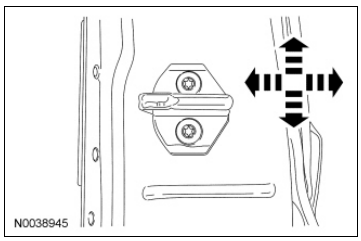
23. Repower the SRS . For additional information, refer to Section 501-20B .

Striker Adjustment

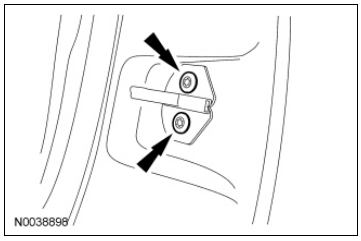
1. Loosen the door latch striker plate screws.



2. Adjust the door latch striker plate from side-to-side or up and down as necessary.



3. Tighten the door latch striker plate screws.
   - Tighten to 25 Nm (18 lb-ft).



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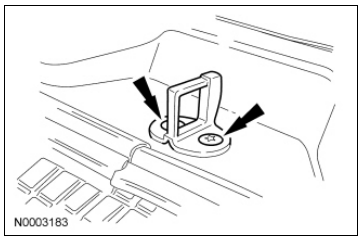
Liftgate Alignment

Liftgate left and right adjustment

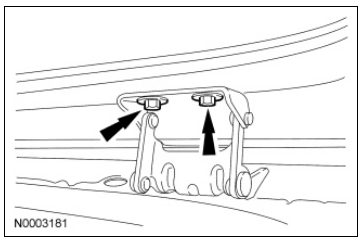
1. **NOTE:** Position the carpet for access to liftgate striker bolts.

   Remove the liftgate striker.

2. Loosen, but do not remove, the hinge-to-liftgate bolts enough to permit movement of the liftgate.



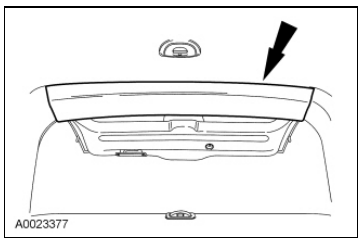
3. Adjust the liftgate so that the gaps are equal.



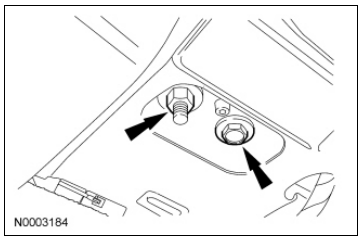
4. Tighten the liftgate hinge-to-liftgate bolts.
   - Tighten to 12 Nm (106 lb-in).

Liftgate in and out, up and down adjustment

5. Remove the headliner rear trim panel.



6. Loosen, but do not remove, the liftgate hinge-to-body fasteners enough to permit movement of the liftgate.



7. Adjust the liftgate so that the gaps are equal.

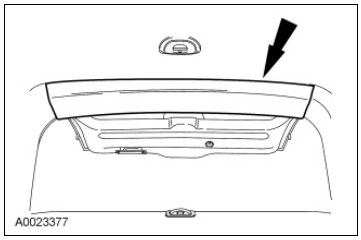
8. Tighten the liftgate hinge-to-body fasteners.
   - Tighten the liftgate hinge-to-body nuts to 35 Nm (26 lb-ft).
   - Tighten the liftgate hinge-to-body bolts to 32 Nm (24 lb-ft).

9. **NOTE:** Keep striker frame aligned fore/aft to the vehicle line. Avoid any twist in the striker frame relative to the vehicle.

   Install the liftgate striker, adjust as necessary.

   - Tighten to 30 Nm (22 lb-ft).

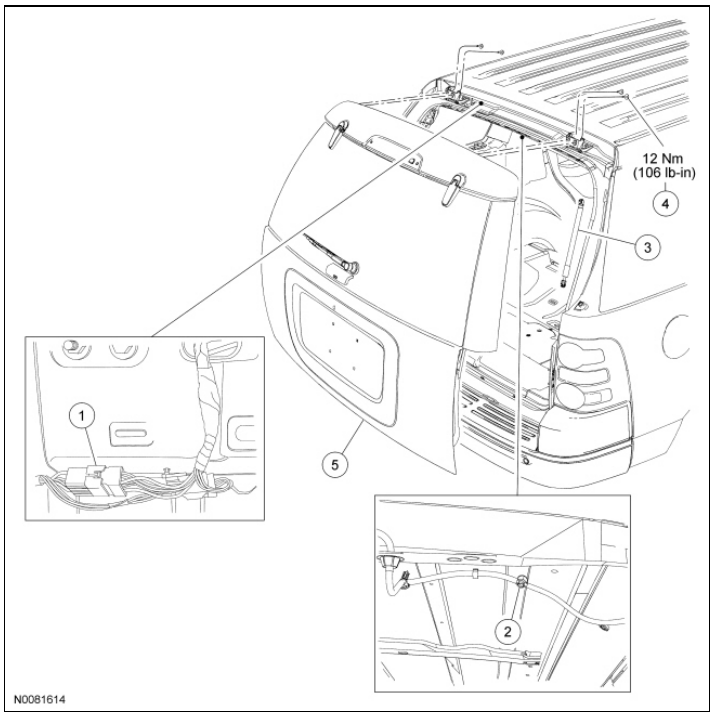
10. Install the headliner rear trim panel.



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Liftgate

Liftgate Assembly

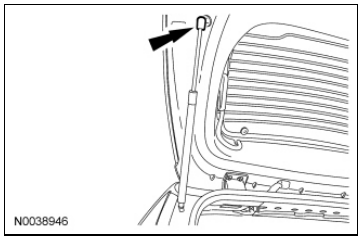


Item	Part Number	Description
1	14489A	Liftgate electrical connector
2	17A422A	Windshield washer hose nozzle
3	78406A11 LH/ 78406A10 RH	Liftgate strut
4	W709783	Liftgate hinge-to-liftgate bolt (4 required)
5	7840400	Liftgate

Removal and Installation

1. Remove the D-pillar trim panels. For additional information, refer to Section 501-00 .
2. Position the headliner to access the rear washer hose and the liftgate electrical harness connectors.
3. Disconnect the liftgate electrical connector.
4. Disconnect the windshield washer hose nozzle.
5. **NOTE:** Support the liftgate before removing the liftgate struts.

   Remove the liftgate struts.



6. **NOTE:** With a wax pencil, mark the position of each hinge to aid in the installation of the liftgate.

   Remove the 4 liftgate hinge-to-liftgate bolts.

   - To install, tighten to 12 Nm (106 lb-in).

7. ***NOTICE:*** **To avoid damaging the liftgate, this step requires an assistant.**

   Remove the liftgate.

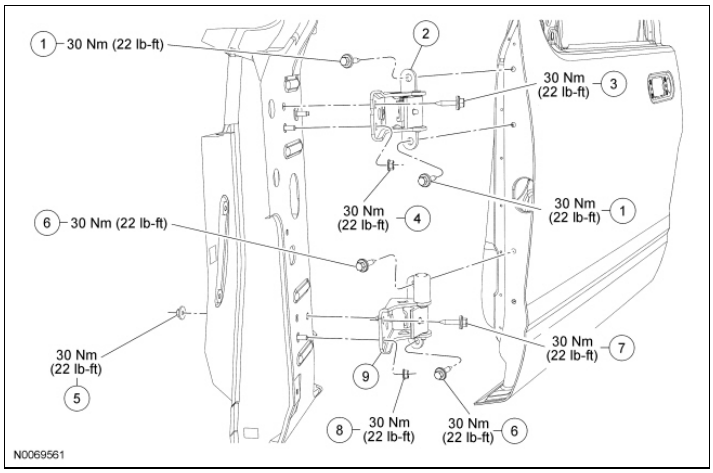
8. To install, reverse the removal procedure.
   - Transfer components as necessary.

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Door

Removal and Installation

NOTE: Front door shown, rear door similar.



Item	Part Number	Description
1	W709189	Front door upper hinge-to-door bolts
2	7822801 LH/ 7822800 RH	Front door upper hinge
3	W709189	Front door hinge-to-body bolt
4	W707665	Front door upper hinge-to-body nut
5	W707665	Front door lower hinge-to-body interior nut
6	W709189	Front door lower hinge-to-door bolts
7	W709189	Front door lower hinge-to-body bolt
8	W707665	Front door lower hinge-to-body nut
9	7822811 LH/ 7822810 RH	Front door lower hinge

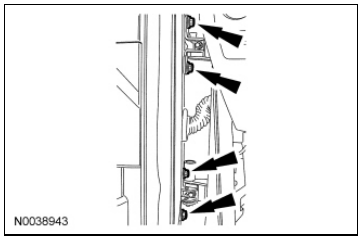
1. Disconnect the front door electrical connector at the A-pillar.

2. ***NOTICE:*** **To minimize the possibility of cross threading, hand start all fasteners during the installation.**

   NOTICE: **To avoid damaging the door, this step requires an assistant.**

   Mark the position of each hinge and remove the hinge-to-door bolts.

   - To install, tighten to 30 Nm (22 lb-ft).



3. Remove the front door.

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General Specifications

Item	Specification
Measurements For the Box to Cab	
Pickup box leading edge to cab distance	29 mm (1.14 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Body side outer front bolts	12	-	106
Body side outer mounting bolts	12	-	106
Body side outer panel bolts	12	-	106
Body side outer rear bolts	12	-	106
Fuel filler pipe screws	3	-	27
Lower rear body side outer bolt	12	-	106
Pickup bed exterior tie-down bolt	5	-	44
Pickup bed front nuts and rear bolts	62	46	-
Pickup bed reinforcement mounting bolts	25	18	-
Pickup bed reinforcement outer bolts	25	18	-
Pickup bed storage compartment front hinge nuts	12	-	106
Pickup bed storage compartment lid nuts	12	-	106
Pickup bed tailgate hinge bolts	47	35	-
Tailgate striker	40	30	-

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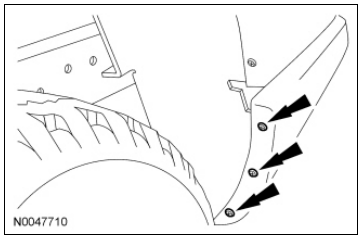
Pickup Bed

The pickup bed consists of the following components:

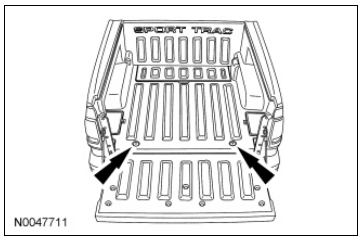
- Bed extender (optional)
- Box inner panel
- Body side outer moulding
- Body side outer panels
- Cargo divider (optional)
- Front/side storage compartments
- Fuel filler door
- Fuel filler housing
- Pickup bed inner tie-downs
- Pickup bed exterior tie-downs
- Pickup bed reinforcement assembly
- Power point receptacle
- Rear wheel house panels
- Tonneau cover (optional)
- Tailgate assembly
- Wiring harnesses

Pickup Bed Alignment

1. Remove the 6 bumper cover screws (3 each side).

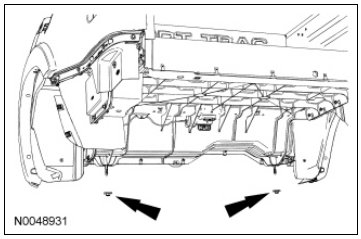


2. Loosen the pickup bed rear bolts.

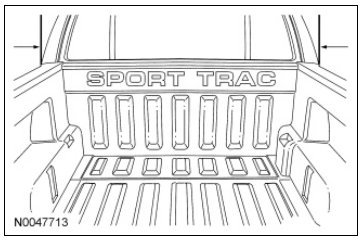


3. **NOTE:** The nuts are loosened from under the vehicle.

   Loosen the front pickup bed bolts.

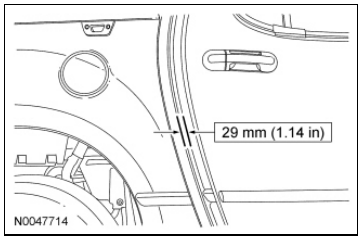


4. Center the pickup bed to the rear of the cab.



5. Align the leading edge of the pickup bed and the rear of the cab to specifications.

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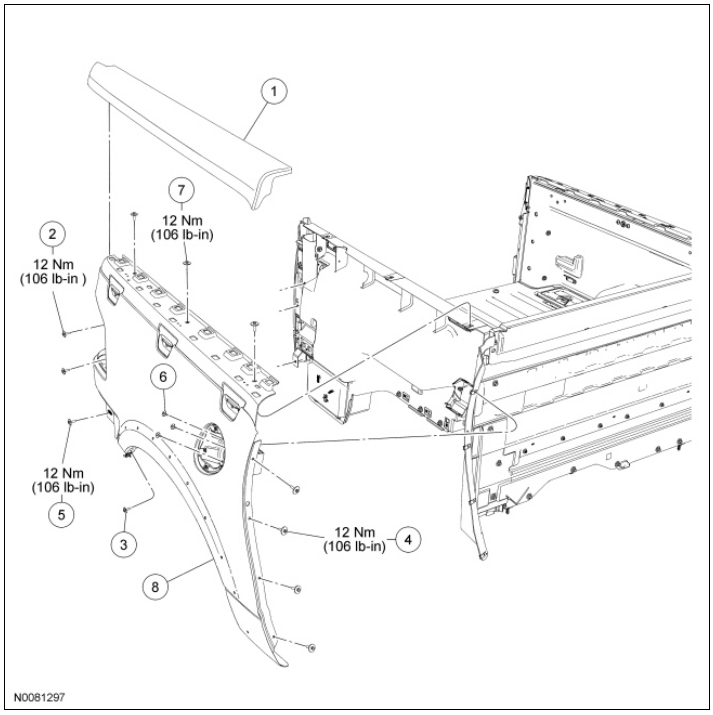


6. Tighten the pickup bed bolts and nuts.
    - To install, tighten to 62 Nm (46 lb-ft).

7. Install the 6 bumper cover screws (3 each side).

Pickup Bed Body Side

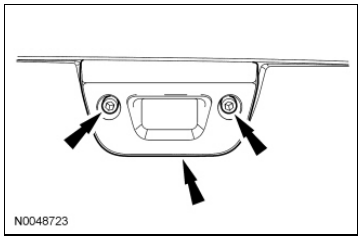
NOTE: RH shown, LH similar.



Item	Part Number	Description
1	7829141 LH/ 7829140 RH	Body side outer moulding
2	W710478-S	Rear body side outer bolt (2 required)
3	-	Pickup bed wheel house opening screw (4 required)
4	W710478-S	Front body side outer bolt (4 required)
5	W710478-S	Lower rear body side outer bolt
6	W711589-S	Fuel filler neck pipe screw (3 required)
7	W710478-S	Upper body side outer bolt (3 required)
8	9927841 LH/ 9927840 RH	Pickup bed body side outer panel

1. Remove the 3 exterior pickup bed tie-downs.
    - Remove the 6 bolts.
        - ♦ To install, tighten to 5 Nm (44 lb-in).
    - Remove the 3 tie-downs.

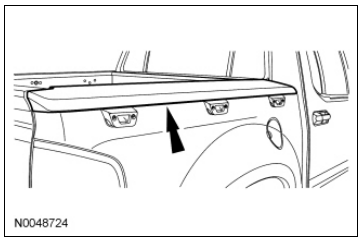
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2. **NOTE:** RH shown, LH similar.

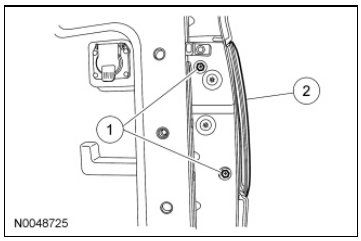
   Remove the body side outer moulding.

   - To release the moulding, start at the inside and roll the moulding to the outside.

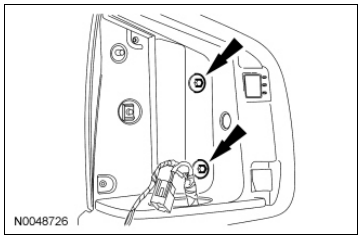


3. Remove the pickup bed. For additional information, refer to Pickup Bed in this section.

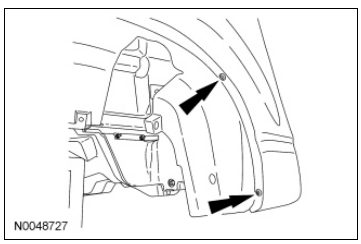
4. Remove the rear lamp assembly.
   1. Remove the bolts.
   2. Remove the rear lamp.
      - Disconnect the electrical connectors.



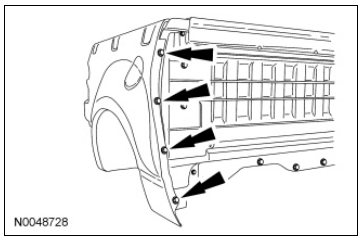
5. Remove the 2 body side outer rear bolts.
   - To install, tighten to 12 Nm (106 lb-in).



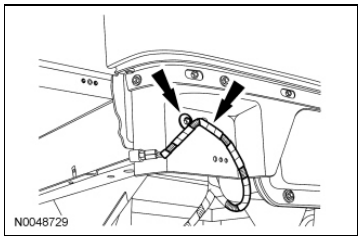
6. Remove the 4 pickup bed wheel house screws.



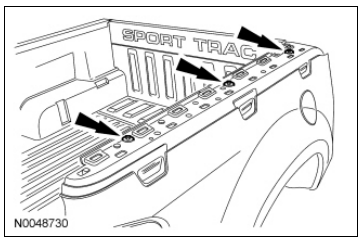
7. Remove the 4 body side outer front bolts.
    - To install, tighten to 12 Nm (106 lb-in).



8. Remove the lower rear body side outer bolt and disconnect the wiring harness from the body side outer panel.
    - To install, tighten to 12 Nm (106 lb-in).



9. Remove the 3 upper body side outer mounting bolts and remove the body side outer panel.
    - To install, tighten to 12 Nm (106 lb-in).

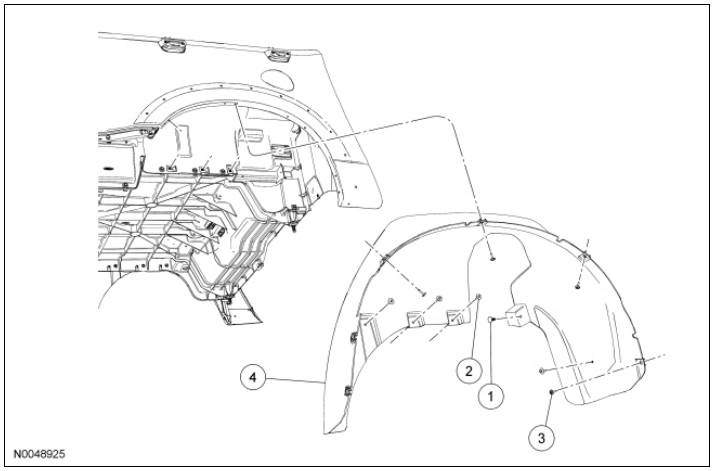


10. To install, reverse the removal procedure.

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Pickup Bed Wheel House

NOTE: RH shown, LH similar.

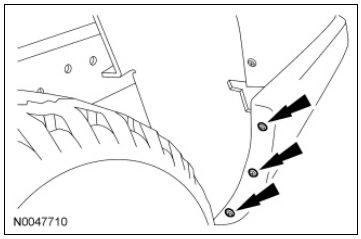


Item	Part Number	Description
1	W711687-S	Wheel house pin-type retainer
2	N808650-S	Rear wheel house screw (4 required)
3	W706805-S	Rear wheel house-to-wheel house opening screw (4 required)
4	7827886 LH/ 7827887 RH	Rear wheel house

RH and LH

1. Remove the rear fender moulding. For additional information, refer to Section 501-08 .
2. **NOTE:** LH shown, RH similar.

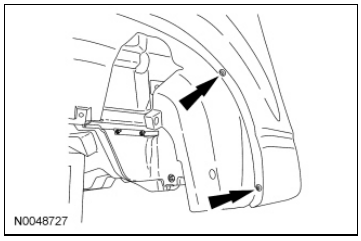
   Remove the 3 bumper cover screws.



3. **NOTE:** RH shown, LH similar.

   Remove the 4 rear wheel house-to-wheel house opening screws.

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RH only

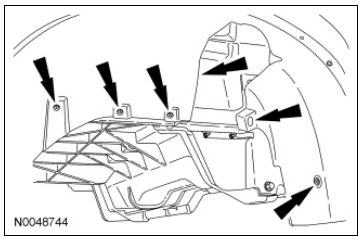
4. Remove the pin-type retainer.

LH and RH

5. **NOTE:** RH shown, LH similar.

   Remove the rear wheel house.

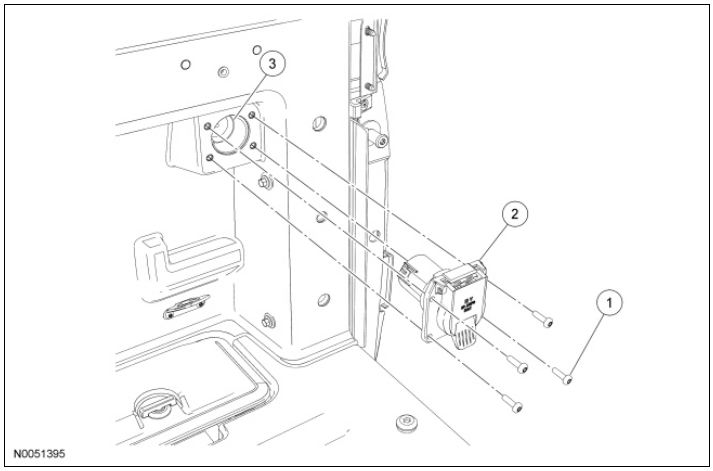
   - Remove the screws.
   - Remove the rear wheel house.



6. To install, reverse the removal procedure.

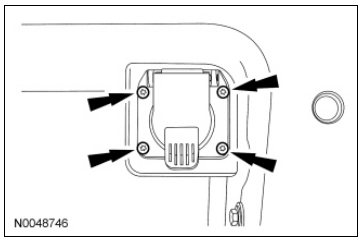
Pickup Bed Power Point

Removal and Installation

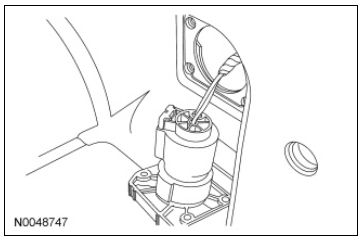


Item	Part Number	Description
1	W504696-S	Power point screw (4 required)
2	19G257	Power point receptacle
3	14A464	Power point wiring connector

1. Remove the 4 screws and the power point receptacle from the pickup bed side.



2. Disconnect the power point receptacle electrical connector and remove the power point receptacle.

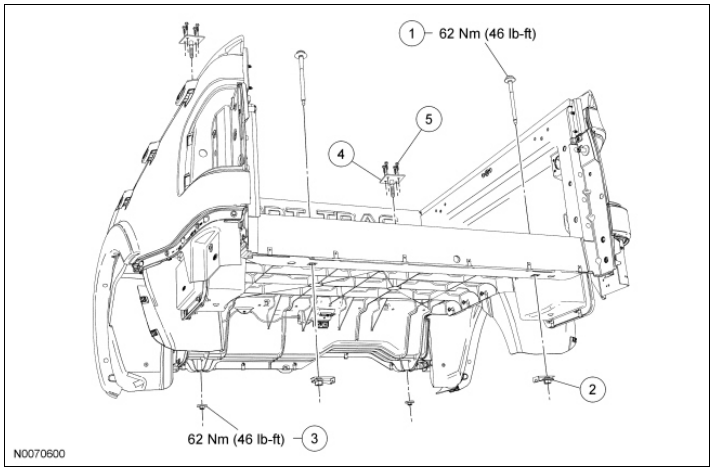


3. To install, reverse the removal procedure.

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Pickup Bed

Removal and Installation



Item	Part Number	Description
1	W711319-S	Pickup bed rear bolt (2 required)
2	W709404-S	Pickup bed rear nut retainer (2 required)
3	W708731-S	Pickup bed front nut (2 required)
4	99286E44	Stud plate
5	W702065	Rivet (4 required)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

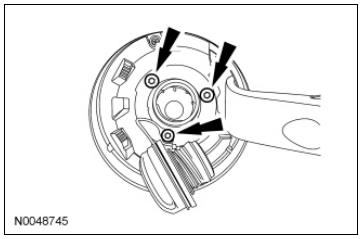
2. If equipped, remove the Tonneau cover.

3. If equipped, remove the cargo divider.

4. Remove the tailgate assembly.

5. Remove the fuel filler cap.

6. Remove the fuel filler pipe screws and position the filler pipe aside.
   - To install, tighten to 3 Nm (27 lb-in).

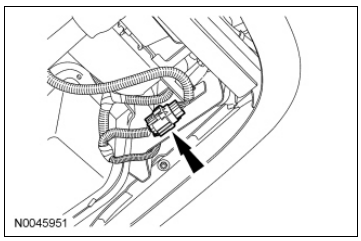


7. Remove the rear fender mouldings. For additional information, refer to Section 501-08 .

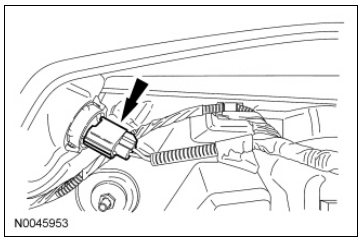
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8. Raise the vehicle.

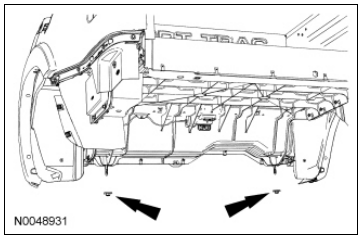
9. Disconnect the electrical connector.



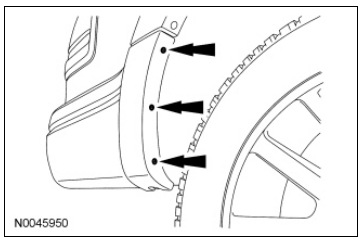
10. Disconnect the license plate lamp electrical connectors.



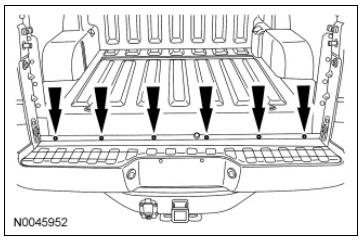
11. Remove the 2 pickup bed front nuts from under the vehicle (1 each side).
    - To install, tighten to 62 Nm (46 lb-ft).



12. Remove the 6 rear bumper cover screws (3 each side).

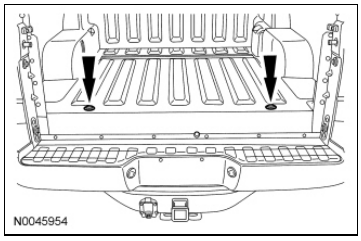


13. Remove the 6 rear bumper cover screws and the bumper cover.



14. Lower the vehicle.

15. Remove the 2 pickup bed rear bolts (1 each side).
    - To install, tighten to 62 Nm (46 lb-ft).



16. ***NOTICE:*** **Protect the paint on the pickup bed and cab as the pickup bed is lifted to avoid damage to the paint surface.**

    With the help of an assistant, remove the pickup bed and place it on a suitable support.

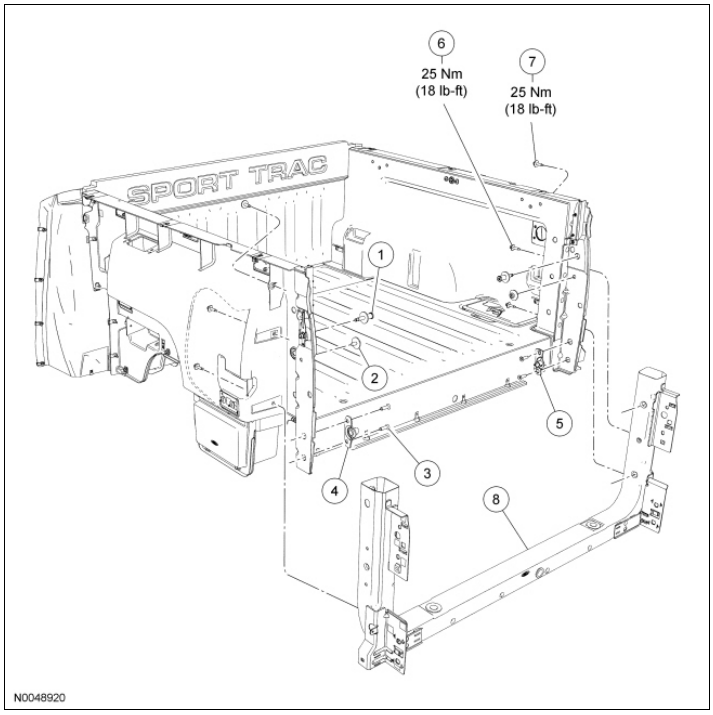
17. To install, reverse the removal procedure.

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Pickup Bed Reinforcement

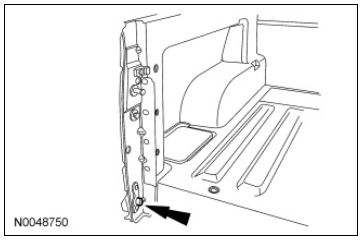
Removal and Installation



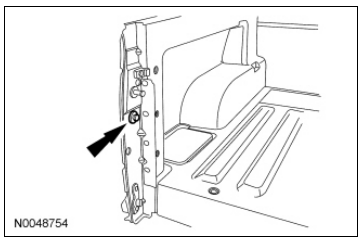
Item	Part Number	Description
1	99432A06	Tailgate striker (2 required)
2	N805156-S	Tailgate cable anchor (2 required)
3	W710261-S	Tailgate hinge bolt (4 required)
4	78430B39	LH tailgate hinge
5	78430B38	RH tailgate hinge
6	W706056-S	Reinforcement mounting bolt (4 required)
7	W706056-S	Reinforcement outer mounting bolt (2 required)
8	99281B44	Pickup bed reinforcement

1. Remove the LH and RH body side outer panels. For additional information, refer to Pickup Bed Body Side in this section.

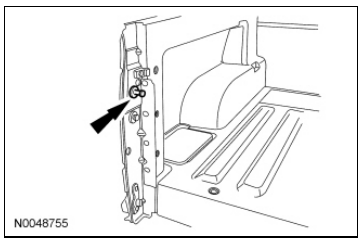
2. Remove the 2 tailgate hinge bolts (1 each side), and remove the hinges.
   - To install, tighten to 47 Nm (35 lb-ft).



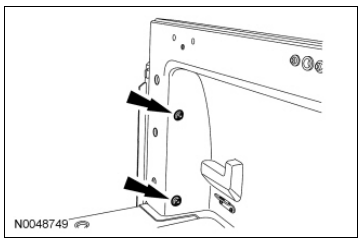
3. Remove the 2 tailgate cable anchors (1 each side).



4. Remove the 2 tailgate strikers (1 each side).
    - To install, tighten to 40 Nm (30 lb-ft).

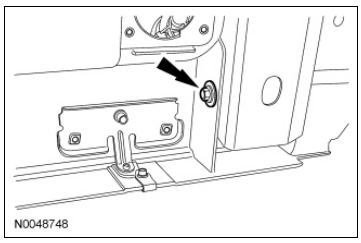


5. Remove the 4 reinforcement mounting bolts from the pickup bed (2 each side).
    - To install, tighten to 25 Nm (18 lb-ft).



6. Turn the pickup bed upside down on a suitable support.

7. Remove the 2 outer pickup bed reinforcement bolts and remove the reinforcement.
    - To install, tighten to 25 Nm (18 lb-ft).

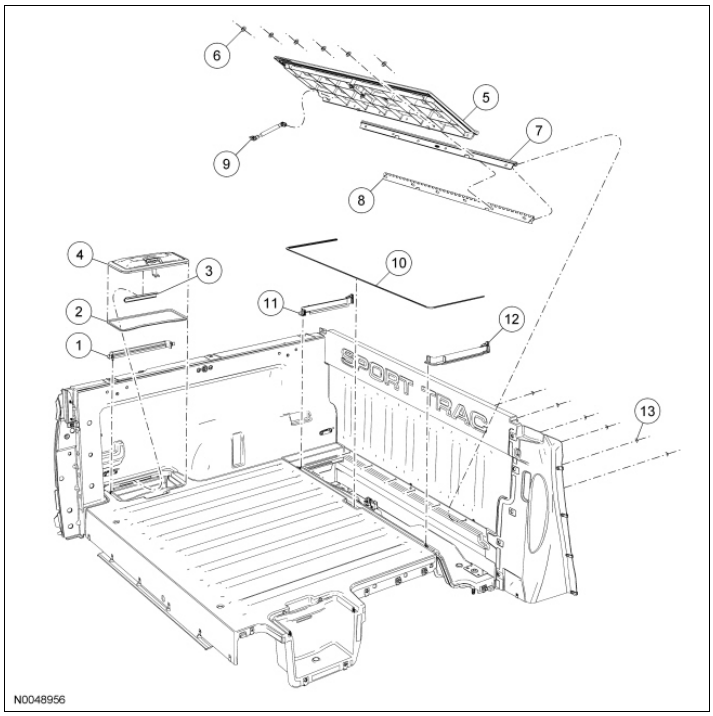


8. Disconnect the wiring harness from the pickup bed reinforcement.

9. To install, reverse the removal procedure.

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Pickup Bed Storage Compartment - Exploded View



Item	Part Number	Description
1	99286A30	Side storage compartment seal
2	99286E52	Side storage compartment lid seal
3	99461A30	Side storage compartment hinge
4	99461A30	Side storage compartment lid
5	99461A30	Front storage compartment lid
6	99286A30	Front storage compartment lid-to-hinge nut (6 required)
7	99286E46	Front storage compartment hinge seal
8	9928A32	Front storage compartment hinge
9	99286D18	Front compartment strut
10	99286A30	Front storage compartment seal
11	99286A30	Front storage compartment side seal LH
12	99286A30	Front storage compartment side seal RH
13	99286A30	Front storage compartment-to-box nut (6 required)

1. For additional information, refer to the procedures in this section.

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Pickup Bed Storage Compartment Hinge - Side Compartment

1. Remove the side compartment lid. For additional information, refer to Pickup Bed Storage Compartment Lid - Side Compartment in this section.

2. **NOTE:** The side compartment hinge is installed prior to the storage compartment seal.

   NOTE: The surface of the compartment lid must be thoroughly cleaned before installing the new hinge.

   Remove the storage compartment hinge.

   - Remove the storage compartment seal.
   - Remove the storage compartment hinge.
   - Clean the lid surface of any residual seal material.
   - Scuff the seal surface area.
   - Apply adhesive promoter.
   - Apply pressure to the hinge surface with a roller and allow seal to cure before installation for one hour.

3. To install, reverse the removal procedure.

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Pickup Bed Storage Compartment Hinge - Front Compartment

1. Remove the front compartment lid. For additional information, refer to Pickup Bed Storage Compartment Lid - Front Compartment in this section.

2. Remove the pickup bed. For additional information, refer to Pickup Bed in this section.

3. Remove the front compartment lid hinge nuts from the front of the pickup bed.
    - To install, tighten to 12 Nm (106 lb-in).

4. Remove the front compartment lid hinge from the pickup box.

5. To install, reverse the removal procedure.

Pickup Bed Storage Compartment Lid - Front Compartment

1. Open the storage compartment lid and disconnect the compartment lid struts from the door.

2. Remove the 6 storage compartment lid nuts.
   - To install, tighten to 12 Nm (106 lb-in).

3. Remove the storage compartment lid.

4. To install, reverse the removal procedure.

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Pickup Bed Storage Compartment Lid - Side Compartment

1. Open the compartment lid and remove the pickup bed seal.
2. Remove the storage compartment door.
3. To install, reverse the removal procedure.

Pickup Bed Storage Compartment Seal - Side Compartment

1. Remove the side compartment lid. For additional information, refer to Pickup Bed Storage Compartment Lid - Side Compartment in this section.

2. **NOTE:** The storage compartment seal is installed over the hinge assembly.

   Remove the storage compartment seal from the storage compartment.

   - Remove any adhesive or residual seal material.
   - Clean the lid surface with a 50/50 solution of alcohol and water.
   - Apply adhesive promotor.
   - Apply seal.
   - Apply pressure to the seal with a roller and allow seal to cure before installation for one hour.

3. To install, reverse the removal procedure.

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Pickup Bed Storage Compartment Seal - Front Compartment

1. Remove the front compartment lid. For additional information, refer to Pickup Bed Storage Compartment Lid - Front Compartment in this section.

2. Remove the storage compartment seal from the storage compartment.
   - Remove any adhesive or residual seal material.
   - Clean the lid surface with a 50/50 solution of alcohol and water.
   - Apply adhesive promotor.
   - Apply seal.
   - Apply pressure to the seal with a roller and allow seal to cure before installation for one hour.

3. To install, reverse the removal procedure.

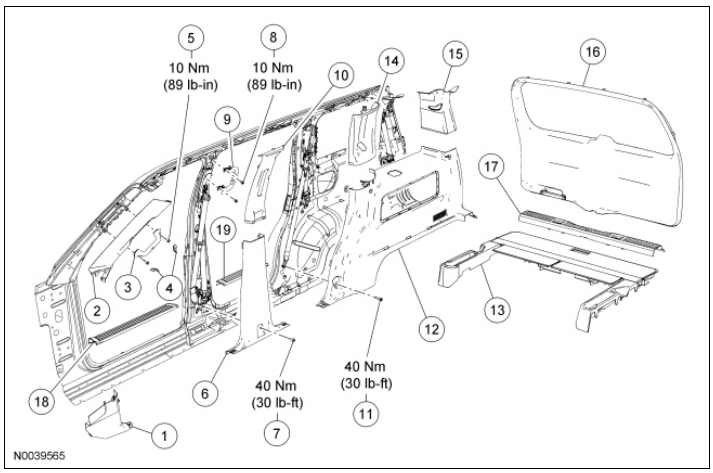
Torque Specifications

Description	Nm	lb-ft	lb-in
Assist handle bolts	10	-	89
Hood latch release handle screws	12	-	106
Safety belt anchor bolts	40	30	-

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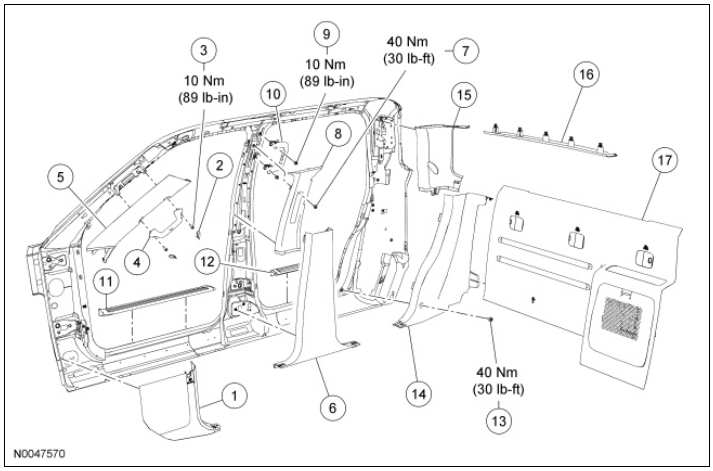
Interior Trim - Exploded View

Explorer and Mountaineer



Item	Part Number	Description
1	02348	Cowl side trim panel
2	03598	A-pillar trim panel
3	31406	A-pillar assist handle
4	31458	A-pillar assist handle bolt covers (2 required)
5	505252	A-pillar assist handle bolt (2 required)
6	24356	Lower B-pillar trim panel
7	W704703	B-pillar lower safety belt anchor bolt
8	705342	B-pillar assist handle bolt (2 required)
9	31406	B-pillar assist handle
10	24396	Upper B-pillar trim panel
11	W704703	C-pillar lower safety belt anchor bolt
12	31012	Quarter trim panel
13	115A00	Cargo management system
14	31004	C-pillar trim panel
15	31010	D-pillar trim panel
16	46404	Liftgate trim panel
17	42624	Liftgate scuff plate trim panel
18	13208	Front door scuff plate
19	13244	Rear door scuff plate

Explorer Sport Trac



Item	Part Number	Description
1	02348	Cowl side trim panel
2	31458	A-pillar assist handle bolt cover (2 required)
3	505252	A-pillar assist handle bolt (2 required)
4	31406	A-pillar assist handle
5	03598	A-pillar trim panel
6	24356	Lower B-pillar trim panel
7	W704703	B-pillar upper safety belt anchor bolt
8	24396	Upper B-pillar trim panel
9	705342	B-pillar assist handle bolt (2 required)
10	31406	B-pillar assist handle
11	13208	Front door scuff plate
12	13244	Rear door scuff plate
13	W704703	C-pillar lower safety belt anchor bolt
14	31486	Lower C-pillar trim panel
15	31004	Upper C-pillar trim panel
16	403A60	Roof trim panel
17	40374	Cab rear trim panel

1. For additional information, refer to the procedures in this section.

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A-Pillar Trim Panel

Removal and Installation

1. Remove the 2 assist handle bolt covers.

2. Remove the 2 assist handle bolts.
   - To install, tighten to 10 Nm (89 lb-in).

3. Remove the assist handle.

4. Position the door opening weatherstrip aside.

5. **NOTE:** The clip on the LH A-pillar trim panel must remain in the sheet metal. The clip comes off the A-pillar trim panel when the panel is removed.

   Remove the A-pillar trim panel.

6. To install, reverse the removal procedure.

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B-Pillar Lower Trim Panel

Removal and Installation

1. Remove the front and rear door scuff plates.
2. Position the door opening weatherstrip aside.
3. Remove the B-pillar lower trim panel.
4. To install, reverse the removal procedure.

B-Pillar Upper Trim Panel

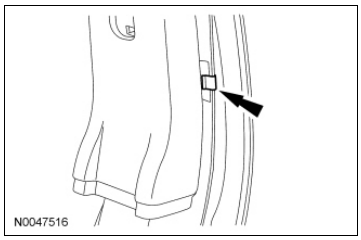
Removal and Installation

1. Remove the B-pillar lower trim panel. For additional information, refer to B-Pillar Lower Trim Panel in this section.

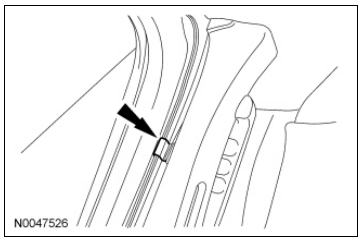
2. Remove the D-ring safety belt anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

3. Position the door opening weatherstrip aside.

4. Remove the B-pillar upper trim panel retaining clip from the lower right corner of the panel.



5. Remove the B-pillar upper trim panel retaining clip from the upper left of the panel.



6. To install, reverse the removal procedure.
   - Be sure the hole on the back of the B-pillar upper trim panel is seated over the safety belt D-ring bolt.

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C-Pillar Trim Panel - Explorer, Mountaineer

Removal and Installation

Second row bucket

1. Position the second row seat to the forward position.

Second row bench

2. Remove the second row seat. For additional information, refer to Section 501-10 .

All vehicles

3. Remove the C-pillar lower safety belt anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

4. Position the door opening weatherstrip aside.

5. Remove the C-pillar trim panel.

6. To install, reverse the removal procedure.
   - Be sure the hole on the back of the C-pillar upper trim panel is seated over the upper safety belt anchor bolt.

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C-Pillar Upper Trim Panel - Explorer Sport Trac

1. Remove the C-pillar lower trim panel. For additional information, refer to C-Pillar Lower Trim Panel - Explorer Sport Trac in this section.

2. Remove the roof trim panel.

3. Remove the C-pillar upper trim panel.
    - Route the safety belt through the upper trim panel.

4. To install, reverse the removal procedures.

C-Pillar Lower Trim Panel - Explorer Sport Trac

1. Remove the rear seat. For additional information, refer to Section 501-10 .

2. Remove the rear cab trim panel. For additional information, refer to Cab Rear Trim Panel in this section.

3. Remove the C-pillar lower safety belt anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

4. Position the door opening weatherstrip aside.

5. Remove the C-pillar lower trim panel.

6. To install, reverse the removal procedure.

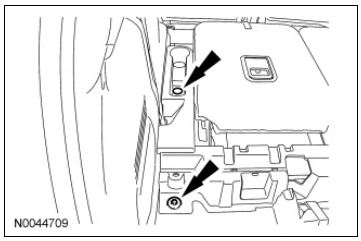
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D-Pillar Trim Panel

Removal and Installation

Vehicles with third row seating

1. Remove the rear cargo management system.
   - Remove the screw.
   - Remove the pushpin.
   - Remove the system.

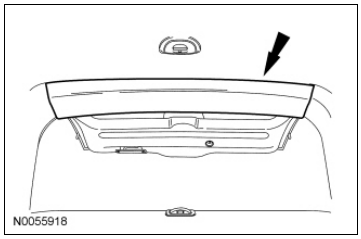


2. Remove the D-pillar lower safety belt anchor bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

All vehicles

3. Position the liftgate opening weatherstrip aside.

4. Remove the rear upper headliner trim panel.



5. Remove the D-pillar trim panel.

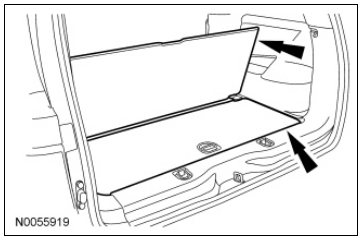
6. To install, reverse the removal procedure.

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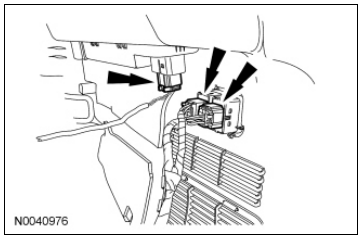
Quarter Trim Panel

Removal and Installation

1. Remove the rear door scuff plate.
2. Remove the C-pillar trim panel. For additional information, refer to C-Pillar Trim Panel - Explorer, Mountaineer in this section.
3. Remove the D-pillar trim panel. For additional information, refer to D-Pillar Trim Panel in this section.
4. Remove the liftgate scuff plate trim panel.
5. Remove the luggage compartment assembly cover, if equipped.



6. Remove the stowage compartment doors.
7. Position the carpet aside.
8. Remove the rear quarter trim panel.
9. Disconnect the electrical connectors, if necessary.



10. To install, reverse the removal procedure.

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Cowl Side Trim Panel

Removal and Installation

All vehicles

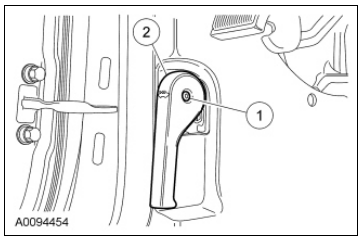
1. Remove the front door scuff plate.

Passenger side

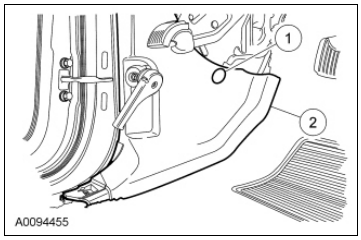
2. Remove the cowl trim panel.

Driver side

3. Remove the hood release lever.
    1. Remove the screw.
    2. Remove the hood release lever.



4. Remove the cowl trim panel.
    1. Remove the pin-type retainer.
    2. Remove the cowl trim panel.



All vehicles

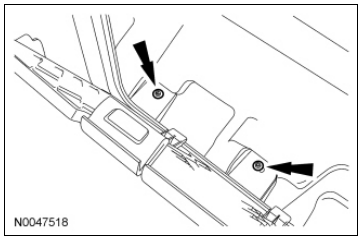
5. To install, reverse the removal procedure.

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Cab Rear Trim Panel

1. Position the second row seat back forward.

2. Remove the 2 screws from the storage compartment.



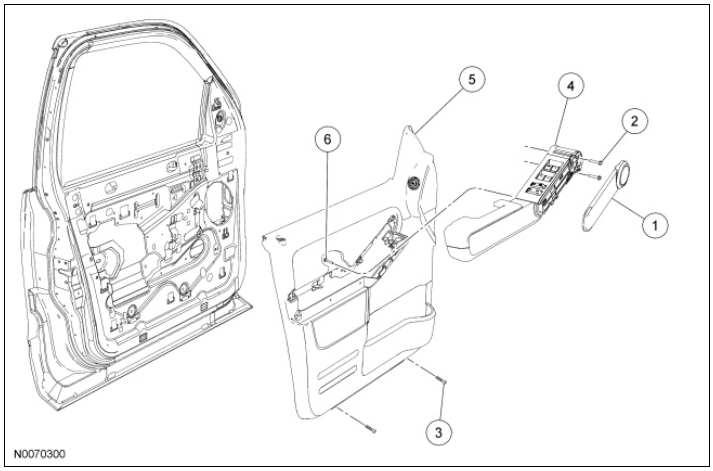
3. **NOTE:** When removing the cab rear trim panel, start in the upper left corner, moving clockwise and remove the panel from the retaining clips.

   Remove the rear trim panel.

4. To install, reverse the removal procedures.

Door Trim Panel - Front

Removal and Installation



Item	Part Number	Description
1	226A38	Front door handle bezel screw cover
2	78226A56	Front door handle bezel screw (2 required)
3	N800481	Front door trim panel lower screw (2 required)
4	-	Front door handle (part of 23942)
5	23942	Front door trim panel
6	56907	Front door handle bezel rear screw (11 required)

1. Remove the front door trim panel handle bezel cover.
2. Remove the front door trim panel handle bezel screws.
3. Remove the front door trim panel lower screws.

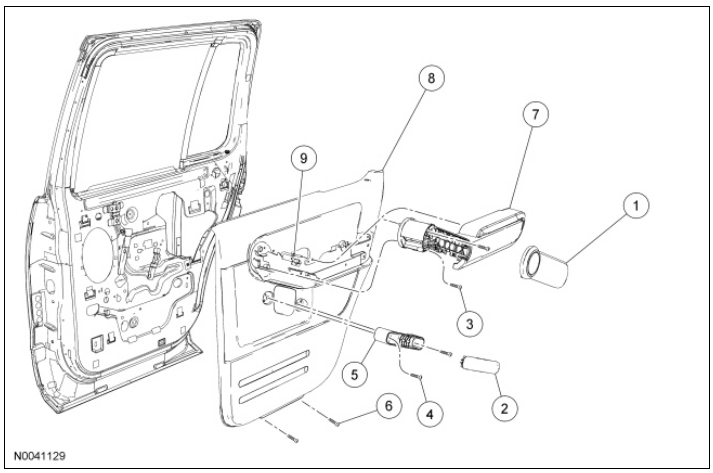
NOTICE: **To avoid damaging the front door trim panel, do not pull the bottom of the panel outward.**

4. Remove the front door trim panel by lifting upward on the armrest to disengage the panel clips.
5. Disconnect the electrical connectors.
6. Disconnect the lock rod cable from the front door trim panel.
7. Disconnect the door handle conduit and cable from the front door trim panel.
8. To install, reverse the removal procedure.

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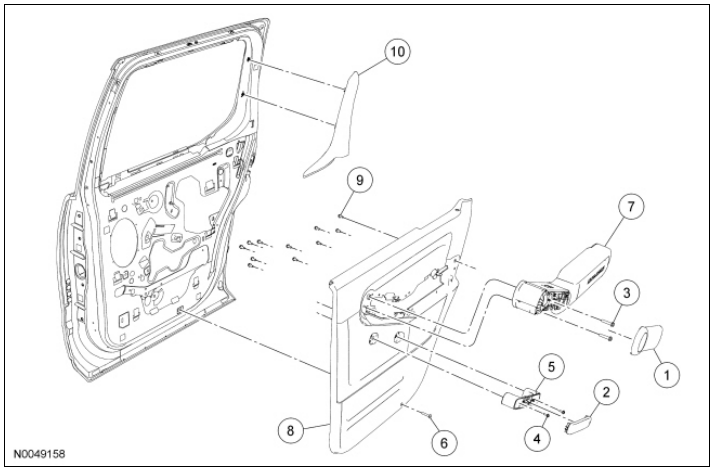
Door Trim Panel - Rear

Explorer/Mountaineer



Item	Part Number	Description
1	226A38	Rear door handle bezel screw cover
2	226A50	Rear door assist handle screw cover
3	W707364	Rear door handle bezel screw (2 required)
4	W707364	Rear door assist handle screw (2 required)
5	-	Rear door assist handle (part of 27406)
6	N800481	Rear door trim panel cover lower screw
7	-	Rear door handle (part of 27406)
8	27406	Rear door trim panel
9	56907	Rear door handle bezel rear screw (11 required)

Explorer Sport Trac



Item	Part Number	Description

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1	226A38	Rear door handle bezel screw cover
2	226A50	Rear door assist handle screw cover
3	78226A56	Rear door handle bezel screw (2 required)
4	W707364	Rear door assist handle screw (2 required)
5	-	Rear door assist handle (part of 27406)
6	N800481	Rear door trim panel cover lower screw
7	-	Rear door handle (part of 27406)
8	27406	Rear door trim panel
9	56907	Rear door handle bezel rear screw (11 required)
10	-	Rear door upper trim cover

Removal and Installation

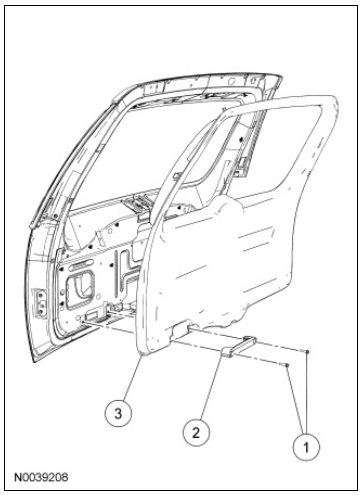
1. Remove the rear door trim panel assist handle cover.
2. Remove the rear door trim panel assist handle screws.
3. Remove the rear door trim panel handle bezel cover.
4. Remove the rear door trim panel handle bezel screws.
5. Remove the rear door trim panel lower screw.
6. ***NOTICE:*** **To avoid damaging the trim panel, do not pull the bottom of the panel outward.**

   Remove the rear door trim panel by lifting upward on the armrest to disengage the panel clips.
7. Disconnect the electrical connectors.
8. Disconnect the rod cable from the rear door trim panel.
9. To install, reverse the removal procedure.

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Liftgate Trim Panel



Item	Part Number	Description
1	W500015	Liftgate grab handle screws (2 required)
2	78434A14	Liftgate grab handle
3	7846404	Liftgate trim panel

Removal and Installation

1. Remove the 2 liftgate grab handle screws.
2. Remove the liftgate grab handle.
3. ***NOTICE:*** **To avoid damaging the trim panel, do not pull the bottom of the panel outward.**

   Lift the liftgate trim panel by lifting upward to disengage the clips and remove the panel.

   - Disconnect the liftgate trim panel electrical connector.

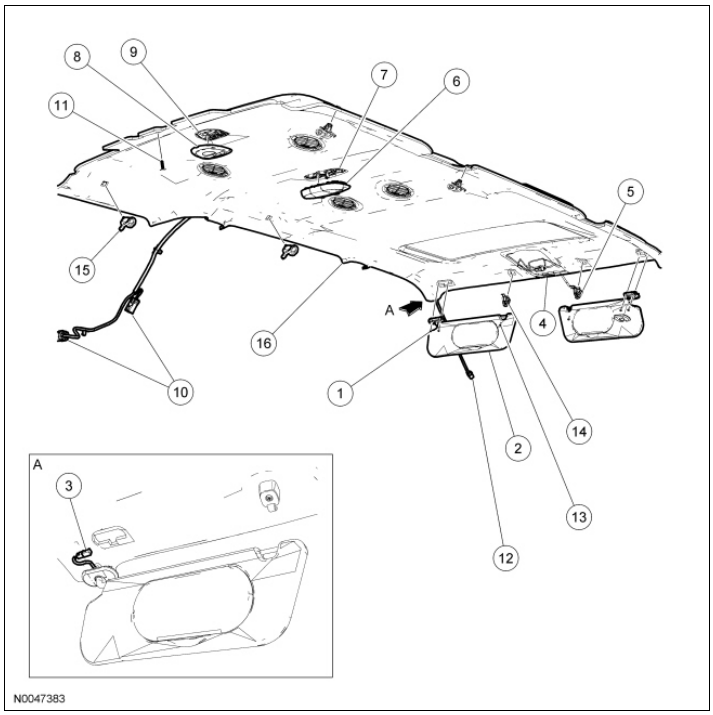
4. To install, reverse the removal procedure.

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Headliner

Explorer/Mountaineer

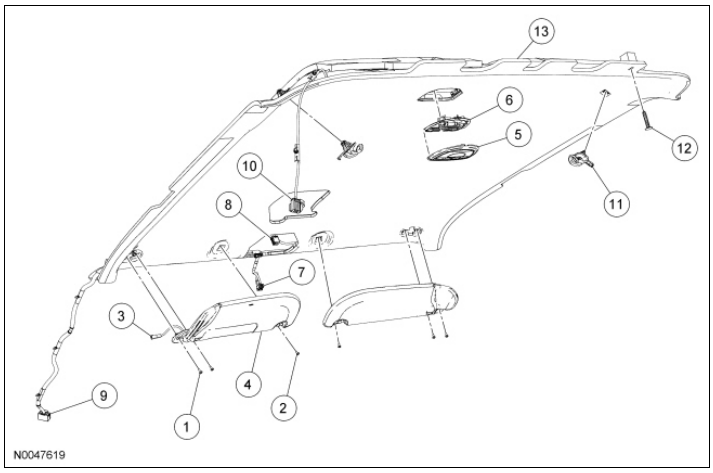
NOTE: Headliner with roof opening panel shown, headliner without opening panel similar.



Item	Part Number	Description
1	W707364	Sun visor retainer screw (4 required)
2	04100	Sun visor
3	14334	Sun visor electrical connector
4	14334	Roof opening panel electrical connector
5	14334	Interior mirror electrical connector
6	19893	Dome lamp cover
7	14334	Dome lamp electrical connector
8	19893	Cargo lamp cover
9	14334	Cargo lamp electrical connector
10	14334	Headliner electrical connectors (rear)
11	51968	Pin-type retainer
12	14334	Headliner electrical connector (front)
13	W707364	Sun visor center retainer screw
14	041A20	Sun visor center retainer
15	29019	Garment hook (4 required)
16	51944	Headliner

Explorer Sport Trac

NOTE: Headliner without roof opening panel shown, headliner with opening panel similar.



Item	Part Number	Description
1	W707364	Sun visor retainer screw (4 required)
2	W707364	Sun visor center retainer screw (2 required)
3	14334	Sun visor electrical connector
4	04100	Sun visor
5	-	Dome lamp cover
6	-	Dome lamp
7	14334	Interior mirror electrical connector
8	14334	Overhead console electrical connector
9	14334	Headliner electrical connector (front)
10	14334	Headliner electrical connector (rear)
11	29019	Garment hook (2 required)
12	51968	Pin-type retainer
13	51944	Headliner

Explorer and Mountaineer only

1. If equipped, remove the rear entertainment system. For additional information, refer to Section 415-00 .

Explorer Sport Trac only

2. **NOTE:** The headliner is removed through the rear passenger door. To facilitate removal, the front passenger seat must be removed.

   Remove the front passenger seat. For additional information, refer to Section 501-10 .

All vehicles

3. Remove the overhead console. For additional information, refer to Section 501-12 .

4. Remove the A-pillar trim panel. For additional information, refer to A-Pillar Trim Panel in this section.

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5. Position the B-pillar upper trim panel aside. For additional information, refer to B-Pillar Upper Trim Panel in this section.

Explorer and Mountaineer only

6. Remove the C-pillar trim panel. For additional information, refer to C-Pillar Trim Panel - Explorer, Mountaineer in this section.

7. Remove the D-pillar trim panel. For additional information, refer to D-Pillar Trim Panel in this section.

Explorer Sport Trac

8. Position the C-pillar upper trim panel aside. For additional information, refer to C-Pillar Upper Trim Panel - Explorer Sport Trac in this section.

All vehicles

9. Remove the gimp around the roof opening panel, if equipped.

10. Remove the 4 sun visor retainer screws.

11. Remove the sun visors.

12. Carefully lower the headliner at the corner of the sun visor location to access the electrical connector and disconnect the electrical connector.

13. Disconnect the roof opening panel, if equipped.

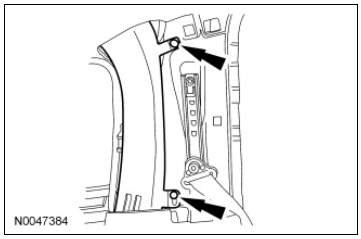
14. Disconnect the interior mirror electrical connector and electronic compass sensor connector, if equipped.

15. Use a thin-blade tool and carefully remove the dome lamp cover.

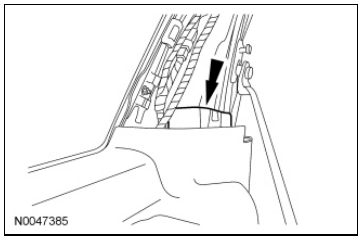
16. Disconnect the dome lamp electrical connectors.

Explorer and Mountaineer only

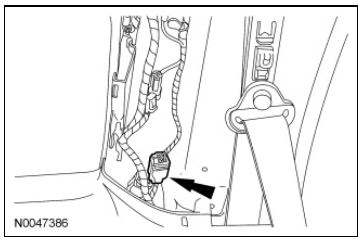
17. Remove the upper air duct.
    - Remove the pin-type retainers.
    - Push down on the duct, tilt the top outward and pull upward to remove.



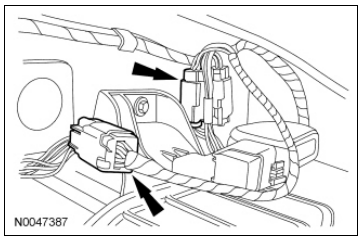
18. Remove the lower air duct.



19. Disconnect the electrical connector located at the C-pillar.
    - Release the wiring harness pin-type retainers.

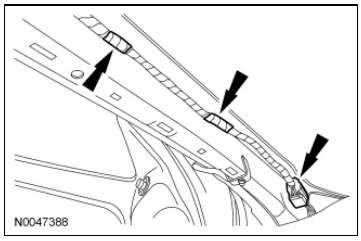


20. Disconnect all the electrical connectors.



All vehicles

21. Disconnect the electrical connector and the wiring pin-type retainers on the A-pillar.



22. ***NOTICE:*** **To prevent bending or damaging the headliner, an assistant is required to support the headliner while carrying out the remaining steps.**

    Open the sun visor center retainer cover and remove the screw.

23. Remove the sun visor center retainer.

24. Remove the rear pin-type retainer.

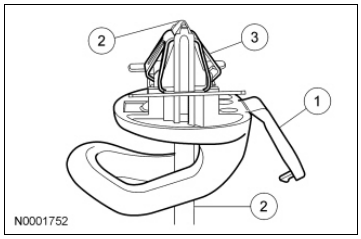
25. ***NOTICE:*** **To prevent damaging the garment hanger retainer, use a 3/16-inch flat-blade screwdriver to carry out this step.**

    NOTE: The garment hanger is shown without the roof sheet metal screw to show the metal retainer clip. The metal retainer clip will remain engaged in the sheet metal after the garment hanger is removed.

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Remove the garment hangers.

1. Open the access door.
2. Insert the flat-blade screwdriver fully into the garment hanger slot.
3. Rotate the screwdriver 90 degrees so that the screwdriver spreads the metal retainer clip. Remove the plastic garment hanger.



26. **NOTE:** The headliner is removed through the passenger rear door for Explorer Sport Trac.

    Remove the headliner.

27. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Power Running Board (PRB) module retaining screws	7	-	62
PRB retaining bolts	23	17	-
PRB retaining nuts	23	17	-
PRB step screws	12	-	106
PRB wedge screw	8	-	71
Running board retaining bolts	23	17	-

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Exterior Trim

The exterior trim and ornamentation consists of:

- front fender wheel opening moulding.
- front door moulding.
- grille assembly.
- Power Running Boards (PRBs) (if equipped).
- PRB step
- PRB gap hider (if equipped)
- PRB module
- PRB motor and bracket assembly
- rear door moulding.
- rear quarter panel moulding.
- running boards.

If equipped, the PRBs automatically move when the doors are opened to assist entering and exiting the vehicle.

The PRB feature may be enabled/disabled through the message center. For information on how to access the PRB feature within the message center, refer to the Owner's Literature.

When the PRB is disabled (OFF), the PRB will immediately move to the stowed position regardless of the position of the doors.

When the PRB is enabled (AUTO), the PRBs will extend when the doors are opened and return to the stowed position 2 seconds after the doors are closed or vehicle speed is greater than 8 km/h (5 mph).

When the PRBs are manually set to the deployed position (OUT), they will return to the stowed position and (AUTO) mode when the vehicle speed is greater than 8 km/h (5 mph).

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Power Running Board (PRB)

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The Power Running Boards (PRBs) are controlled by the Power Running Board (PRB) module. The PRB motors receive motor power and ground from the PRB module. The PRB module receives door ajar switch status and vehicle speed information from the Controller Area Network (CAN).

When in AUTO mode, the PRBs will deploy when a door on the same side of the vehicle is opened. When both doors on the same side are closed, the PRBs will retract after a 2 second delay.

When in OUT mode, both PRBs will stay deployed until OUT mode is deselected or reset to AUTO mode and vehicle speed is greater than 8 km/h (5 mph). Mode will automatically switch back to AUTO once above 8 km/h (5 mph).

When an obstacle is detected, the PRB will reverse direction. If a second obstacle is detected, the PRB will reverse direction again. If a third obstacle is detected, the PRB will stop against the third obstacle until the following conditions are met:

- Change in door ajar status
- Change in the message center status (AUTO, OUT, OFF)
- Vehicle speed greater than 8 km/h (5 mph)

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Power Running Board (PRB)	• Battery Junction Box (BJB) fuse 19 (30A)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 . No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PRB module.

7. Carry out the network test.
   - If the scan tool responds with no communication from one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. Clear the CMDTCs and carry out the self-test diagnostics for the PRB .

9. If the DTCs retrieved are related to the concern, go the Power Running Board (PRB) Module DTC Chart. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Chart

Power Running Board (PRB) Module DTC Chart

DTC	Description	Action
B1162	Power Running Board Hall Effect Sensor Power Circuit Short to Battery	GO to Pinpoint Test E .
B1163	Left Power Running Board Hall Effect Sensor Failure	GO to Pinpoint Test E .
B1164	Power Running Board Hall Effect Sensor Power Circuit Short To Ground	GO to Pinpoint Test E .
B1167		GO to Pinpoint Test D .

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	Left Power Running Board Deploy and/or Stow Circuit Short To Battery	
B1168	Left Power Running Board Stow Circuit Short To Ground	GO to Pinpoint Test D .
B1169	LH Motor Traveled Too Far	LH motor is freewheeling (broken geartrain linkage). INSTALL a new LH Power Running Board (PRB) bracket assembly. REFER to Power Running Board (PRB) Bracket in this section.
B116A	RH Motor Traveled Too Far	RH motor is freewheeling (broken geartrain linkage). INSTALL a new RH PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section.
B116B	LH Power Running Board Motor Short	GO to Pinpoint Test D .
B116C	RH Power Running Board Motor Short	GO to Pinpoint Test D .
B116D	LH Power Running Board Motor Line Open	GO to Pinpoint Test D .
B116E	RH Power Running Board Motor Line Open	GO to Pinpoint Test D .
B1170	Right Power Running Board Hall Effect Sensor Failure	GO to Pinpoint Test E .
B1171	Left Power Running Board Hall Effect Signal Noisy	INSTALL a new LH PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section.
B1172	Right Power Running Board Hall Effect Signal Noisy	INSTALL a new RH PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section.
B1175	Right Power Running Board Stow Circuit Short To Ground	GO to Pinpoint Test D .
B1178	Right Power Running Board Deploy and/or Stow Circuit Short To Battery	GO to Pinpoint Test D .
B1317	Battery Voltage High	GO to Pinpoint Test F .
B1318	Battery Voltage Low	GO to Pinpoint Test F .
B1342	ECU is Faulted	INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section.
B2139	Data Mismatch (receive data does not match what was expected)	RETRIEVE and FOLLOW Instrument Cluster (IC) and PCM DTCs. REFER to Section 419-10 and Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B2813	LH Power Running Board Stow Time Fail	GO to Pinpoint Test B .
B2814	LH Power Running Board Deploy Time Fail	GO to Pinpoint Test B .
B2816	RH Power Running Board Stow Time Fail	GO to Pinpoint Test C .
B2817	RH Power Running Board Deploy Time Fail	GO to Pinpoint Test C .
U1900	CAN Communication Bus Fault - Receive Error	Do not install a new PRB module as part of the repair for a PRB DTC U1900 fault. The PRB is not the source of the fault when DTC U1900

		is present. REFER to Section 418-00 to diagnose the Medium Speed Controller Area Network (MS-CAN) concern.
U2050	No Application Present	INSTALL a new PRB module. REFER to Section 419-10 . REPEAT the self-test.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Power Running Board (PRB) Does Not Operate Correctly - Both Running Boards

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Running Boards for schematic and connector information.

Normal Operation

The Power Running Board (PRB) module receives power through circuit SBB19 (BU/RD) and ground through circuit GD151 (BK/GN). The LH and RH PRB motor Hall-effect sensors receive a regulated 10-volt power supply from the PRB module through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module receives door ajar and vehicle speed status over the Controller Area Network (CAN).

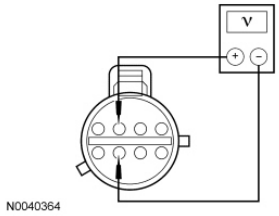
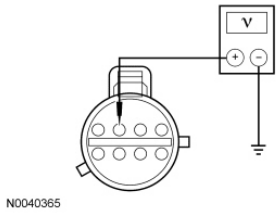
This pinpoint test is intended to diagnose the following:
- Fuse
- Wiring, terminals or connectors
- PCM
- Instrument Cluster (IC)
- PRB module

PINPOINT TEST A: THE PRB DOES NOT OPERATE CORRECTLY - BOTH RUNNING BOARDS

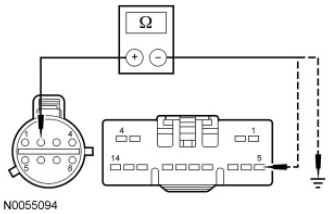
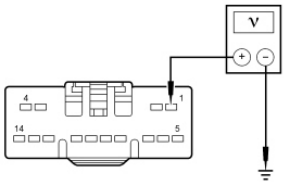
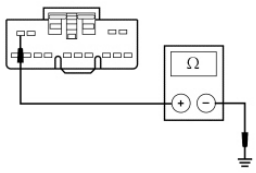
Test Step	Result / Action to Take
A1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: ♦ Self-Test - ALL CMDTCs . • **Are any door ajar switch or Vehicle Speed Sensor (VSS) related DTCs present?**	**Yes** REFER to Section 419-10 to diagnose the door ajar switch or VSS related DTCs. **No** GO to A2 .
A2 CHECK THE OPERATION OF THE PRBs - AUTOMATIC MODE	
	Yes The system is operating as

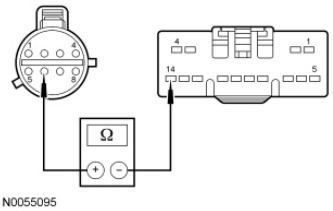
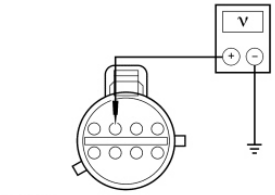
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• **NOTE:** There is a 2-second delay for the PRB to retract after the last door is closed. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the LH rear door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH rear door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Did both PRBs operate correctly, with no reversal of motion or noise while in motion?**	designed. REVIEW operation of the PRB system with the customer. **No** GO to A3 .
A3 CHECK THE OPERATION OF THE PRBs - MANUAL MODE	
• Set the PRB system to the OUT mode, where the boards are deployed all the time, regardless of door open/closed status and vehicle speed is less than 8 km/h (5 mph). • **Did both PRBs deploy?**	**Yes** GO to A5 . **No** GO to A4 .
A4 CHECK THE PRBs FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce-back, stops in mid travel, is noisy or will not deploy or stow completely, check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the Owner's Literature for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the LH and RH PRBs for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Does the PRB system operate normally during all test steps?**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the Owner's Literature for correct cleaning instructions. **No** GO to A5 .
A5 VERIFY THE DOOR AJAR SWITCH OPERATION	
• Open and close each door, verify the interior lights operate correctly and door ajar is noted on the vehicle message center. • **Do the interior lights turn ON when the door is opened, and OFF when the door is closed?**	**Yes** GO to A6 . **No** REFER to Section 417-02 to diagnose the interior lighting concern before attempting to diagnose the

	PRB concern.
A6 CHECK THE HALL-EFFECT SENSOR POWER AND GROUND	
• Disconnect: PRB LH Motor C3185. • Disconnect: PRB RH Motor C3186. • Ignition ON. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and RH PRB motor C3186-6, circuit RPR47 (BU/GN), harness side.  N0040364 • Open RH door. • Voltage signal will only be present for less than one second. • **Is the voltage between 7 and 10.5 volts?**	**Yes** GO to A13 . **No** If the voltage was less than 7 volts, GO to A7 . If the voltage was greater than 10.5 volts, GO to A12 .
A7 CHECK HALL-EFFECT SENSOR POWER CIRCUIT FOR VOLTAGE	
• Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and ground.  N0040365 • Open RH door. • Voltage signal will only be present for less than one second. • **Is the voltage between 7 and 10.5 volts?**	**Yes** GO to A11 . **No** GO to A8 .
A8 CHECK HALL-EFFECT POWER CIRCUIT FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: PRB Module C4322B. • Measure the resistance between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and PRB module C4322B-5, circuit CPR47 (GY/BN), harness side and between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and ground.	**Yes** GO to A9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

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 N0055094 • **Is the resistance less than 5 ohms between PRB motor and PRB module; and greater than 10,000 ohms between PRB motor and ground?**	
A9 CHECK THE PRB MODULE POWER CIRCUIT FOR VOLTAGE	
• Measure the voltage between PRB module C4322B-1, circuit SBB19 (BU/RD), harness side and ground.  N0055096 • **Is the voltage greater than 10.5 volts?**	**Yes** GO to A10 . **No** VERIFY Battery Junction Box (BJB) fuse 19 (30A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A10 CHECK THE PRB MODULE GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the PRB module C4322B-4, circuit GD151 (BK/GN), harness side and ground.  N0060073 • **Is the resistance less than 5 ohms?**	**Yes** GO to A13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A11 CHECK THE HALL-EFFECT SENSOR GROUND CIRCUIT FOR AN OPEN	

• Ignition OFF. • Disconnect: PRB Module C4322B. • Measure the resistance between RH PRB motor C3186-6, circuit RPR47 (BU/GN), harness side and PRB module C4322B-14, circuit RPR47 (BU/GN), harness side.  N0055095 • **Is the resistance less than 5 ohms?**	**Yes** GO to A13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A12 CHECK HALL-EFFECT SENSOR POWER CIRCUIT FOR SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PRB Module C4322B. • Ignition ON. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and ground.  N0040365 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR The DTCs. REPEAT the self-test. **No** GO to A13 .
A13 CHECK THE PRB MODULE FOR CORRECT OPERATION	
• Connect: PRB LH Motor C3185. • Connect: PRB RH Motor C3186. • Visually inspect all PRB module connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

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Pinpoint Test B: The Power Running Board (PRB) Does Not Operate Correctly - Left Running Board Does Not Deploy/Stow or Reverses Direction

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Running Boards for schematic and connector information.

Normal Operation

The Power Running Board (PRB) module receives door ajar and vehicle speed status over the Controller Area Network (CAN). During LH PRB deployment, the PRB module supplies power to the LH PRB motor through circuit CPR41 (BU/WH) and ground through circuit CPR42 (WH). The PRB stows the LH PRB by supplying power to the LH PRB motor through circuit CPR42 (WH) and ground through circuit CPR41 (BU/WH). The PRB module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the LH PRB Hall-effect signal through circuit VPR43 (GY/BU). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

- B2813 (LH Power Running Board Stow Time Fail) - When the left running board takes greater than 4 seconds to stow.
- B2814 (LH Power Running Board Deploy Time Fail) - When the left running board takes greater than 4 seconds to deploy.

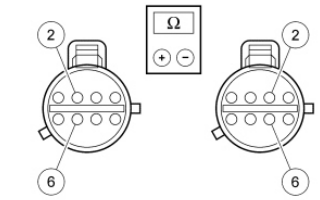
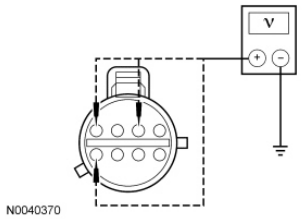
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Door ajar switch
- PRB module
- LH PRB bracket assembly

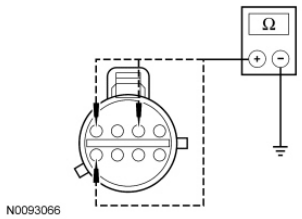
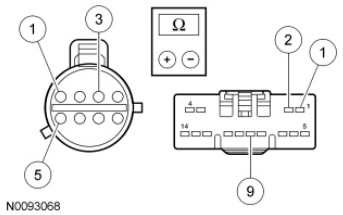
PINPOINT TEST B: THE PRB DOES NOT OPERATE CORRECTLY - LEFT RUNNING BOARD DOES NOT DEPLOY/STOW OR REVERSES DIRECTION

Test Step	Result / Action to Take
B1 CHECK THE OPERATION OF THE PRB - AUTOMATIC MODE	
• Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the LH rear door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH rear door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Did both PRBs operate correctly, with no reversal of motion, or noise while in motion?**	**Yes** The system is operating as designed. REVIEW operation of the PRBs system with the customer. **No** GO to B2 .
B2 CHECK THE OPERATION OF THE PRBs - MANUAL MODE	

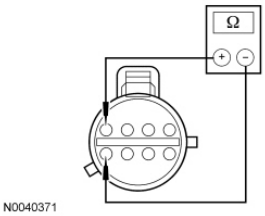
• Set the PRB system to the OUT mode, where the boards are deployed all the time, regardless of door open/closed status and vehicle speed is less than 8 km/h (5 mph). • **Did both PRBs deploy?**	**Yes** GO to B5 . **No** GO to B3 .
B3 CHECK THE PRBs FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce-back, stops in mid travel, is noisy or will not deploy or stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the Owner's Literature for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the LH PRB for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when either door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract 2 seconds after the door is closed. • **Does the LH PRB operate normally during all test steps?**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the Owner's Literature for correct cleaning instructions. **No** GO to B4 .
B4 CHECK IF DTCs ARE PRESENT	
• Use the recorded PRB module DTCs from the continuous and on-demand self tests. • **Is DTC B2813 or B2814 present?**	**Yes** INSTALL a new PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to B6 .
B5 VERIFY THE DOOR AJAR SWITCH OPERATION	
• Open and close the LH front and LH rear door, and verify the interior lights operate correctly and door ajar is noted on the vehicle message center. • **Do the interior lights turn ON when the door is opened, and OFF when the door is closed?**	**Yes** GO to B6 . **No** REFER to Section 417-02 to diagnose the interior lighting concern before attempting to diagnose the PRB concern.
B6 CHECK FOR CONTINUITY BETWEEN LH AND RH PRB MOTORS ON THE HALL-EFFECT SENSOR POWER AND GROUND CIRCUITS	

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• Disconnect: PRB LH Motor C3185. • Disconnect: PRB RH Motor C3186. • Ignition OFF. • Measure the resistance between LH PRB motor C3185, harness side and RH PRB motor C3186, harness side using the following chart: **LH PRB Motor / Circuit / RH PRB Motor** C3185-2 / CPR47 (GY/BN) / C3186-2 C3185-6 / RPR47 (BU/GN) / C3186-6  N0093067 • **Is the resistance less than 5 ohms?**	**Yes** GO to B7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B7 CHECK FOR SHORT TO VOLTAGE IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	
• Ignition OFF. • Disconnect: PRB Module C4322A. • Disconnect: PRB Module C4322B. • Ignition ON. • Measure the voltage between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and ground; and between LH PRB motor C3185-1, circuit CPR41 (BU/WH), harness side and ground; and between LH PRB motor C3185-5, circuit CPR42 (WH), harness side and ground.  N0040370 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B8 .
B8 CHECK FOR A SHORT TO GROUND IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	

• Ignition OFF. • Measure the resistance between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and ground; and between LH PRB motor C3185-1, circuit CPR41 (BU/WH), harness side and ground; and between RH PRB motor C3185-5, circuit CPR42 (WH), harness side and ground.  N0093066 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B9 CHECK FOR OPEN IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	
• Measure the resistances between PRB module C4322A or C4322B, harness side and LH PRB motor C3185, harness side using the following chart: **LH Motor Connector** / **Circuit** / **PRB Module Connector** C3185-3 / VPR43 (GY/BU) / C4322B-9 C3185-1 / CPR41 (BU/WH) / C4322A-1 C3185-5 / CPR42 (WH) / C4322A-2  N0093068 • **Is the resistance less than 5 ohms?**	**Yes** GO to B10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B10 CHECK FOR SHORT BETWEEN THE STOW AND DEPLOY CIRCUITS	
• Measure the resistance between LH PRB motor C3185-1, circuit CPR41 (BU/WH), harness side and LH PRB motor C3185-5, circuit CPR42 (WH), harness side.	**Yes** INSTALL a new LH PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test. If the concern is still present, GO to B11 .

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 N0040371 • **Is the resistance greater than 10,000 ohms?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B11 CHECK THE PRB MODULE FOR CORRECT OPERATION	
• Connect: PRB LH Motor C3185. • Connect: PRB RH Motor C3186. • Visually inspect all PRB module connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The Power Running Board (PRB) Does Not Operate Correctly - Right Running Board Does Not Deploy/Stow or Reverses Direction

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Running Boards for schematic and connector information.

Normal Operation

The Power Running Board (PRB) module receives door ajar and vehicle speed status over the Controller Area Network (CAN). During RH PRB deployment, the PRB module supplies power to the RH PRB motor through circuit CPR44 (BN/WH) and ground through circuit CPR45 (VT/GY). The PRB module stows the RH PRB by supplying power to the RH PRB motor through circuit CPR45 (VT/GY) and ground through circuit CPR44 (BN/WH). The PRB module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the RH PRB Hall-effect signal through circuit VPR46 (GY/OG). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

- B2816 (RH Power Running Board Stow Time Fail) - Right running board takes greater than 4 seconds to stow.
- B2817 (RH Power Running Board Deploy Time Fail) - Right running board takes greater than 4 seconds to deploy.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Door ajar switch
- PRB module
- RH PRB bracket assembly

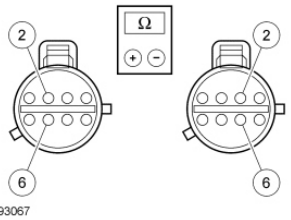
PINPOINT TEST C: THE PRB DOES NOT OPERATE CORRECTLY - RIGHT RUNNING BOARD DOES NOT DEPLOY/STOW OR REVERSES DIRECTION

Test Step	Result / Action to Take
C1 CHECK THE OPERATION OF THE PRB - AUTOMATIC MODE	
• Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when a door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the LH rear door. The LH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • Open and close the RH rear door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Did both PRBs operate correctly, with no reversal of motion or noise while in motion?**	**Yes** The system is operating as designed. REVIEW operation of the PRBs system with the customer. **No** GO to C2 .
C2 CHECK THE OPERATION OF THE PRBs - MANUAL MODE	
• Set the PRB system to the OUT mode, where the boards are deployed all the time, regardless of door open/closed status and vehicle speed is less than 8 km/h (5 mph). • **Did both PRBs deploy?**	**Yes** GO to C5 . **No** GO to C3 .
C3 CHECK THE PRB FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce-back, stops in mid travel, is noisy or will not deploy or stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the Owner's Literature for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the RH PRB for foreign material or blockage. If any foreign material or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when either door on the same side is opened, and retract when the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract when the door is closed. • **Does the RH PRB operate normally during all test steps?**	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the PRB hinge points, step area or door sill. REFER the customer to the Owner's Literature for correct cleaning instructions. **No** GO to C4 .
C4 CHECK IF DTCs ARE PRESENT	

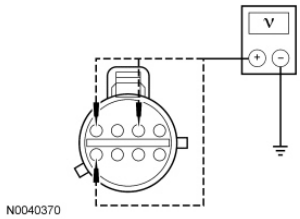
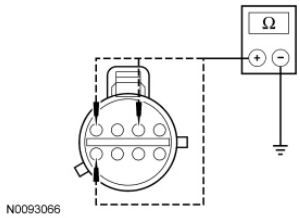
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• Use the recorded PRB module DTCs from the continuous and on-demand self-tests. • **Is DTC B2816 or B2817 present?**	**Yes** INSTALL a new PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to C6 .
C5 VERIFY THE DOOR AJAR SWITCH OPERATION	
• Open and close the RH front and RH rear door, and verify the interior lights operate correctly and door ajar is noted on the vehicle message center. • **Do the interior lights turn ON when the door is opened, and OFF when the door is closed?**	**Yes** GO to C6 . **No** REFER to Section 417-02 to diagnose the interior lighting concern before attempting to diagnose the PRB concern.
C6 CHECK FOR CONTINUITY BETWEEN LH AND RH MOTORS ON THE HALL-EFFECT SENSOR POWER AND GROUND CIRCUITS	
• Disconnect: PRB LH Motor C3185. • Disconnect: PRB RH Motor C3186. • Ignition OFF. • Measure the resistance between LH PRB motor C3185, harness side and RH PRB motor C3186, harness side using the following chart: • **Is the resistance less than 5 ohms?**	**Yes** GO to C7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C7 CHECK FOR SHORT TO VOLTAGE IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	

LH PRB Motor	Circuit	RH PRB Motor
C3185-2	CPR47 (GY/BN)	C3186-2
C3185-6	RPR47 (BU/GN)	C3186-6



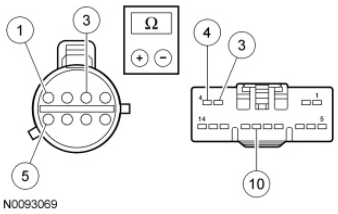
N0093067

• Ignition OFF. • Disconnect: PRB Module C4322A. • Disconnect: PRB Module C4322B. • Ignition ON. • Measure the voltage between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and ground; and between RH PRB motor C3186-1, circuit CPR44 (BN/WH), harness side and ground; and between RH PRB motor C3186-5, circuit CPR45 (VT/GY), harness side and ground.  N0040370 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C8 .
C8 CHECK FOR A SHORT TO GROUND IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	
• Ignition OFF. • Measure the resistance between RH PRB motor C3186-5, circuit CPR45 (VT/GY), harness side and ground; and between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and ground; and between RH PRB motor C3186-1, circuit CPR44 (BN/WH), harness side and ground.  N0093066 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK FOR OPEN IN CIRCUITS VPR46 (GY/OG), CPR44 (BN/WH) OR CPR45 (VT/GY)	
• Measure the resistances between PRB module C4322A or C4322B, harness side and RH PRB motor C3186, harness side using the following chart:	**Yes** GO to C10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

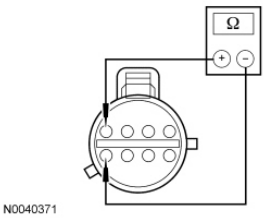
RH PRB Motor Connector	Circuit	PRB Module Connector
C3186-3		C4322B-10

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	VPR46 (GY/OG)	
C3186-1	CPR44 (BN/WH)	C4322A-4
C3186-5	CPR45 (VT/GY)	C4322A-3



- **Is the resistance less than 5 ohms?**

C10 CHECK FOR SHORT BETWEEN THE STOW AND DEPLOY CIRCUITS	
• Measure the resistance between RH PRB motor C3186-1, circuit CPR44 (BN/WH), harness side and RH PRB motor C3186-5, circuit CPR45 (VT/GY), harness side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new RH PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test. If the concern is still present, GO to C11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C11 CHECK THE PRB MODULE FOR CORRECT OPERATION	
• Connect: PRB LH Motor C3185. • Connect: PRB RH Motor C3186. • Visually inspect all PRB module connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTCs B1167, B1168, B1175, B1178, B116B, B116C, B116D and B116E

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Running Boards for schematic and connector information.

Normal Operation

During Power Running Board (PRB) deployment, the PRB module supplies power to the PRB motor through circuit CPR41 (BU/WH) (LH) or CPR44 (BN/WH) (RH) and ground through circuit CPR42 (WH) (LH) or CPR45 (VT/GY) (RH). The PRB module stows the PRB by supplying power to the PRB motor through circuit CPR42 (WH) (LH) or CPR45 (VT/GY) (RH) and ground through circuit CPR41 (BU/WH) (LH) or CPR44 (BN/WH) (RH). The PRB module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB module through circuit RPR47 (BU/GN). The PRB module monitors the PRB Hall-effect signal through circuit VPR43 (GY/BU) (LH) or VPR46 (GY/OG) (RH). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

DTC Description	Fault Trigger Conditions
• B1167 - Left Power Running Board Deploy and/or Stow Circuit Short to Battery	The PRB module sets this DTC if a short to battery voltage is detected in the LH running board motor circuit(s).
• B1168 - Left Power Running Board Motor Circuit Short to Ground	The PRB module sets this DTC if a short to ground is detected in the motor circuit while attempting to retract/stow the LH running board.
• B1175 - Right Power Running Board Stow Circuit Short to Ground	The PRB module sets this DTC if a short to ground is detected in the motor circuit while attempting to retract/stow the RH running board.
• B1178 - Right Power Running Board Deploy and/or Stow Circuit Short to Battery	The PRB module sets this DTC if a short to battery voltage is detected in the RH running board motor circuit(s).
• B116B - LH Power Running Board Motor Short	The PRB module sets this DTC if it detects the LH running board motor circuit(s) are shorted together.
• B116C - RH Power Running Board Motor Short	The PRB module sets this DTC if it detects the RH running board motor circuit(s) are shorted together.
• B116D - LH Power Running Board Motor Line Open	The PRB module sets this DTC when it detects an open in the LH running board motor circuit(s).
• B116E - RH Power Running Board Motor Line Open	The PRB module sets this DTC when it detects an open in the RH running board motor circuit(s).

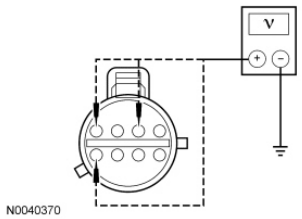
This pinpoint test is intended to diagnose the following:

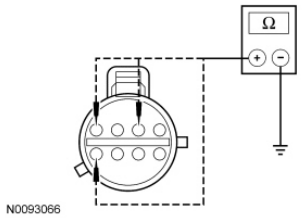
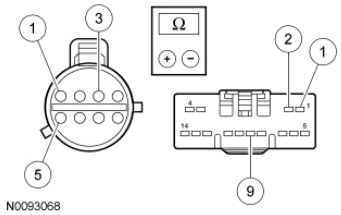
- Wiring, terminals or connectors
- LH or RH PRB bracket assembly

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- PRB module

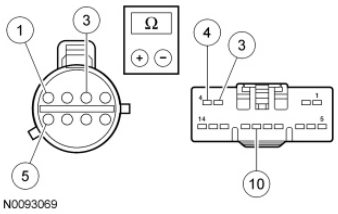
PINPOINT TEST D: DTCs B1167, B1168, B1175, B1178, B116B, B116C, B116D AND B116E

Test Step	Result / Action to Take
D1 CHECK FOR SHORT TO VOLTAGE IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	
• Ignition OFF. • Disconnect: PRB Module C4322A. • Disconnect: PRB Module C4322B. • Disconnect: PRB LH Motor C3185. • Disconnect: PRB RH Motor C3186. • Ignition ON. • For DTC B1167, B1168, B116B or B116D, measure the voltage between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and ground; and between LH PRB motor C3185-1, circuit CPR41 (BU/WH), harness side and ground; and between LH PRB motor C3185-5, circuit CPR42 (WH), harness side and ground.  • For DTC B1175 or B1178, B116C or B116E, measure the voltage between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and ground; and between RH PRB motor C3186-1, circuit CPR44 (BN/WH), harness side and ground; and between RH PRB motor C3186-5, circuit CPR45 (VT/GY), harness side and ground. • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to D2 .
D2 CHECK FOR A SHORT TO GROUND IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	
• Ignition OFF. • For DTC B1167, B1168, B116B or B116D, measure the resistance between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and ground; and between LH PRB motor C3185-1, circuit CPR41 (BU/WH), harness side and ground; and between LH PRB motor C3185-5, circuit CPR42 (WH), harness side and ground. • For DTC B1175, B1178, B116C or B116E, measure the resistance between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and ground; and between RH PRB motor	**Yes** GO to D3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

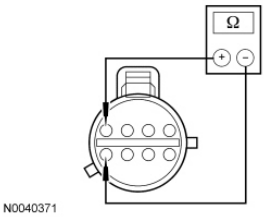
C3186-1, circuit CPR44 (BN/WH), harness side and ground; and between RH PRB motor C3186-5, circuit CPR45 (VT/GY), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	
D3 CHECK FOR OPEN IN THE HALL-EFFECT SENSOR SIGNAL, DEPLOY OR STOW CIRCUIT	
• Ignition OFF. • For DTC B1167, B1168, B116B or B116D, measure the resistances between PRB module C4322A or C4322B, harness side and LH PRB motor C3185, harness side using the following chart: **LH PRB Motor Connector** / **Circuit** / **PRB Module Connector** C3185-3 / VPR43 (GY/BU) / C4322B-9 C3185-1 / CPR41 (BU/WH) / C4322A-1 C3185-5 / CPR42 (WH) / C4322A-2  • For DTC B1175, B1178, B116C or B116E, measure the resistances between PRB module C4322A or C4322B, harness side and RH PRB motor C3186, harness side using the following chart: **RH PRB Motor Connector** / **Circuit** / **PRB Module Connector**	**Yes** GO to D4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

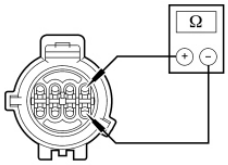
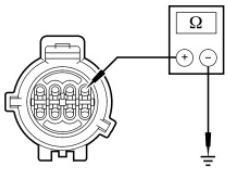
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C3186-3	VPR46 (GY/OG)	C4322B-10
C3186-1	CPR44 (BN/WH)	C4322A-4
C3186-5	CPR45 (VT/GY)	C4322A-3



- **Is the resistance less than 5 ohms?**

D4 CHECK FOR SHORT BETWEEN THE STOW AND DEPLOY CIRCUITS	
• For DTC B1167, B1168, B116B or B116D, measure the resistance between LH PRB motor C3185-1, circuit CPR41 (BU/WH), harness side and LH PRB motor C3185-5, circuit CPR42 (WH), harness side. • For DTC B1175, B1178, B116C or B116E, measure the resistance between RH PRB motor C3186-1, circuit CPR44 (BN/WH), harness side and C3186-5, circuit CPR45 (VT/GY), harness side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
D5 CHECK THE PRB MOTOR FOR AN OPEN CIRCUIT	
• For DTC B1167, B1168, B116B or B116D, measure the resistance between LH PRB motor C3185-1, circuit CPR41 (BU/WH), component side and LH PRB motor C3185-5, circuit CPR42 (WH), component side. • For DTC B1175, B1178, B116C or B116E, measure the resistance between RH PRB motor C3186-1, circuit CPR44 (BN/WH), component side and RH PRB motor C3186-5, circuit CPR45 (VT/GY), component side.	**Yes** GO to D6 . **No** INSTALL a new PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test.

 N0055108 • **Is any measurable continuity present?**	
D6 CHECK THE PRB MOTOR FOR A SHORT TO GROUND	
• For DTC B1167, B1168, B116B or B116D, measure the resistance between LH PRB motor C3185-1, circuit CPR41 (BU/WH), component side. • For DTC B1175, B1178, B116C or B116E, measure the resistance between RH PRB motor C3186-1, circuit CPR44 (BN/WH), component side and ground.  N0055109 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D7 . **No** INSTALL a new PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test.
D7 CHECK THE PRB MODULE FOR CORRECT OPERATION	
• Connect: PRB LH Motor C3185. • Connect: PRB RH Motor C3186. • Visually inspect all PRB module connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTCs B1162, B1163, B1164 and B1170

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Running Boards for schematic and connector information.

Normal Operation

The Power Running Board (PRB) module provides a regulated 10-volt power supply to the Hall-effect sensor (internal to the PRB motor) through circuit CPR47 (GY/BN). The Hall-effect ground is provided by the PRB

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module through circuit RPR47 (BU/GN). The PRB module monitors the PRB Hall-effect signal through circuit VPR43 (GY/BU) (LH) or VPR46 (GY/OG) (RH). If the PRB module does not receive any signal from the Hall-effect sensor during operation, the PRB will stop.

DTC Description	Fault Trigger Conditions
• B1162 - Power Running Board Hall-Effect Sensor Power Circuit Short to Battery	The PRB module sets this DTC if it detects the Hall-Effect sensor power circuit is shorted to battery voltage.
• B1163 - Left Power Running Board Hall-Effect Sensor Failure	The PRB module sets this DTC if it does not see any feedback from the Hall-Effect sensor during the stowing/deploying of the LH running board.
• B1164 - Power Running Board Hall-Effect Sensor Power Circuit Short to Ground	The PRB module sets this DTC if it detects the Hall-Effect sensor power circuit is shorted to ground.
• B1170 - Right Power Running Board Deploy and/or Stow Circuit Short to Battery	The PRB module sets this DTC if it does not see any feedback from the Hall-Effect sensor during the stowing/deploying of the RH running board.

This pinpoint test is intended to diagnose the following:

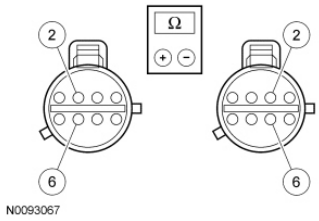
- Wiring, terminals or connectors
- PRB module
- LH or RH PRB bracket assembly

PINPOINT TEST E: DTCs B1162, B1163, B1164 AND B1170

Test Step	Result / Action to Take
E1 CHECK CONTINUITY BETWEEN LH AND RH PRB MOTORS ON THE HALL-EFFECT SENSOR POWER AND GROUND CIRCUITS	
• Disconnect: PRB LH Motor C3185. • Disconnect: PRB RH Motor C3186. • Ignition OFF. • Measure the resistance between LH PRB motor C3185, harness side and RH PRB motor C3186, harness side using the following chart:	**Yes** GO to E2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

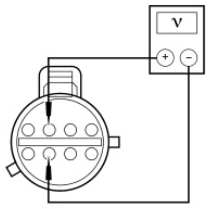
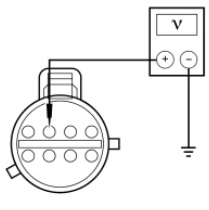
LH PRB Motor	Circuit	RH PRB Motor
C3185-2	CPR47 (GY/BN)	C3186-2

C3185-6	RPR47 (BU/GN)	C3186-6

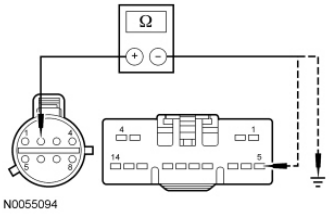
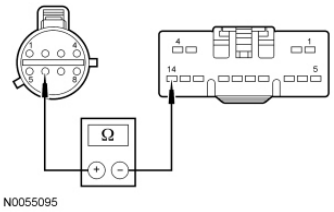


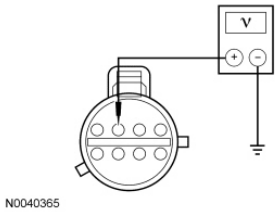
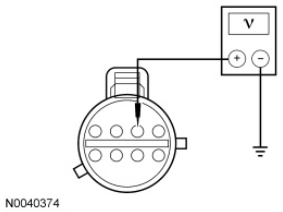
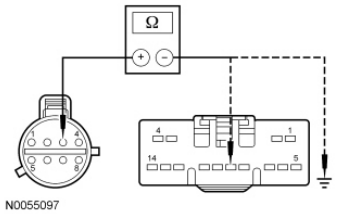
N0093067

- **Is the resistance less than 5 ohms?**

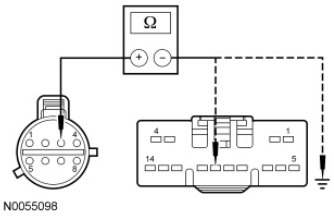
E2 CHECK THE HALL-EFFECT SENSOR POWER AND GROUND CIRCUITS	
• Ignition ON. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and RH PRB motor C3186-6, circuit RPR47 (BU/GN), harness side.  N0040364 • Open RH door. • Voltage signal will only be present for less than one second. • **Is the voltage between 7 and 10.5 volts?**	**Yes** GO to E7 . **No** If the voltage was less than 7 volts, GO to E3 . If the voltage was greater than 10.5 volts, GO to E6 .
E3 CHECK THE HALL-EFFECT SENSOR POWER CIRCUIT FOR VOLTAGE	
• Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and ground.  N0040365 • Open RH door. • Voltage signal will only be present for less than one second. • **Is the voltage between 7 and 10.5 volts?**	**Yes** GO to E5 . **No** GO to E4 .
E4 CHECK HALL-EFFECT SENSOR POWER CIRCUIT FOR AN OPEN OR SHORT TO GROUND	

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• Ignition OFF. • Disconnect: PRB Module C4322B. • Measure the resistance between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and PRB module C4322B-5, circuit CPR47 (GY/BN), harness side and between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and ground.  N0055094 • **Is the resistance less than 5 ohms between the PRB motor and the PRB module; and greater than 10,000 ohms between the PRB motor and ground?**	**Yes** GO to E9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E5 CHECK THE HALL-EFFECT SENSOR GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: PRB Module C4322B. • Measure the resistance between RH PRB motor C3186-6, circuit RPR47 (BU/GN), harness side and PRB module C4322B-14, circuit RPR47 (BU/GN), harness side.  N0055095 • **Is the resistance less than 5 ohms?**	**Yes** GO to E9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E6 CHECK THE HALL-EFFECT SENSOR POWER CIRCUIT FOR SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PRB Module C4322B. • Ignition ON. • Measure the voltage between RH PRB motor C3186-2, circuit CPR47 (GY/BN), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to E9 .

 N0040365 • **Is any voltage present?**	
E7 CHECK THE HALL-EFFECT SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PRB Module C4322B. • Ignition ON. • For DTC B1163, measure the voltage between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and ground. • For DTC B1170, measure the voltage between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and ground.  N0040374 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to E8 .
E8 CHECK THE HALL-EFFECT SENSOR SIGNAL CIRCUIT FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • For DTC B1163, measure the resistance between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and PRB module C4322B-9, circuit VPR43 (GY/BU), harness side and between LH PRB motor C3185-3, circuit VPR43 (GY/BU), harness side and ground.  N0055097 • For DTC B1170, measure the resistance between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and PRB module C4322B-10, circuit VPR46 (GY/OG), harness side and between RH PRB motor C3186-3, circuit VPR46 (GY/OG), harness side and ground.	**Yes** GO to E10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

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 • **Is the resistance less than 5 ohms between the PRB motor and PRB module; and greater than 10,000 ohms between the PRB motor and ground?**	
E9 CHECK THE PRB MODULE FOR CORRECT OPERATION	
• Connect: PRB LH Motor C3185. • Connect: PRB RH Motor C3186. • Disconnect all PRB module connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
E10 CHECK THE PRB MODULE FOR CORRECT OPERATION	
• Connect: PRB LH Motor C3185. • Connect: PRB RH Motor C3186. • Disconnect all PRB module connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** GO to E11 . **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
E11 CHECK THE PRBs FOR FOREIGN MATERIAL	
• **NOTE:** If the system has false bounce-back, stops in mid travel, is noisy or will not deploy or stow completely, extend the PRB and check to see if any foreign material is caught in the PRB hinge points, step area or door sill. If foreign material is found, clean the PRB hinge points, step area and door sill with a high-pressure washer. If the system operates correctly after cleaning, refer the customer to the Owner's Literature for correct cleaning instructions. • Check the PRB hinge points, step area and door sill of the PRBs for foreign material or blockage. If any foreign material	**Yes** The system is operating normally. The concern may have been caused by foreign material or blockage in the pivot areas or track guides. REFER the customer to the Owner's Literature for correct cleaning instructions. **No**

or blockage is found, remove it, and if necessary, set the PRB system to the OUT mode and clean the PRB hinge points, step area and door sill with a high-pressure washer. Avoid direct spray to the motor. • Set the PRB system to the AUTO (enabled) mode, where the boards automatically deploy when either door on the same side is opened, and retract when the door is closed. • Open and close the LH front door. The LH PRB should deploy when the door is open, and retract 2 seconds after the door is closed. • Open and close the RH front door. The RH PRB should deploy when the door is open, and retract 2 seconds after the door is closed. • **Do the LH and RH PRBs operate normally during all test steps?**	INSTALL a new PRB bracket assembly. REFER to Power Running Board (PRB) Bracket in this section. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC B1317/B1318

Refer to Wiring Diagrams Cell 109 , Power Liftgate/Retractable Running Boards for schematic and connector information.

NOTE: DTC B1317 or B1318 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

Normal Operation

The Power Running Board (PRB) module continuously monitors the input voltage for correct operation. If the PRB module detects input voltage below 9.5 volts, it will store DTC B1318 in memory. If the PRB module detects input voltage greater than 16 volts, it will store DTC B1317 in memory. If the PRB module sets DTC B1317 or B1318, it will inhibit the PRB system operation.

- DTC B1317 (Battery Voltage High) - If the PRB module detects voltage above 16 volts while the running boards are in motion (deploy/stow), it will set this DTC. Once this DTC is set, the PRB system will be disabled until the battery voltage returns to normal.
- DTC B1318 (Battery Voltage Low) - If the PRB module detects voltage below 9.5 volts while the running boards are in motion (deploy/stow), it will set this DTC.

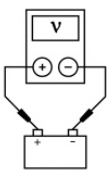
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- PRB module

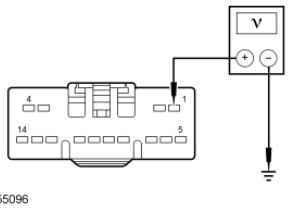
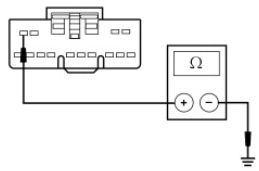
PINPOINT TEST F: DTC B1317/B1318

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

Test Step	Result / Action to Take
F1 RETRIEVE ALL CMDTCs IN ALL MODULES	

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• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - ALL CMDTCs . • **Is DTC B1317 or B1318 retrieved from one or more modules and P0563, P0620, P0626 or P065B retrieved from the PCM?**	**Yes** REFER to Section 414-00 to diagnose the charging system. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). REPEAT the PRB module self-test. **No** GO to F2 .
F2 TEST BATTERY CONDITION	
• Ignition OFF. • Carry out the Battery Condition Test. Refer to Section 414-01 . • **Did the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . REPEAT the PRB module self-test. If the battery passed the condition test and did not require a recharge, GO to F3 . **No** INSTALL a new battery. CLEAR all CMDTCs . REPEAT the PRB module self-test.
F3 CHECK CHARGING SYSTEM VOLTAGE	
NOTE: Do not allow the engine speed to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine speed goes above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Measure the voltage of the battery: ♦ For DTC B1317, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage. ♦ For DTC B1318, turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage.  AJ0210-A • **Is the voltage between 13 and 15.2 volts?**	**Yes** For DTC B1318, GO to F4 . For DTC B1317, GO to F6 . **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . REPEAT the PRB module self-test.

F4 CHECK THE PRB MODULE POWER CIRCUIT	
• Measure the voltage between PRB module C4322B-1, circuit SBB19 (BU/RD), harness side and ground.  N0055096 • **Is the voltage greater than 10.5 volts?**	**Yes** GO to F5 . **No** VERIFY Battery Junction Box (BJB) fuse 19 (30A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F5 CHECK THE PRB MODULE GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the PRB module C4322B-4, circuit GD151 (BK/GN), harness side and ground.  N0060073 • **Is the resistance less than 5 ohms?**	**Yes** GO to F6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F6 CHECK FOR PRB MODULE OPERATION	
• Check PRB module C4322A and C4322B for the following: ♦ corrosion. ♦ damaged pins. ♦ pushed-out pins. • Connect PRB module C4322A and C4322B and make sure the connectors seat correctly. • CLEAR all CMDTCs . • Operate the system to verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Power Running Board (PRB) Module in this section. REPEAT the PRB module self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the PRB module self-test.

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Applique Repair

General Equipment

3 inch dual-action (DA) sander
3 inch polisher

NOTE: Appliques located on the front and rear window frames may experience minor scratches from vehicle shipment or car wash racks. These imperfections may be repaired instead of replacing the component by following the steps below.

NOTE: Scratches deep enough to cause a thumb nail to catch cannot be repaired and the component must be replaced.

1. Clean with a mild soap and water wash and dry the affected panels.

2. Apply protective masking to adjacent components.

3. Apply a small amount of clear coat and plastic formulated polishing compound (obtain locally) to a 3 inch polisher with an appropriate foam pad attached.

4. **NOTE:** Do not allow the polishing compound to dry while polishing the component.

   Thoroughly polish the component.

5. Reclean with a mild soap and water wash and dry the polished panels.
   - If the scratches are repaired return the vehicle.
   - If the scratches remain, continue with the following steps.

6. Choose a sandpaper appropriate to the scratch severity.
   - For very minor scratches, use a 3 inch 3000 grit sandpaper (obtain locally).
   - For minor scratches, use a 3 inch 1000 grit sandpaper (obtain locally).
   - For heavier scratches that do not catch a thumb nail when pulled across the scratch, use a 3 inch 800 grit sandpaper (obtain locally).
   - For scratches that are too deep to remove with 800 grit sandpaper, install a new component.

7. ***NOTICE:*** **Do not remove any more material than necessary or component replacement will be required.**

   Apply the appropriate sandpaper to a 3 inch dual-action (DA) sander and carefully sand the component until all the damage has been removed.

8. Apply progressively finer sandpaper to the 3 inch dual-action (DA) sander and repeat the process. Finish the sanding with 3000 grit sandpaper.

9. Apply a small amount of clear coat and plastic formulated rubbing compound (obtain locally) to a 3 inch polisher with an appropriate foam pad attached.

10. **NOTE:** Do not allow the rubbing compound to dry while polishing the component.

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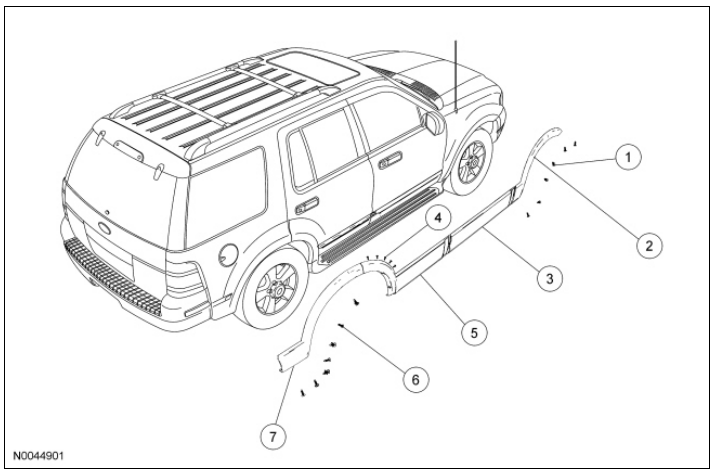
Buff the component until the sanding scratches have been completely removed.

11. Apply a small amount of clear coat and plastic formulated polishing compound (obtain locally) to a 3 inch polisher with an appropriate clean foam pad attached.
12. **NOTE:** Do not allow the polishing compound to dry while polishing the component.

    Polish the component until the buffing swirl marks are removed.
13. Continue polishing the component until the original level of shine is present.
14. Apply a small amount of clear coat and plastic formulated hand glaze (obtain locally) to a soft and clean shop cloth and hand polish to remove swirl marks left by the 3 inch polisher.

Exterior Trim - Exploded View

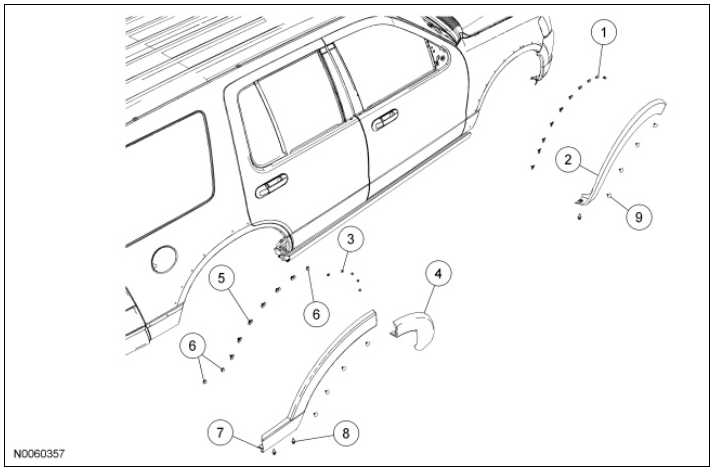
Exterior Moulding - All Explorer and Mountaineer Vehicles



Item	Part Number	Description
1	W709837	Front fender moulding pin-type retainer (6 required)
2	16A074 LH/ 16A075 RH	Front fender moulding
3	20200 LH/ 20201 RH	Front door moulding
4	W710604	Rear door moulding retaining screw (5 required)
5	254A76 LH/ 254A77 RH	Rear door moulding
6	W709837	Rear quarter panel trim moulding pin-type retainer (6 required)
7	29C120 LH/ 29C121 RH	Rear quarter panel trim moulding

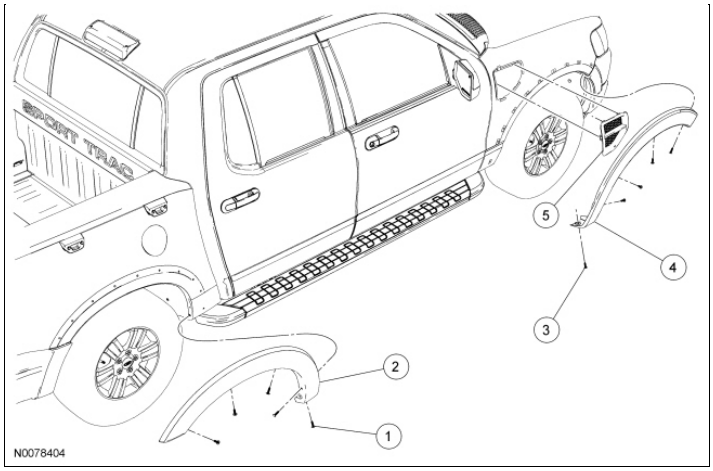
NOTE: Explorer XLT shown.

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Item	Part Number	Description
1	16A074	Front fender moulding clip (10 required)
2	16A074 LH/ 16A075 RH	Front fender moulding
3	W710604	Rear door moulding retaining screw (5 required)
4	254A76 LH/ 254A77 RH	Rear door moulding
5	16A074	Rear quarter panel trim moulding clip (6 required)
6	78291C20	Rear quarter panel trim moulding clips (3 required)
7	29C120 LH/ 29C121 RH	Rear quarter panel trim moulding
8	W709837	Rear quarter panel trim moulding pin-type retainer (6 required)
9	W709837	Front fender moulding pin-type retainer (6 required)

Exterior Moulding - Explorer Sport Trac



Item	Part Number	Description

1	W709837	Rear fender moulding pin-type retainer (5 required)
2	291C20 LH/ 291C20-1 RH	Rear fender moulding
3	W709837	Front fender moulding pin-type retainer (5 required)
4	16A074 LH/ 16A075 RH	Front fender moulding
5	16C027 LH/ 16C026 RH	Fender vent

1. For additional information, refer to the procedures in this section.

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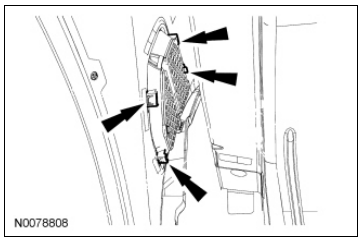
Fender Vent

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

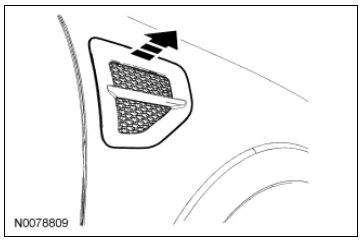
2. Remove the fender splash shield. For additional information, refer to Section 501-02 .

3. Release the retainer clips on the back of the fender vent.



4. **NOTE:** Using a plastic putty knife or similar tool, start from the top of the fender vent.

   Pull gently on the fender vent to release the pressure sensitive tape from the fender and remove the fender vent.



5. Clean the fender vent mounting area with an appropriate cleaner.

Installation

1. **NOTE:** The temperature of the mounting surface must be greater then 16°C (60°F).

   NOTE: Make sure to apply at least 30 psi to the fender vent for correct seating.

   Install the fender vent.

2. Install the fender splash shield. For additional information, refer to Section 501-02 .

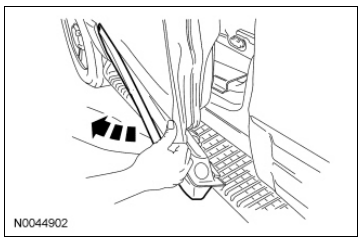
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Door Moulding - Explorer

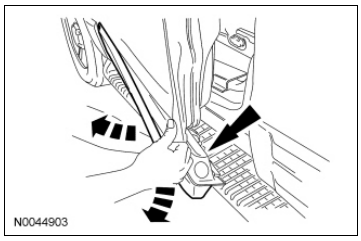
Removal

Front door moulding

1. Pull the top of the front door moulding away from the door to release the tape.

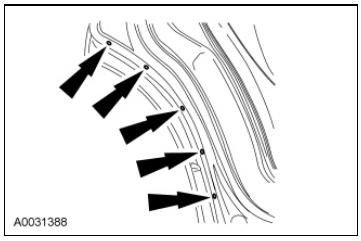


2. Tilt the front door moulding downward to release from the bottom of the door.

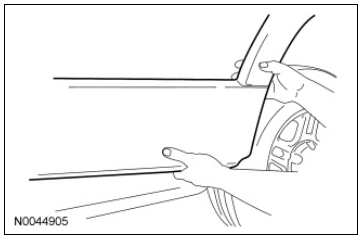


Rear door moulding

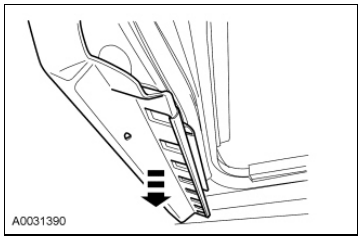
3. Remove the 5 rear door moulding retaining screws.



4. Pull the rear door moulding away from the door to release the tape.



5. Tilt the rear door moulding down and remove the lower portion of the rear door moulding from the door.



6. Remove the rear door moulding.

Installation

Front door moulding

1. Wipe the door tape surface with alcohol.
2. Release the tape liner on the cladding.
3. Hook the moulding to the bottom return flange on the door.
4. Align the locating pins on the cladding to the location holes on the door.
5. Press the tape into position. Make sure even pressure is applied to all of the taped area.

Rear door moulding

6. Wipe the door tape surface with alcohol.
7. Release the tape liner on the cladding.
8. Hook the moulding to the bottom return flange on the door.
9. Once the cladding is aligned on the door, press the tape into position. Make sure even pressure is applied to all of the taped area.
10. Install the 5 rear door moulding retaining screws.

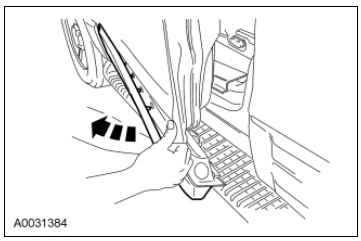
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Door Moulding - Mountaineer

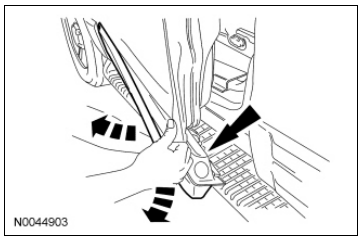
Removal and Installation

Front door moulding

1. Pull the top of the front door moulding away from the door to release the retaining clips.

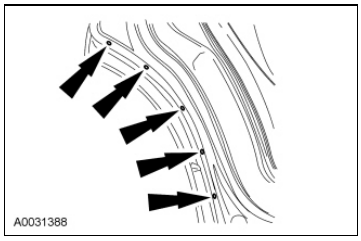


2. Tilt the front door moulding downward to release from the bottom of the door.



Rear door moulding

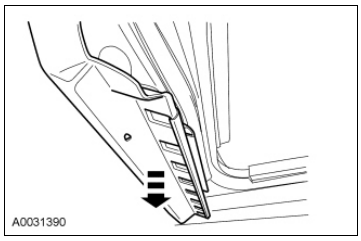
3. Remove the 5 rear door moulding retaining screws.



Rear door moulding

4. Pull the rear door moulding away from the door to release the retaining clips.

5. Tilt the rear door moulding down and remove the lower portion of the rear door moulding from the door.



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6. Remove the rear door moulding.

All door mouldings

7. **NOTE:** All clips must be installed on the front door moulding before installation.

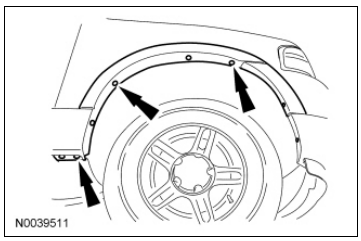
   To install, reverse the removal procedure.

Fender Moulding - Front

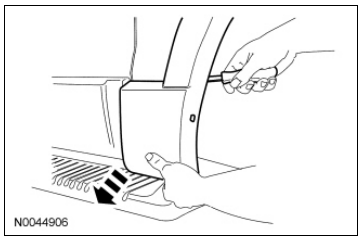
Removal and Installation

NOTE: Explorer shown, Mountaineer and Explorer Sport Trac similar.

1. Remove the 6 (Ironman) or 5 (all others) front fender moulding pin-type retainers.



2. Pull the front fender moulding outward to release the retaining clips.



3. Remove the front fender moulding.

4. **NOTE:** All retainer clips must be installed onto the front fender moulding before installation.

   To install, reverse the removal procedure.

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Fender Moulding - Rear

Removal and Installation

1. Remove the 5 pin-type retainers.
2. Pull the fender moulding outward to release the retaining clips.
3. To install, reverse the removal procedure.

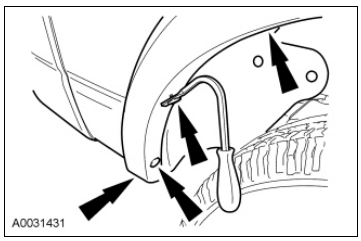
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Quarter Panel Moulding

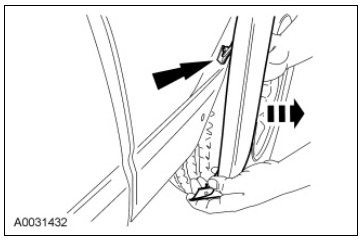
Removal and Installation

NOTE: Explorer shown, Mountaineer similar.

1. Remove the 6 rear quarter panel trim moulding pin-type retainers.



2. Pull the rear quarter panel trim moulding outward to release the retaining clips.



3. Remove the rear quarter panel trim moulding.

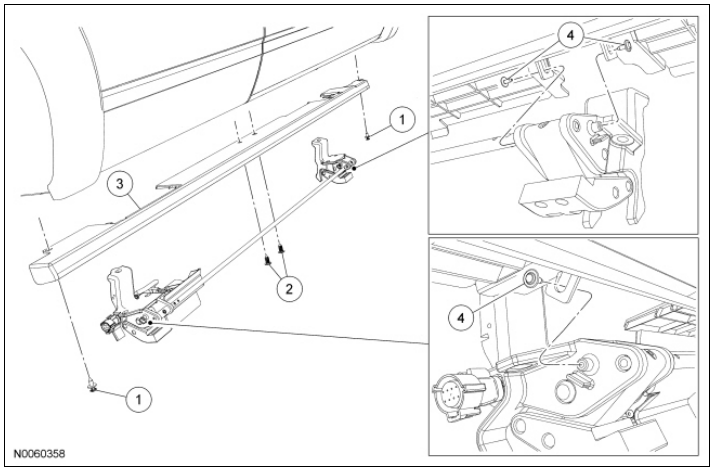
4. **NOTE:** All retainer clips must be installed onto the rear quarter panel trim moulding before installation.

   To install, reverse the removal procedure.

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Power Running Board (PRB) Gap Hider

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	N807389	Scrivets (2 required each side)
2	N804379	Pushpins (2 required each side)
3	-	Power Running Board (PRB) gap hider
4	-	Gap hider-to-bracket screws (3 required)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** If the Power Running Board (PRB) cannot be extracted, extend the running board by hand.

   Extend the PRB .

3. Remove the 2 pushpins and 2 scrivets.

4. Remove the 3 gap hider-to-bracket screws.

5. Remove the PRB gap hider.

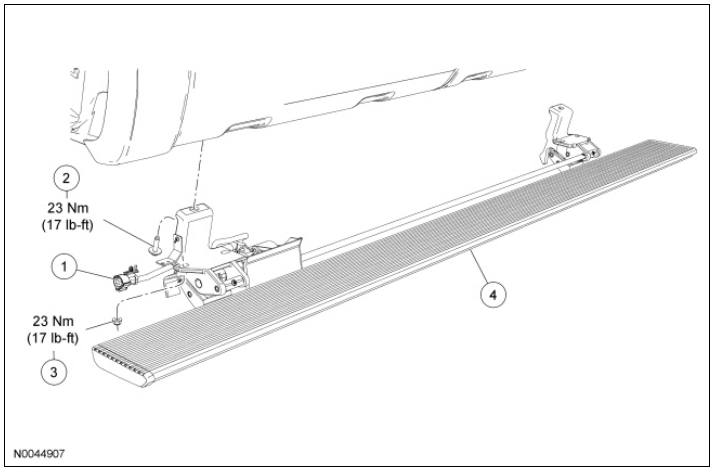
6. To install, reverse the removal procedure.

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Power Running Board (PRB)

NOTE: Mountaineer shown, Explorer similar.

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	-	Power Running Board (PRB) motor electrical connector
2	W709851	PRB retaining bolt (2 required per side)
3	N800911	PRB retaining nut (4 required per side)
4	16B46718	PRB assembly

Removal and Installation

Explorer only

1. Remove the Power Running Board (PRB) gap hider. For additional information, refer to Power Running Board (PRB) Gap Hider in this section.

Mountaineer only

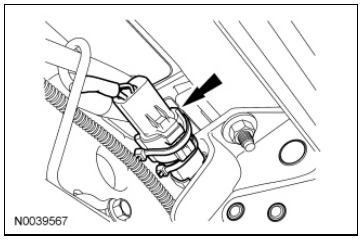
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. **NOTE:** If the PRB cannot be extracted, extend the running board by hand.

   Extend the PRB .

All vehicles

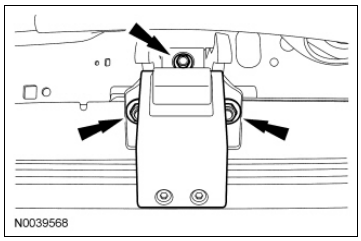
4. Remove the straps and disconnect the PRB motor electrical connector.



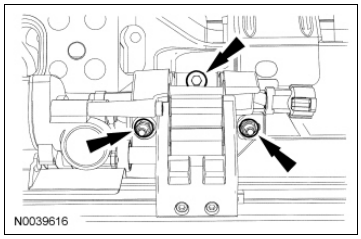
5. **NOTE:** An assistant is required to hold the PRB before removing the lower bolts.

   Remove the front PRB lower 2 nuts and bolt.

   - To install, tighten to 23 Nm (17 lb-ft).



6. Remove the rear PRB lower 2 nuts and bolt and remove the PRB assembly.
   - To install, tighten to 23 Nm (17 lb-ft).



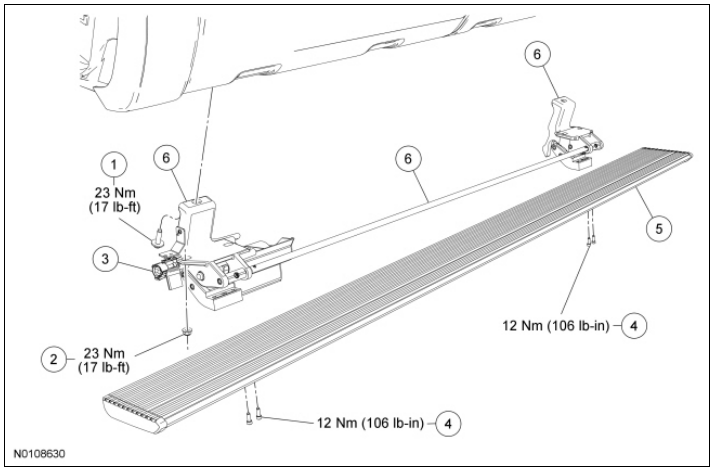
7. To install, reverse the removal procedure.

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Power Running Board (PRB) Bracket

NOTE: Mountaineer shown, Explorer similar.

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	W709851	Power Running Board (PRB) retaining bolt (2 required per side)
2	N800911	PRB retaining nut (4 required per side)
3	-	PRB motor electrical connector
4	-	PRB step screws (4 required per side)
5	16490	PRB step assembly
6	T6A507	PRB bracket assembly

Removal and Installation

NOTE: The Power Running Board (PRB) motor and bracket assemblies cannot be serviced individually. The complete motor and bracket assembly and linkage must be serviced as a unit.

Explorer only

1. Remove the PRB gap hider. For additional information, refer to Power Running Board (PRB) Gap Hider in this section.

Mountaineer only

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. **NOTE:** If the PRB cannot be extracted, extend the running board by hand.

   Extend the retractable running board.

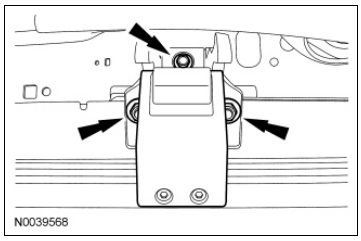
All vehicles

4. Remove the PRB step. For additional information, refer to Power Running Board (PRB) Step in this section.

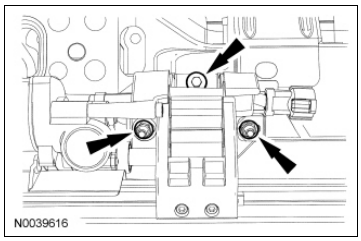
5. **NOTE:** An assistant is required to hold the PRB motor and bracket assembly before removing the lower bolts.

   Remove the PRB front bracket lower 2 nuts and bolt.

   - To install, tighten to 23 Nm (17 lb-ft).



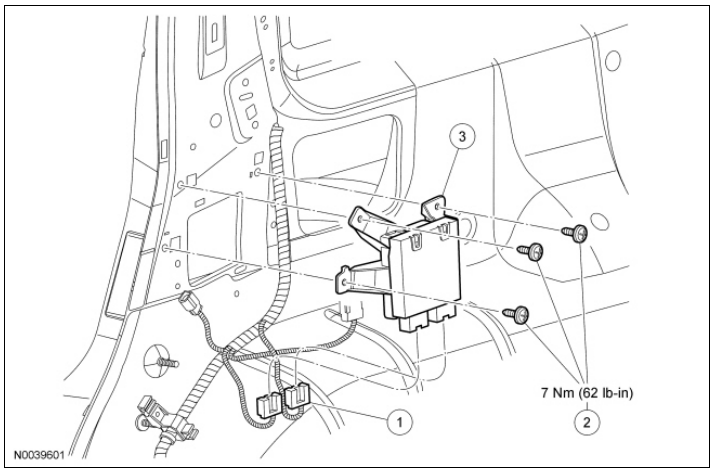
6. Remove the PRB rear bracket lower 2 nuts and bolt.
   - To install, tighten to 23 Nm (17 lb-ft).



7. To install, reverse the removal procedure.

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Power Running Board (PRB) Module



Item	Part Number	Description
1	14A488	Electrical connector
2	W500012	Power Running Board (PRB) module retaining screws (3 required)
3	14C177	PRB module assembly

Removal and Installation

1. Remove the RH C-pillar trim panel. For additional information, refer to Section 501-05 .

2. Disconnect the Power Running Board (PRB) module electrical connectors.

3. Remove the 3 screws and the PRB module assembly.
   - To install, tighten to 7 Nm (62 lb-in).

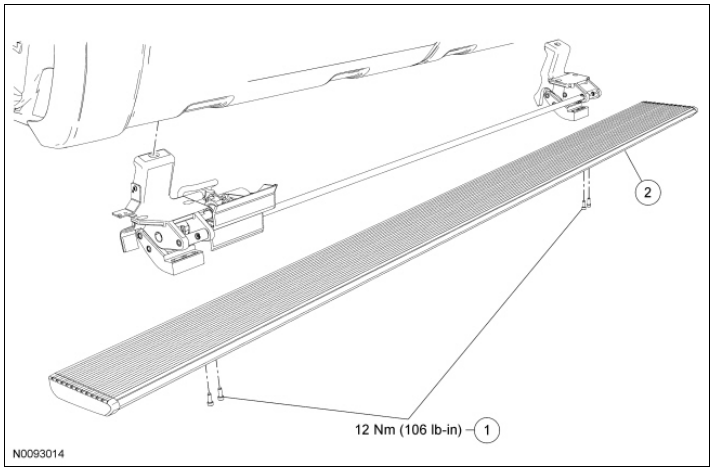
4. To install, reverse the removal procedure.

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Power Running Board (PRB) Step

NOTE: Mountaineer shown, Explorer similar.

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	-	Power Running Board (PRB) step screws (4 required per side)
2	16450	PRB step assembly

Removal and Installation

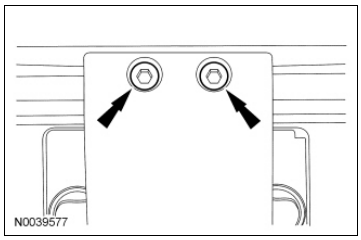
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Extend the Power Running Board (PRB).

3. **NOTE:** An assistant is required to hold the PRB before removing the bracket-to-step screws.

   Remove the 2 front and 2 rear bracket-to-step screws and the PRB step.

   - To install, align the step approximately 5 mm (0.20 in) away from the mini-mudflap that hangs down from the front splash shield. Tighten the screws to 12 Nm (106 lb-in).

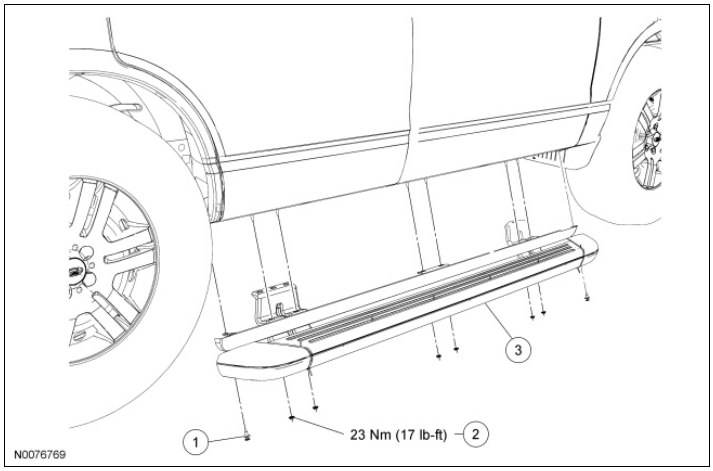


4. To install, reverse the removal procedure.

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Running Board

NOTE: Explorer Limited shown, all others similar.



Item	Part Number	Description
1	W709837	Running board pin-type retainer (2 required)
2	N621940	Running board retaining nut (6 required)
3	16450 LH/ 16451 RH	Running board

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 6 running board retaining nuts.
   - To install, tighten to 23 Nm (17 lb-ft).

3. Remove the 2 running board pin-type retainers.

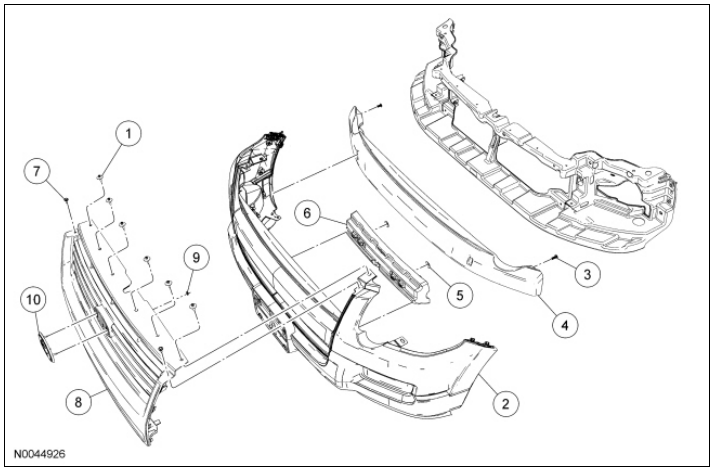
4. Remove the running board.

5. To install, reverse the removal procedure.

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Radiator Grille - Explorer, Explorer Sport Trac

NOTE: For Mountaineer, refer to Radiator Grille - Mountaineer in this section.

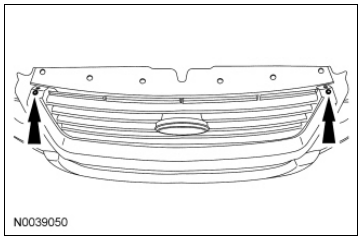


Item	Part Number	Description
1	W706207	Radiator grille scrivet (6 required)
2	-	Bumper cover
3	W709837	Pushpin retainer
4	17C882	Bumper isolator
5	-	Front bumper absorber retaining nut (2 required)
6	17C882	Front bumper absorber
7	-	Grille-to-bumper cover screw (2 required)
8	8200	Radiator grille
9	W707501	Emblem retaining nut (2 required)
10	8B262	Emblem

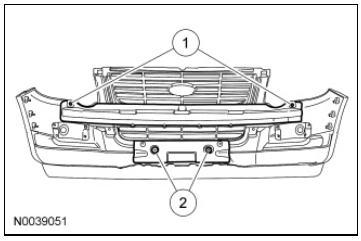
Removal and Installation

1. Remove the front bumper cover. For additional information, refer to Section 501-19 .

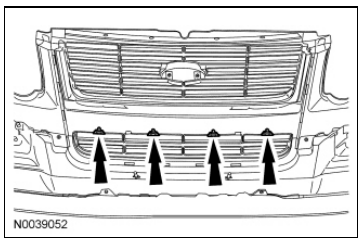
2. Remove the 2 grille-to-bumper cover screws.



3. Remove the front bumper isolator and absorber.
    1. Remove the 2 pushpins.
    2. Remove the 2 nuts.



4. Remove the 4 scrivets.



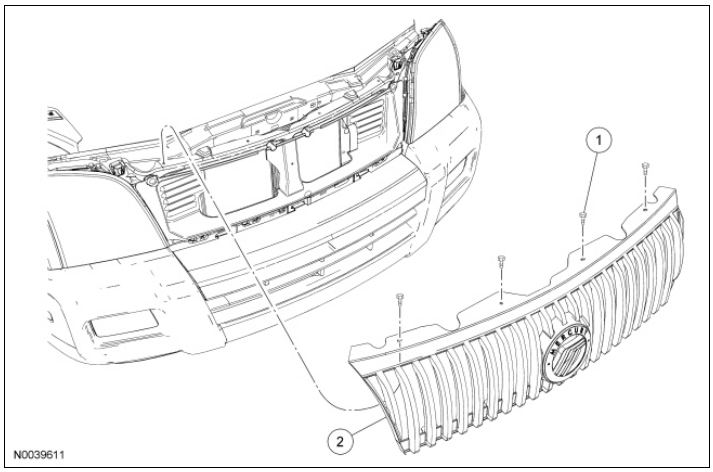
5. Carefully release the 14 clips and remove the grille assembly from the bumper cover.

6. To install, reverse the removal procedure.

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Radiator Grille - Mountaineer

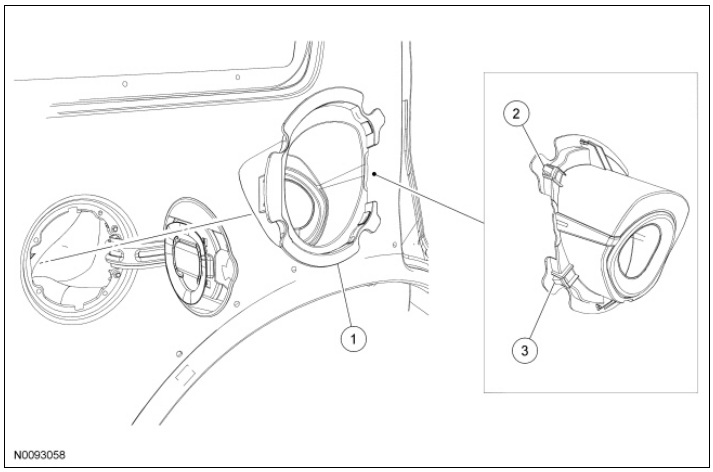


Item	Part Number	Description
1	W706207	Radiator grille scrivet (4 required)
2	8200	Radiator grille

Removal and Installation

1. Remove the 4 radiator grille scrivets.
2. Lift the radiator grille upward and remove.
3. To install, reverse the removal procedure.

Fuel Filler Door Cup Bezel

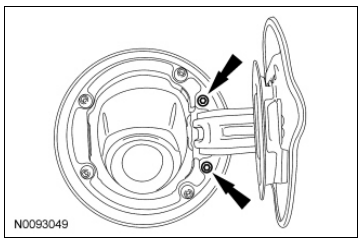


Item	Part Number	Description
1	9A212	Fuel filler door cup bezel
2	-	Fuel filler door cup bezel upper RH clip (part of 9A212)
3	-	Fuel filler door cup bezel lower RH clip (part of 9A212)

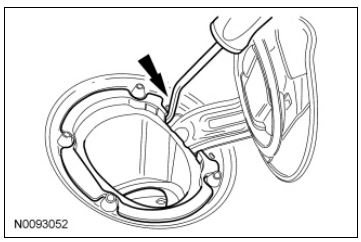
Removal

1. ***NOTICE:*** **Apply tape around the circumference of the fuel filler door. Failure to follow this direction may result in damage to the vehicle.**

   Remove the fuel filler door screws and reposition the fuel filler door.

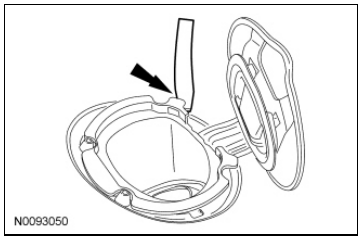


2. Using a 90 degree pick tool, release the upper RH fuel filler door cup bezel clip from the body.

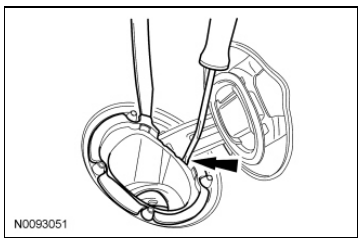


3. Using a non-marring body tool, prevent the fuel filler door cup bezel from re-attaching to the body.

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4. Using a 90 degree pick tool, release the bottom RH fuel filler door cup bezel clip from the body.



5. Pull outward and upward to remove the fuel filler door cup bezel from the body.

Torque Specifications

Description	Nm	lb-in
Exterior mirror nuts (door mounted)	9	80
Exterior mirror nuts (hood mounted)	8	71

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Rear View Mirrors

Exterior Mirrors

The main components of the exterior mirrors are:

- Exterior mirror control switch
- Exterior mirror glass adjustment motors (power mirrors only)
- Exterior mirror glass
- Exterior mirror plastic housing
- Interior rear view mirror

Power Exterior Mirrors

Power mirrors allow the LH or RH exterior mirror glass to be positioned electronically. The position of the power mirror glass is controlled by the exterior mirror control switch. Adjusting the exterior mirror control switch to the LH or RH position determines which power mirror glass will be controlled.

Heated Exterior Rear View Mirrors

The exterior rear view mirrors are equipped with a heated mirror glass feature, which heats the mirror glass to remove frost, snow, ice and condensation. The Explorer/Mountaineer uses the rear window defrost switch and the Sport Trac uses the heated mirror switch to control the operation of the heated exterior rear view mirrors.

Interior Mirror

The vehicle may be equipped with one of the following interior rear view mirrors:

- Interior rear view mirror
- Interior auto-dimming rear view mirror
- Interior auto-dimming rear view mirror
    - ♦ with microphone

Interior Rear View Mirror

The interior rear view mirror consists of a mirror glass and housing. The interior rear view mirror mounts to an interior rear view mirror bracket at the upper center of the windshield glass. The interior rear view mirror can be adjusted left, right, up and down using the 2 pivot points on the support arm. The interior rear view mirror can be adjusted from a day position to a night position to reduce unwanted glare caused by headlamps reflecting in the mirror. Adjusting the interior rear view mirror day/night tab, located at the bottom of the interior rear view mirror, rearward will adjust the interior mirror to the night position. Adjusting the interior rear view mirror day/night tab forward will adjust the interior mirror to the day position.

Interior Auto-Dimming Rear View Mirror

The interior rear view mirror may be equipped with an auto dimming feature. The interior auto-dimming rear view mirrors feature automatically reduces the glare caused by headlamps reflecting in the interior rear view mirror. The auto-dimming feature is activated when the ignition is in the RUN or ACC position. The interior auto-dimming rear view mirror adjusts the reflectance level of the interior rear view mirror glass to eliminate

unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior mirror. To provide increased visibility when backing up, the interior rear view mirror will automatically return to a high reflectance mode whenever the vehicle is in REVERSE.

The interior rear view mirror may be equipped with an integrated microphone. For microphone information or diagnostics, refer to Section 415-00 .

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Rear View Mirrors - Exterior

Special Tool(s)

 ST2574-A	Flex Probe Kit 300-NUD105-R025DE or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent

Principles of Operation

The movement of the LH and RH exterior mirror glass is controlled by the exterior mirror control switch and the LH and RH exterior mirror motors. Adjusting the exterior mirror switch to the LH or RH position determines which exterior mirror motor will be controlled. The exterior mirror control switch logic is the selected movement request from the exterior mirror control switch. When the exterior mirror control switch is adjusted to the left, right, up or down position, the exterior mirror control switch will supply voltage and ground to the selected exterior mirror motor to move the exterior mirror glass to the desired position.

The exterior mirrors use a jumper harness between the vehicle wire harness connector and the exterior mirror motor. The exterior mirror jumper harness is integral to the exterior mirror. Before replacing an exterior mirror or mirror motor, inspect the jumper harness for open and shorted circuits or damaged and pushed-out pins. If a concern with the exterior mirror jumper harness exists, attempt to repair the jumper harness.

Heated Exterior Rear View Mirror

The rear window defrost switch controls the operation of the heated exterior rear view mirrors. The heated exterior rear view mirrors only operate when the rear window defrost system is operating. The heated exterior mirror should become warm to the touch after 4 minutes of operation. The heated exterior rear view mirror power is supplied by the rear defroster relay through Smart Junction Box (SJB) fuse 13 (15A), which isolates the heated exterior mirrors from the rear window defroster system in the event of a concern.

Inspection and Verification

1. Verify the customer concern by operating the exterior mirrors.

2. Visually inspect for the following obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Exterior mirror • Exterior mirror control switch • Exterior mirror glass	• Smart Junction Box (SJB) fuse 13 (15A) • Battery Junction Box (BJB) fuse(s): ♦ 32 (5A) ♦ 15 (40A) • Exterior mirror control switch • Exterior mirror motor • Exterior mirror • Heated exterior mirror glass • Loose or corroded connections • Wiring harness

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern is not visually evident, verify the symptom and GO to Symptom Chart - Exterior Mirrors or GO to Symptom Chart - NVH .

Symptom Chart - Exterior Mirrors

Symptom Chart - Exterior Mirrors

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- The exterior mirror glass movement is restricted, erratic or jumpy
- Exterior mirror damper spring is out of the exterior mirror damper spring track
- CHECK to make sure that the exterior mirror damper springs are installed correctly in the exterior mirror damper spring track. REFER to Exterior Mirror Damper Spring Alignment in this section.
- Mirror vibrates/loose
- Exterior mirror mounting nuts loose
- TIGHTEN nuts to 9 Nm (80 lb-in).
- **NOTE:** Compare the LH and RH exterior mirror glass to verify that the exterior mirror glass is loose.

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Mirror glass loose

- PRESS the center of the exterior mirror glass up, down, left and right to make sure that the exterior mirror glass is seated correctly. If the exterior mirror glass is still loose, REMOVE the exterior mirror glass and INSPECT the exterior mirror backing plate for damage. If the exterior mirror backing plate is damaged, INSTALL a new exterior mirror glass. REFER to Exterior Mirror Glass in this section.
- Aftermarket air deflector/stone shields
- If possible, REMOVE aftermarket air deflector/stone shield, then ROAD TEST the vehicle. If concern is no longer present, ADVISE customer that aftermarket components were causing undesired vibration.
- Wind noise
- Foam gasket between the exterior mirror and door is damaged or misaligned
- VERIFY gasket is present and in good condition. If necessary, REPOSITION gasket between exterior mirror and door frame.
- Exterior mirror is not correctly fitted to the door
- VERIFY that there are no gaps between the exterior mirror and the door. If necessary, LOOSEN the exterior mirror nuts and REPOSITION the exterior mirror.

Pinpoint Test

Pinpoint Test A: The Mirrors are Inoperative

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

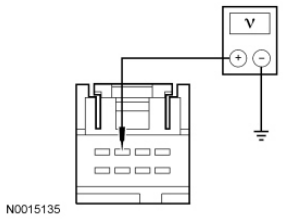
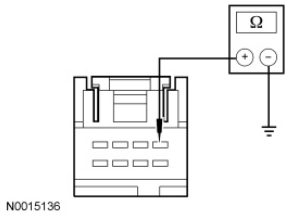
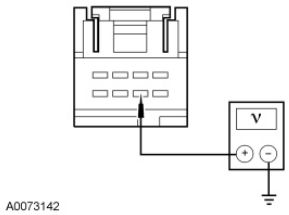
The exterior mirror control switch receives power from Battery Junction Box (BJB) fuse 32 (5A) through circuit SBB32 (VT/RD) and ground through circuit GD133 (BK). The exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror up/down and right/left movement.

This pinpoint test is intended to diagnose the following:
- Fuse
- Wiring, terminals or connectors
- Exterior mirror control switch

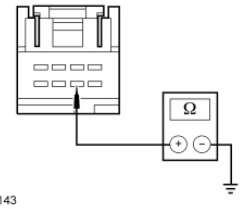
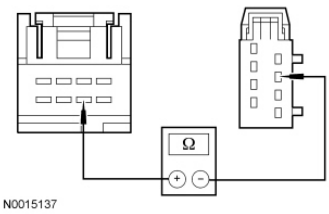
PINPOINT TEST A: THE MIRRORS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 CHECK CIRCUIT SBB32 (VT/RD) FOR AN	

OPEN	
• Ignition OFF. • Disconnect: Exterior Mirror Control Switch C527. • Ignition ON. • Measure the voltage between exterior mirror control switch C527-3, circuit SBB32 (VT/RD), harness side and ground.  N0015135 • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** VERIFY that BJB fuse 32 (5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. TEST the system for normal operation.
A2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between exterior mirror control switch C527-1, circuit GD133 (BK), harness side and ground.  N0015136 • **Is the resistance less than 5 ohms?**	**Yes** GO to A3 . **No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between exterior mirror control switch C527-6, circuit CPM23 (GY), harness side and ground.  A0073142	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to A4 .

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• **Is any voltage present?**	
A4 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A5 . **No** REPAIR the circuit. TEST the system for normal operation.
A5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN	
• Disconnect: LH Exterior Mirror C520. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY), harness side and LH exterior mirror C520-3, circuit CPM23 (GY), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST system for normal operation.

Pinpoint Test B: A Single Mirror is Inoperative

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

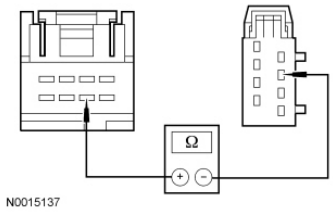
The exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror up/down and right/left movement.

This pinpoint test is intended to diagnose the following:

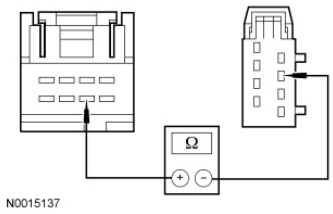
- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST B: A SINGLE MIRROR IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 CHECK THE LH EXTERIOR MIRROR	
• Set the exterior mirror control switch to the LH mirror position. • Use the exterior mirror control switch to operate the LH exterior mirror. • **Does the LH exterior mirror operate?**	**Yes** GO to B2 . **No** GO to B4 .
B2 CHECK THE EXTERIOR MIRROR CONTROL SWITCH	
• Ignition OFF. • Disconnect: Exterior Mirror Control Switch C527. • Carry out the Exterior Mirror Control Switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the exterior mirror control switch pass the component test?**	**Yes** GO to B3 . **No** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. TEST the system for normal operation.
B3 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN	
• Disconnect: RH Exterior Mirror C601. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY), harness side and RH exterior mirror C601-3, circuit CPM23 (GY), harness side.  • **Is the resistance less than 5**	**Yes** CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

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ohms?	
B4 CHECK THE EXTERIOR MIRROR CONTROL SWITCH	
• Ignition OFF. • Disconnect: Exterior Mirror Control Switch C527 . • Carry out the Exterior Mirror Control Switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the exterior mirror control switch pass the component test?**	**Yes** GO to B5 . **No** INSTALL a new exterior mirror control switch. REFER to Exterior Mirror Control Switch in this section. TEST the system for normal operation.
B5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN	
• Disconnect: LH Exterior Mirror C520. • Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY), harness side and LH exterior mirror C520-3, circuit CPM23 (GY), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to Exterior Mirror Motor in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test C: A Single Mirror Does Not Function With Switch Logic

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

The exterior mirror control switch controls the LH exterior mirror movement by switching voltage and ground to circuits CPM14 (GY/BN), CPM16 (BN/BU) and CPM23 (GY). The exterior mirror switch controls the RH exterior mirror movement by switching voltage and ground to circuits CPM18 (GN/BN), CPM19 (GY/OG) and CPM23 (GY).

Mirror Movement

- When the LH/RH exterior mirror motor receives ground through circuit CPM16 (BN/BU)/CPM19 (GY/OG) and voltage through circuit CPM23 (GY), the LH/RH exterior mirror will operate leftward.

- When the LH/RH exterior mirror motor receives voltage through circuit CPM16 (BN/BU)/CPM19 (GY/OG) and ground through circuit CPM23 (GY), the LH/RH exterior mirror will operate rightward.
- When the LH/RH exterior mirror motor receives ground through circuit CPM14 (GY/BN)/CPM18 (GN/BN) and voltage through circuit CPM23 (GY), the LH/RH exterior mirror will operate downward.
- When the LH/RH exterior mirror motor receives voltage through circuit CPM14 (GY/BN)/CPM18 (GN/BN) and ground through circuit CPM23 (GY), the LH/RH exterior mirror will operate upward.

This pinpoint test is intended to diagnose the following:

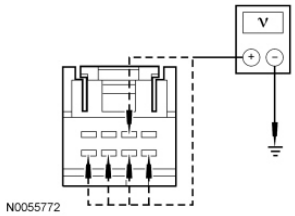
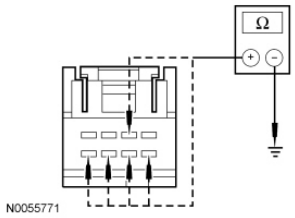
- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

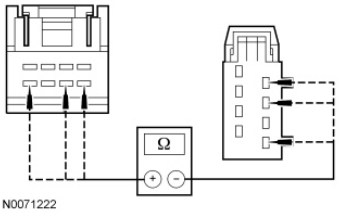
PINPOINT TEST C: A SINGLE MIRROR DOES NOT FUNCTION WITH SWITCH LOGIC

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

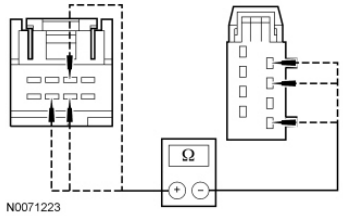
Test Step	Result / Action to Take
C1 CHECK THE EXTERIOR MIRROR CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Exterior Mirror Control Switch C527. • Ignition ON. • Measure the voltage between ground and exterior mirror control switch: ♦ C527-2, circuit CPM18 (GN/BN), harness side. ♦ C527-5, circuit CPM14 (GY/BN), harness side. ♦ C527-6, circuit CPM23 (GY), harness side. ♦ C527-7, circuit CPM19 (GY/OG), harness side. ♦ C527-8, circuit CPM16 (BN/BU), harness side.	**Yes** REPAIR the circuit(s). TEST the system for normal operation. **No** GO to C2 .

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 • **Is any voltage present?**	
C2 CHECK THE EXTERIOR MIRROR CONTROL CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Exterior Mirror C520 (LH) or C601 (RH). • Measure the resistance between ground and exterior mirror control switch: ♦ C527-2, circuit CPM18 (GN/BN), harness side. ♦ C527-5, circuit CPM14 (GY/BN), harness side. ♦ C527-6, circuit CPM23 (GY), harness side. ♦ C527-7, circuit CPM19 (GY/OG), harness side. ♦ C527-8, circuit CPM16 (BN/BU), harness side.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit(s). TEST the system for normal operation.
C3 CHECK THE EXTERIOR MIRROR CONTROL CIRCUITS FOR AN OPEN	
• **LH exterior mirror:** Measure the resistance between exterior mirror control switch: ♦ C527-5, circuit CPM14 (GY/BN), harness side and LH	**Yes** CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to Exterior Mirror in this section. If the jumper

exterior mirror C520-1, circuit CPM14 (GY/BN), harness side. ♦ C527-6, circuit CPM23 (GY), harness side and LH exterior mirror C520-3, circuit CPM23 (GY), harness side. ♦ C527-8, circuit CPM16 (BN/BU), harness side and LH exterior mirror C520-7, circuit CPM16 (BN/BU), harness side.  N0071222 • **RH exterior mirror:** Measure the resistance between exterior mirror control switch: ♦ C527-2, circuit CPM18 (GN/BN), harness side and RH exterior mirror C601-1, circuit CPM18 (GN/BN), harness side. ♦ C527-6, circuit CPM23 (GY), harness side and RH exterior mirror C601-3, circuit CPM23 (GY), harness side. ♦ C527-7, circuit CPM19 (GY/OG), harness side and RH exterior mirror C601-7, circuit CPM19 (GY/OG), harness side.	harness is OK, INSTALL a new LH or RH exterior mirror motor. REFER to Exterior Mirror Motor in this section. TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

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 • **Are the resistances less than 5 ohms?**	

Pinpoint Test D: The Heated Exterior Mirror is Inoperative - Explorer/Mountaineer

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

When the rear window defrost is ON, power is supplied to the heated exterior mirrors from the rear defrost relay through circuit CBP13 (GY/BN). Ground is supplied to the LH exterior mirror through circuit GD133 (BK) and to the RH exterior mirror through circuit GD151 (BK/GN). The heated exterior mirror should become warm to the touch after 4 minutes of operation.

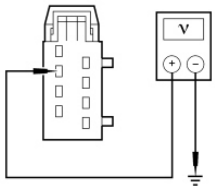
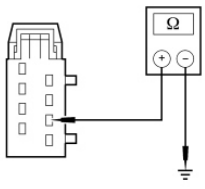
This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Exterior mirror glass
- Exterior mirror

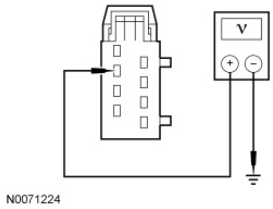
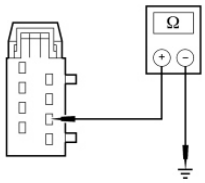
PINPOINT TEST D: THE HEATED EXTERIOR MIRROR IS INOPERATIVE - EXPLORER/MOUNTAINEER

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
D1 CHECK THE REAR WINDOW DEFROST SYSTEM OPERATION	
• Ignition ON. • With the engine running, depress the rear window defrost switch to the ON position. • Place a hand on the rear window to verify that the rear window heats up. • **Does the heated rear window system operate?**	**Yes** GO to D2 . **No** REFER to Section 501-11 to diagnose the rear window defrost system.
D2 CHECK THE OPERATION OF THE LH EXTERIOR MIRROR	
• With the rear window defrost switch in the ON position, place a hand on the LH exterior mirror	**Yes** GO to D5 . **No**

to verify that the LH exterior mirror heats up. • **Does the LH exterior rear view mirror operate?**	GO to D3 .
D3 CHECK CIRCUIT CBP13 (GY/BN) FOR VOLTAGE	
• Ignition OFF. • Disconnect: LH Exterior Mirror C520. • Ignition ON. • With the engine running, depress the rear window defrost switch to the ON position. • Measure the voltage between LH exterior mirror C520-4, circuit CBP13 (GY/BN), harness side and ground.  N0071224 • **Is the voltage greater than 10 volts?**	**Yes** GO to D4 . **No** VERIFY that Smart Junction Box (SJB) fuse 13 (15A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. TEST the system for normal operation.
D4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between LH exterior mirror C520-5, circuit GD133 (BK), harness side and ground.  N0071225 • **Is the resistance less than 5 ohms?**	**Yes** CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. If the jumper harness is OK, INSTALL a new exterior mirror glass. REFER to Exterior Mirror Glass in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
D5 CHECK CIRCUIT CBP13 (GY/BN) FOR VOLTAGE	

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• Ignition OFF. • Disconnect: RH Exterior Mirror C601. • Ignition ON. • With the engine running, depress the rear window defrost switch to the ON position. • Measure the voltage between RH exterior mirror C601-4, circuit CBP13 (GY/BN), harness side and ground.  N0071224 • **Is the voltage greater than 10 volts?**	**Yes** GO to D6 . **No** REPAIR the circuit. TEST the system for normal operation.
D6 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Measure the resistance between RH exterior mirror C601-5, circuit GD151 (BK/GN), harness side and ground.  N0071225 • **Is the resistance less than 5 ohms?**	**Yes** CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new exterior mirror. REFER to Exterior Mirror in this section. If the jumper harness is OK, INSTALL a new exterior mirror glass. REFER to Exterior Mirror Glass in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test E: The Heated Exterior Mirror is Inoperative - Sport Trac

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

The heated exterior mirror feature only operates when the engine is running. The heated mirror switch is provided ground though circuit GD145 (BK/BU) and the indicator is supplied ground through circuit GD138 (BK/WH). When the switch is ON, ground is supplied to the Smart Junction Box (SJB) from the switch circuit CRD08 (GN/OG). When the SJB commands the heated exterior mirrors ON, the SJB supplies ground to the rear defrost relay coil and voltage to the heated mirror switch indicator though circuit CRD03 (BU/GN).

Voltage is supplied to the rear defrost relay though circuit SBB15 (WH/RD).

When the relay is energized, voltage is provided to the heated exterior mirrors through circuit CBP13 (GY/BN). The heated exterior mirrors are grounded though circuit (LH) GD133 (BK) and (RH) GD151 (BK/GN).

This pinpoint test is intended to diagnose the following:

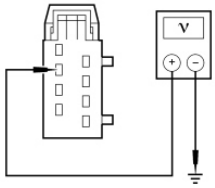
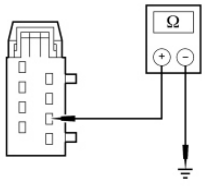
- Fuse
- Wiring, terminals or connectors
- Heated mirror switch
- SJB
- Heated exterior mirrors

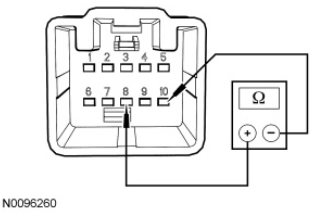
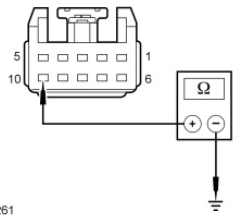
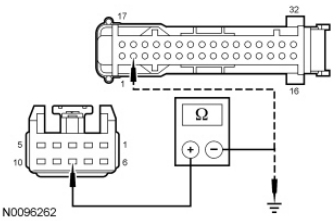
PINPOINT TEST E: THE HEATED EXTERIOR MIRROR IS INOPERATIVE - SPORT TRAC

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

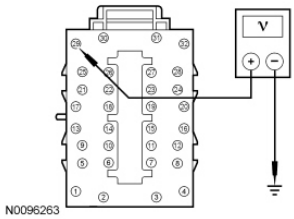
Test Step	Result / Action to Take
E1 CHECK THE HEATED EXTERIOR MIRROR OPERATION	
NOTE: The heated exterior mirror operation depends on the ambient temperature. The SJB will turn the heated exterior mirrors off after 4 minutes when the temperature is above 4°C (40°F) and 7 minutes when the temperature is below 4°C (40°F). • Ignition ON. • With the engine running, depress the heated mirror switch to the ON position. • Touch the heated exterior mirrors to verify that the heated exterior mirrors heat up. • **Do either of the mirrors heat up?**	**Yes** GO to E2 . **No** VERIFY that BJB fuse 15 (40A) is OK. If OK, GO to E4 . If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. TEST the system for normal operation.
E2 CHECK THE VOLTAGE TO THE LH OR RH HEATED EXTERIOR MIRROR	
• Ignition OFF. • Disconnect: Inoperative Heated Exterior Mirror C520 (LH) or C601 (RH). • Ignition ON. • With the engine running, depress the heated mirror switch to the ON position. • Measure the voltage between the inoperative heated exterior mirror	**Yes** GO to E3 . **No** REPAIR circuit CBP13 (GY/BN) for an open. TEST the system for normal operation.

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connector and ground. ♦ For an inoperative LH heated exterior mirror, measure the voltage between LH heated exterior mirror C520-4, circuit CBP13 (GY/BN), harness side and ground. ♦ For an inoperative RH heated exterior mirror, measure the voltage between RH heated exterior mirror C601-4, circuit CBP13 (GY/BN), harness side and ground.  N0071224 • **Is the voltage greater than 10 volts?**	
E3 CHECK THE GROUND CIRCUITS TO THE LH OR RH HEATED EXTERIOR MIRROR FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the inoperative heated exterior mirror connector and ground. ♦ For an inoperative LH heated exterior mirror, measure the resistance between heated exterior mirror C520-5, circuit GD133 (BK), harness side and ground. ♦ For an inoperative RH heated exterior mirror, measure the resistance between heated exterior mirror C601-5, circuit GD151 (BK/GN), harness side and ground.  N0071225 • **Is the resistance less than 5 ohms?**	**Yes** CHECK the inoperative heated exterior mirror jumper harness between the vehicle harness and the heated exterior mirror glass for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new heated exterior mirror. REFER to Exterior Mirror in this section. If the jumper harness is OK, INSTALL a new heated exterior mirror glass. REFER to Exterior Mirror Glass in this section. TEST the system for normal operation. **No** REPAIR the inoperative ground circuit. TEST the system for normal operation.
E4 CHECK THE HEATED MIRROR SWITCH	

• Ignition OFF. • Disconnect: Heated Mirror Switch C2382. • Measure the resistance between pins 8 and 10, component side, of the heated mirror switch while holding the button.  N0096260 • **Is the resistance less than 5 ohms?**	**Yes** GO to E5 . **No** Replace the heated mirror switch. TEST the system for normal operation.
E5 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Measure the resistance between heated mirror switch C2382-10, circuit GD145 (BK/BU), harness side and ground.  N0096261 • **Is the resistance less than 5 ohms?**	**Yes** GO to E6 . **No** REPAIR circuit GD145 (BK/BU). TEST the system for normal operation.
E6 CHECK CIRCUIT CRD08 (GN/OG) FOR AN OPEN	
• Disconnect: SJB C2280D. • Measure the resistance between heated mirror switch C2382-8, circuit CRD08 (GN/OG), harness side and SJB C2280D-2, circuit CRD08 (GN/OG), harness side.  N0096262 • **Is the resistance less than 5 ohms?**	**Yes** GO to E7 . **No** REPAIR circuit CRD08 (GN/OG). TEST the system for normal operation.

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E7 CHECK CIRCUIT SBB15 (WH/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280E. • **NOTE:** The rear defrost relay is internal to the SJB and cannot be replaced. • Measure the voltage between SJB C2280E-29, circuit SBB15 (WH/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** REPAIR circuit SBB15 (WH/RD) for an open. TEST the system for normal operation.

Rear View Mirrors - Interior

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent

Principles of Operation

The interior auto-dimming rear view mirror has 2 photoelectric sensors, a forward facing sensor and a rearward facing sensor, that detect forward and rearward light conditions. Based on these inputs, the automatic dimming feature adjusts the reflectance level of the interior rear view mirror glass to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior mirror.

When the forward sensor detects daytime conditions, the rearward sensor is inactive and the interior rear view mirror stays in a high reflectance mode. When the forward sensor detects nighttime conditions, the rearward sensor is active and detects glare from the headlights of vehicles approaching from the rear or other glare-producing light sources. To provide increased visibility when backing up, the interior rear view mirror will automatically return to a high reflectance mode whenever the vehicle is in REVERSE.

If the forward or rearward sensors are blocked, the interior auto-dimming rear view mirror might not work correctly.

Inspection and Verification

1. Verify the customer concern by operating the interior mirror.

2. Visually inspect for the following obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Interior rear view mirror	• Smart Junction Box (SJB) fuse(s): ♦ 5 (5A) ♦ 18 (10A) • Interior auto-dimming rear view mirror • Loose or corroded connections • Wiring harness

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3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern is not visually evident, verify the symptom and GO to Symptom Chart - Interior Mirrors or GO to Symptom Chart - NVH .

Symptom Chart - Interior Mirrors

Symptom Chart - Interior Mirrors

Symptom Chart - NVH

Symptom Chart - NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- The interior mirror vibrates/loose
- Interior mirror mounting loose
- REMOVE the interior mirror. REFER to Interior Rear View Mirror in this section. INSPECT the interior mirror mount for damage. INSTALL the interior mirror, making sure that it is fully seated.

Pinpoint Test

Pinpoint Test F: The Auto-Dimming Mirror Does Not Operate Correctly

Refer to Wiring Diagrams Cell 124 , Power Mirrors for schematic and connector information.

Normal Operation

The interior auto-dimming mirror can be equipped with or without a microphone. An interior auto-dimming mirror, equipped without a microphone, receives voltage from Smart Junction Box (SJB) fuse 18 (10A) through circuit CBP18 (GY/OG) and ground from circuit GD133 (BK). An interior auto-dimming mirror, equipped with a microphone, receives voltage from SJB fuse 5 (5A) through circuit CBP05 (YE) and ground from circuit GD143 (BK/VT). Both interior auto-dimming mirrors will disable the auto-dimming feature when the selector lever is placed in REVERSE and voltage is sent to the interior auto-dimming mirror through circuit CBP15 (BN/BU). There are 2 photoelectric sensors: a forward facing sensor and a rearward facing sensor that detect forward and rearward light conditions. If the sensors are blocked, the interior auto-dimming feature might not work correctly. Always verify both sensors are not physically blocked before attempting to

diagnose interior auto-dimming mirror concerns.

This pinpoint test is intended to diagnose the following:

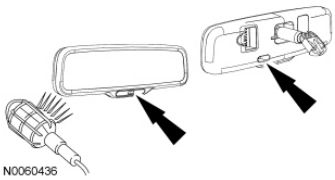
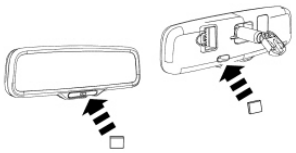
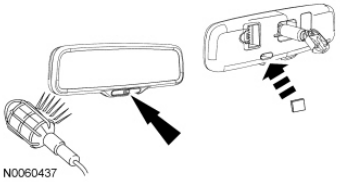
- Fuse
- Wiring, terminals or connectors
- Interior auto-dimming mirror

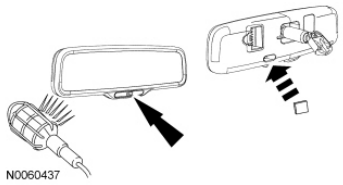
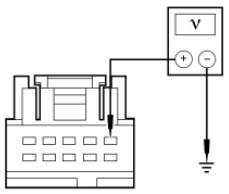
PINPOINT TEST F: THE AUTO-DIMMING MIRROR DOES NOT OPERATE CORRECTLY

NOTE: If the Transmission Range (TR) sensor is malfunctioning and the backup lamps are on all the time or do not turn on, the interior auto-dimming mirror will not darken or return to normal view.

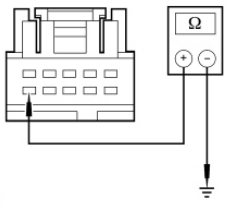
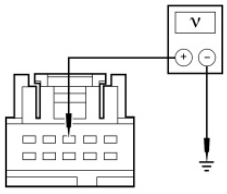
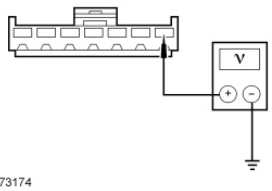
Test Step	Result / Action to Take
F1 CHECK THE OPERATION OF THE BACKUP LAMPS	
• Ignition ON. • Move the selector lever through the entire range. • **Do the backup lamps illuminate only in REVERSE?**	**Yes** GO to F2 . **No** REFER to Section 417-01 to diagnose the backup lamps.
F2 VERIFY THE FORWARD AND REARWARD FACING SENSORS ARE NOT BLOCKED	
• Visually verify the forward and rearward facing sensors are not blocked. Sources of blockage can include: ♦ stickers, window decals or tags. ♦ fold-down screens for TVs or DVD players. ♦ non-OEM window tinting. • **Were either of the sensors blocked?**	**Yes** If possible, REMOVE the blockage. TEST the system for normal operation. If it is not possible to remove the blockage, REVIEW the operation of the interior auto-dimming mirror with the customer. **No** GO to F3 .
F3 CHECK OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - DAYLIGHT CONDITIONS	
• Ignition ON. • Use a bright lamp to illuminate the forward facing sensor and the rearward facing sensor. The mirror should adjust to a high reflectance mode (mirror will be clear).	**Yes** GO to F4 . **No** INSTALL a new interior auto-dimming mirror. REFER to Interior Rear View Mirror in this section. TEST the system for normal operation.

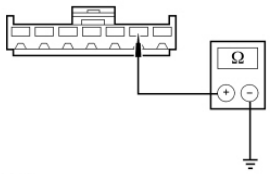
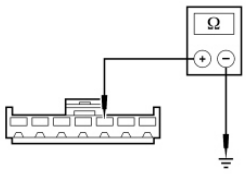
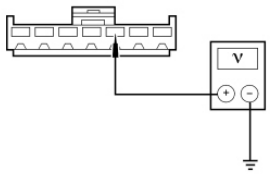
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 N0060436 • **Does the mirror adjust to the high reflectance (clear) mode?**	
F4 CHECK OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHTTIME CONDITIONS WITHOUT GLARE	
• Ignition ON. • **NOTE:** Covering the sensor with a finger or hand is not adequate. • Simulate nighttime conditions without glare: ♦ cover the forward sensor with black electrical tape or other dark material. ♦ cover the rearward facing sensor. The mirror should adjust to the high reflectance mode.  N0060438 • **Did the mirror adjust to the high reflectance (clear) mode?**	**Yes** GO to F5 . **No** GO to F7 .
F5 CHECK OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHTTIME CONDITIONS WITH GLARE	
• Ignition ON. • **NOTE:** Covering the sensor with a finger or hand is not adequate. • Simulate nighttime conditions with glare: ♦ cover the forward sensor with black electrical tape or other dark material. ♦ illuminate the rearward facing sensor. The mirror should darken to a lower reflectance mode.  N0060437	**Yes** GO to F6 . **No** GO to F7 .

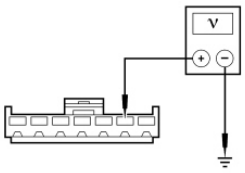
• **Did the mirror darken to a lower reflectance (darker) mode?**	
F6 CHECK OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHTTIME CONDITIONS WITH THE VEHICLE IN REVERSE	
• Ignition ON. • **NOTE:** Covering the sensor with a finger or hand is not adequate. • Simulate nighttime conditions with glare: ♦ cover the forward sensor with black electrical tape or other dark material. ♦ illuminate the rearward facing sensor.  N0060437 • Select REVERSE. • **Did the mirror adjust to a high reflectance (clear) mode?**	**Yes** The system is operating normally at this time. REVIEW operation of the interior auto-dimming mirror feature with the customer. **No** GO to F7 .
F7 CHECK THE INTERIOR MIRROR FOR A MICROPHONE	
• Check the interior mirror for a microphone. • **Is the interior mirror equipped with a microphone?**	**Yes** GO to F8 . **No** GO to F11 .
F8 CHECK CIRCUIT CBP05 (YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Interior Auto-Dimming Mirror C9012. • Ignition ON. • Measure the voltage between interior auto-dimming mirror C9012-1, circuit CBP05 (YE), harness side and ground.  N0066902 • **Is the voltage greater than 10 volts?**	**Yes** GO to F9 . **No** VERIFY that SJB fuse 5 (5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. TEST the system for normal operation.
F9 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	

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• Ignition OFF. • Measure the resistance between interior auto-dimming mirror C9012-10, circuit GD143 (BK/VT), harness side and ground.  N0066903 • **Is the resistance less than 5 ohms?**	**Yes** GO to F10 . **No** REPAIR the circuit. TEST the system for normal operation.
F10 CHECK CIRCUIT CBP15 (BN/BU) FOR VOLTAGE	
• Ignition ON. • Select REVERSE. • Measure the voltage between interior auto-dimming mirror C9012-3, circuit CBP15 (BN/BU), harness side and ground.  N0066904 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new interior auto-dimming mirror. REFER to Interior Rear View Mirror in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
F11 CHECK CIRCUIT CBP18 (GY/OG) (EARLY BUILD VEHICLES) OR CIRCUIT CPB05 (YE) (LATE BUILD VEHICLES) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Interior Auto-Dimming Mirror C911 . • Ignition ON. • Measure the voltage between ground and interior auto-dimming mirror C911-1, circuit CBP18 (GY/OG) (early build vehicles) or circuit CPB05 (YE) (late build vehicles), harness side.  A0073174 • **Is the voltage greater than 10 volts?**	**Yes** GO to F12 . **No** VERIFY SJB fuse 18 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. TEST the system for normal operation.

F12 CHECK CIRCUIT GD133 (BK) (EARLY BUILD VEHICLES) OR CIRCUIT GD143 (BK/VT) (LATE BUILD VEHICLES) FOR AN OPEN	
• Ignition OFF. • Early build vehicles, measure the resistance between interior auto-dimming mirror C911-2, circuit GD133 (BK), harness side and ground.  A0073175 • Late build vehicles, measure the resistance between interior auto-dimming mirror C911-3, circuit GD143 (BK/VT), harness side and ground.  N0077172 • **Is the resistance less than 5 ohms?**	**Yes** GO to F13 . **No** REPAIR the circuit. TEST the system for normal operation.
F13 CHECK CIRCUIT CBP15 (BN/BU) FOR VOLTAGE	
• Ignition ON. • Select REVERSE. • Early build vehicles, measure the voltage between interior auto-dimming mirror C911-3, circuit CBP15 (BN/BU), harness side and ground.  A0073178 • Late build vehicles, measure the voltage between interior auto-dimming mirror C911-2, circuit CBP15 (BN/BU), harness side and ground.	**Yes** INSTALL a new interior auto-dimming mirror. REFER to Interior Rear View Mirror in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

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 N0077173 • **Is the voltage greater than 10 volts?**	

Exterior Mirror Damper Spring Alignment

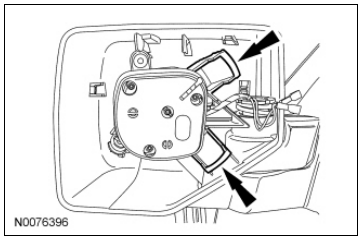
NOTE: The LH exterior mirror glass has 2 exterior mirror damper springs. The RH exterior mirror glass has 1 exterior mirror damper spring.

NOTE: LH exterior mirror shown, RH exterior mirror similar.

1. **NOTE:** The exterior mirror glass is removed for clarity.

   It is not necessary to remove the exterior mirror glass for this step.

   Position the exterior mirror glass to the full outboard position, so that the exterior mirror damper springs and the exterior mirror damper spring tracks are visible. To help locate the exterior mirror damper springs, refer to Exterior Mirrors - Exploded View in this section.

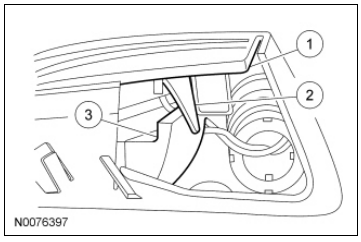


2. **NOTE:** An exterior mirror damper spring that is out of the exterior mirror damper spring track is shown.

   NOTE: It is not necessary to remove the exterior mirror glass for this step.

   Inspect between the exterior mirror housing and the exterior mirror glass backing plate to see if an exterior mirror damper spring is out of the exterior mirror damper spring track. Refer to the following:

   1. Exterior mirror glass
   2. Exterior mirror damper spring
   3. Exterior mirror damper spring track



3. **NOTE:** It is not necessary to remove the exterior mirror glass for this step.

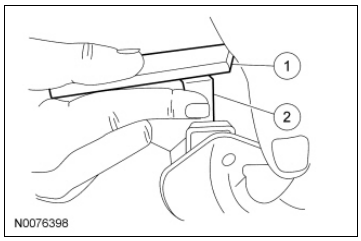
   For an exterior mirror damper spring that is not in the exterior mirror damper spring track perform the following:

   1. Gently lift the exterior mirror glass outward until the bottom tip of the exterior mirror damper spring is above the exterior mirror damper spring track.

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- If an exterior mirror damper spring or the exterior mirror glass is damaged, replace the exterior mirror glass. Refer to Exterior Mirror Glass in this section.

2. Position the exterior mirror damper spring into the exterior mirror damper spring track and release the exterior mirror glass.

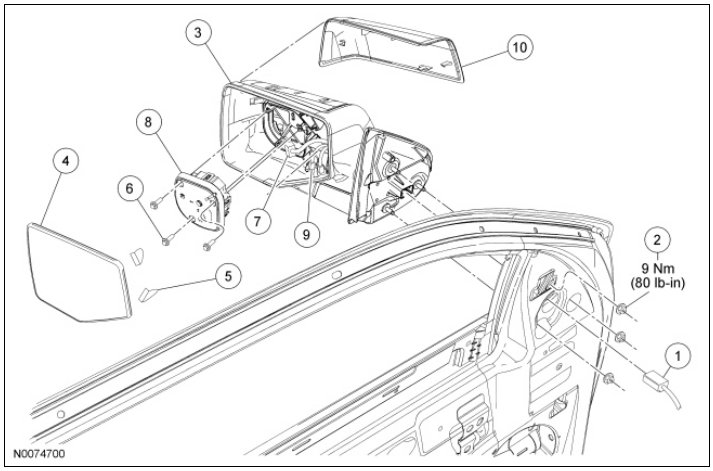


4. For exterior mirror damper springs that are in the exterior mirror glass dampener spring tracks, remove the exterior mirror glass, refer to Exterior Mirror Glass in this section.
   Check for a mechanical binding condition or damaged exterior mirror parts. Install new exterior mirror parts as needed. Refer to Exterior Mirrors - Exploded View in this section.

5. Operate the exterior mirror and check for correct operation.

Exterior Mirrors - Exploded View

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	-	Exterior mirror electrical connector (part of 14631)
2	N621905	Exterior mirror nut (3 required)
3	17683 LH/ 17682 RH	Exterior mirror assembly
4	17K707	Exterior mirror glass
5	-	Exterior mirror damper spring (part of 17K707)
6	-	Exterior mirror motor screw (part of 17D696)
7	-	Exterior mirror motor electrical connector
8	17D696	Exterior mirror motor
9	-	Exterior mirror glass electrical connector (if equipped)
10	17D742 RH/ 17D743 LH	Exterior mirror cover

1. For additional information, refer to the procedures in this section.

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Exterior Mirror

Removal and Installation

NOTE: Do not remove the exterior mirror when repairing an individual part. Individual components can be installed without removing the exterior mirror.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the exterior mirror weather shield.
3. Disconnect the exterior mirror electrical connector.
4. Remove the 3 exterior mirror nuts.
    - To install, tighten to 9 Nm (80 lb-in).
5. Remove the exterior mirror.
6. To install, reverse the removal procedure.

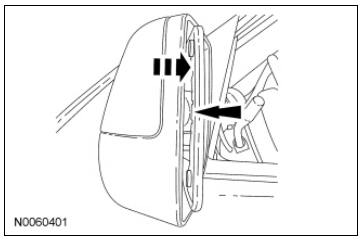
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Exterior Mirror Glass

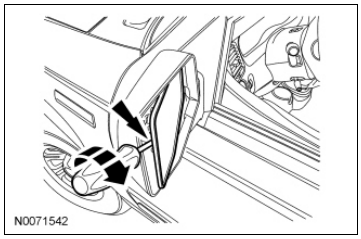
Removal

NOTE: LH shown, RH similar.

1. Position the exterior mirror glass to the full inboard position and locate the notch at the bottom of the exterior mirror glass.



2. Release the exterior mirror glass.
   - Insert a long flat-blade screwdriver into the notch.
   - Gently turn the screwdriver until the 2 outboard glass backing plate hooks are released from the exterior mirror motor.



3. Remove the exterior mirror glass.
   - Using your fingers, carefully release the 2 inboard glass backing plate hooks from the exterior mirror motor.
   - If equipped, disconnect the electrical connectors from the exterior mirror glass.

Installation

1. Position the exterior mirror motor to the center position.

2. If equipped, connect the electrical connectors to the exterior mirror glass.

3. Position the exterior mirror glass onto the exterior mirror motor.

4. ⚠ **WARNING: Place a shop towel between the hands and the exterior mirror glass for protection in case of glass breakage during mirror service. Failure to follow this instruction may result in serious personal injury.**

   NOTE: Make sure the exterior mirror damper springs are located inboard of the damper spring tracks. Failure to do this will restrict exterior mirror glass movement.

Place a hand against the back of the exterior mirror housing and a hand flat against the exterior mirror glass. Press the exterior mirror glass until it is fully seated.

5. Operate the exterior mirror and check for correct exterior mirror movement. If the exterior mirror glass movement is restricted, refer to Exterior Mirror Damper Spring Alignment in this section.

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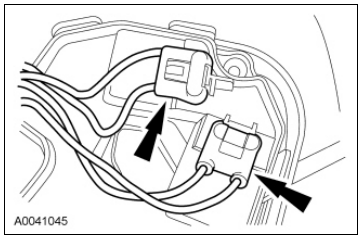
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Exterior Mirror Motor

Removal and Installation

NOTE: RH shown, LH similar.

1. Remove the exterior mirror glass. For additional information, refer to Exterior Mirror Glass in this section.
2. Remove the exterior mirror motor screws.
3. Disconnect the exterior mirror motor electrical connectors.



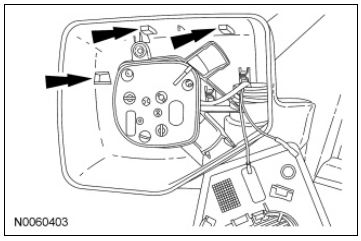
4. To install, reverse the removal procedure.

Exterior Mirror Cover

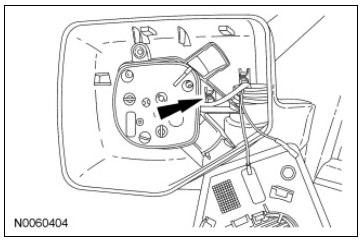
Removal and Installation

1. Remove the exterior mirror glass. For additional information, refer to Exterior Mirror Glass in this section.

2. Release the 3 exterior mirror cover upper retaining tabs by carefully pressing down until the tab is free.



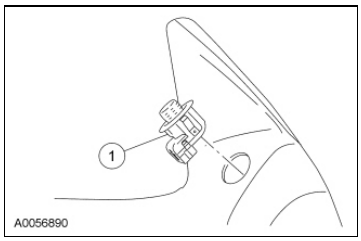
3. Release the exterior mirror cover lower inboard tag.



4. To install, reverse the removal procedure.
    - Rotate the exterior mirror glass in all directions after installation to make sure all clips are completely attached.

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Exterior Mirror Control Switch



Item	Part Number	Description
1	17B676	Exterior mirror control switch

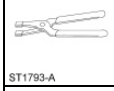
Removal and Installation

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Depress the 2 retaining tabs and remove the exterior mirror control switch from the front door trim panel.
3. To install, reverse the removal procedure.

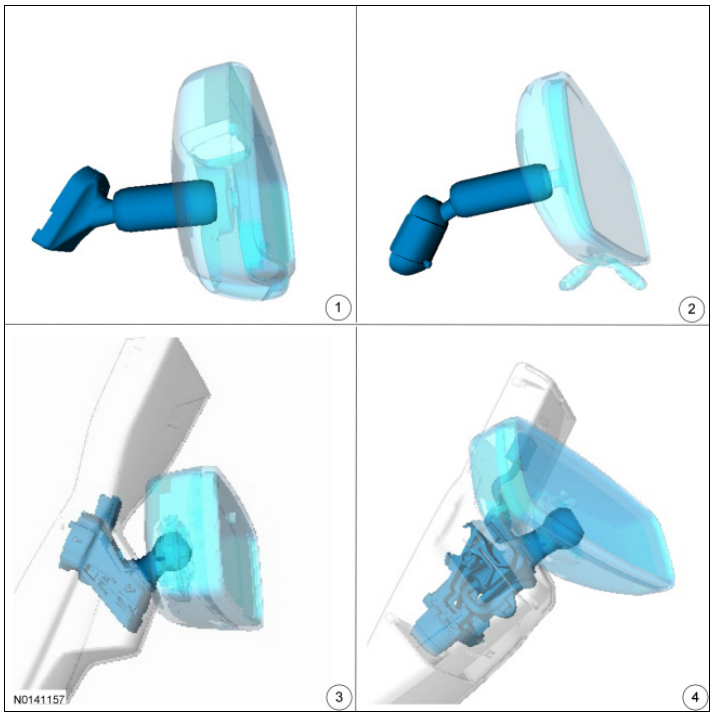
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Interior Rear View Mirror

Special Tool(s)

 ST1793-A	Installer, Rear View Mirror 501-025 (T94P-17700-AH)
 ST3250-A	Mirror Remover 501-D118A
 ST3311-A	Installer, Rear View Mirror 501-191
 ST3310-A	Mirror Remover 501-190

Mirror Identification



Item	Part Number	Description
1	-	Mirror type 1
2	-	Mirror type 2
3	-	Mirror type 3
4	-	Mirror type 4

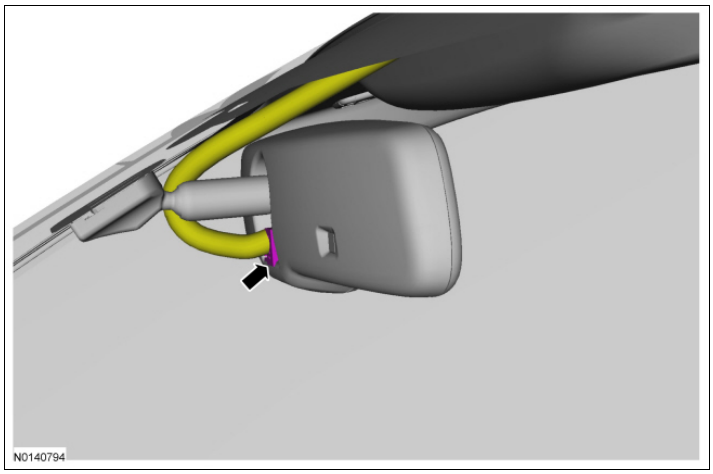
Removal

Mirror Type 1

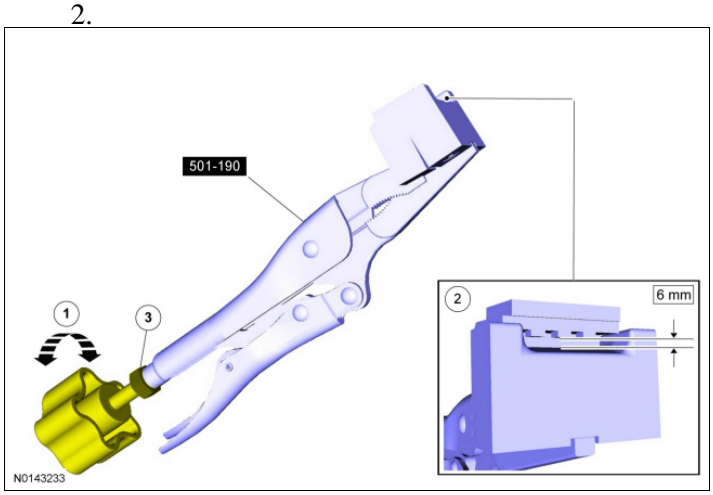
NOTICE: **The windshield must be at room temperature. Otherwise, damage to the windshield glass may occur.**

NOTE: Click here to view a video version of this procedure.

1. If equipped.

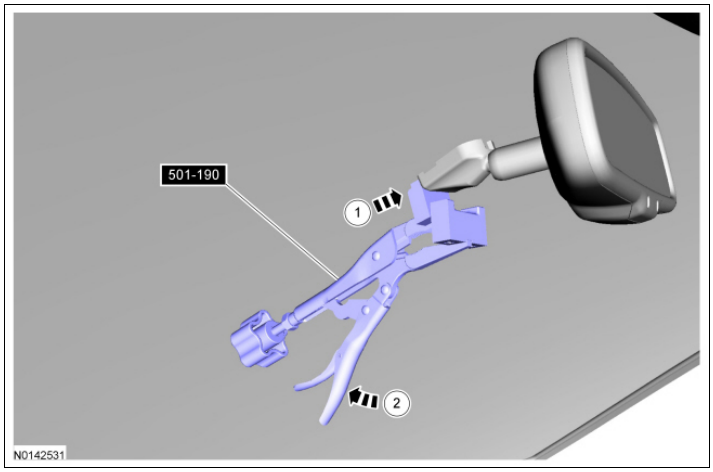


2.

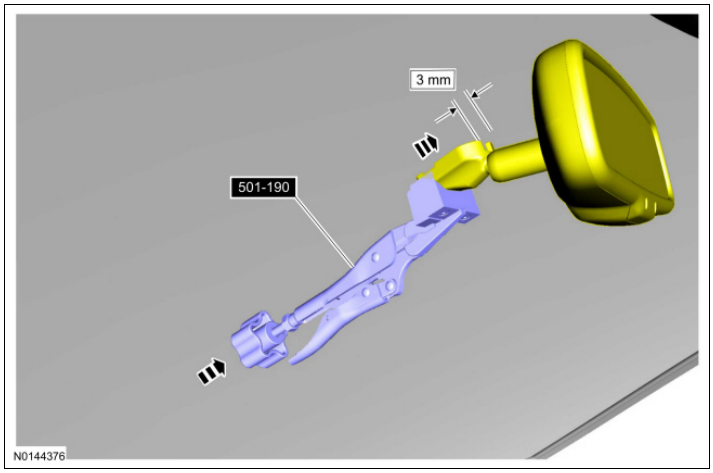


3. ***NOTICE:*** **Make sure the Mirror Remover is fully inserted into the interior rear view mirror mount access hole. Otherwise, damage to the windshield glass may occur.**

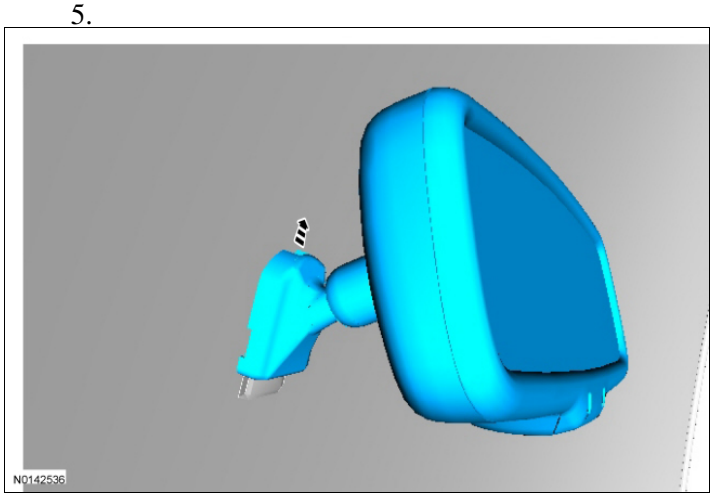
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4. Using a closed hand, bump the adjustment handle of the Mirror Remover to slide the mirror upward on the mirror mount.

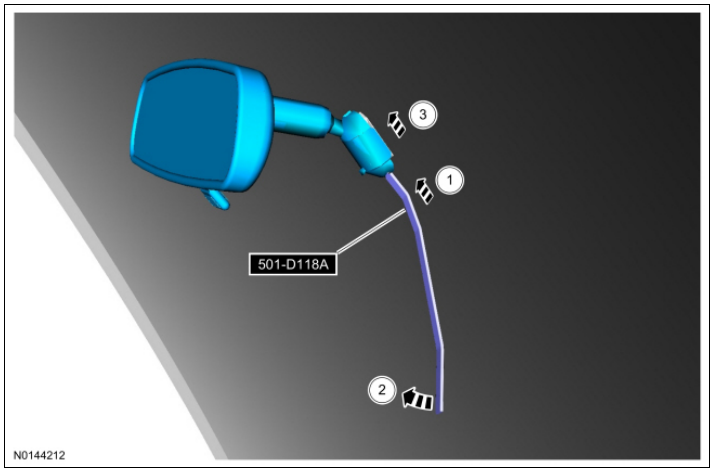


5.



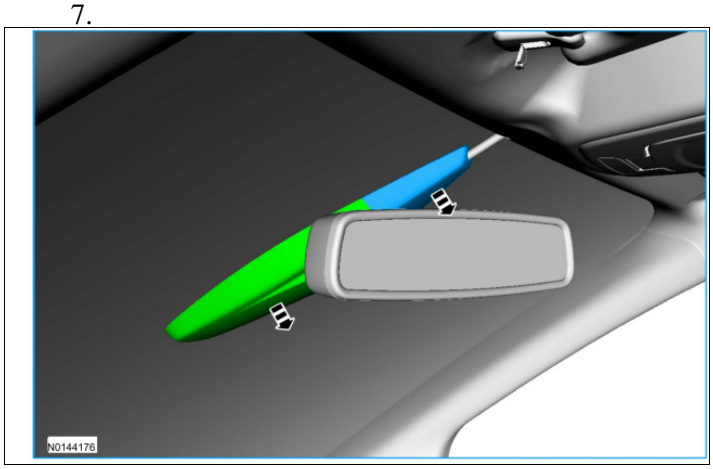
Mirror Type 2

6.

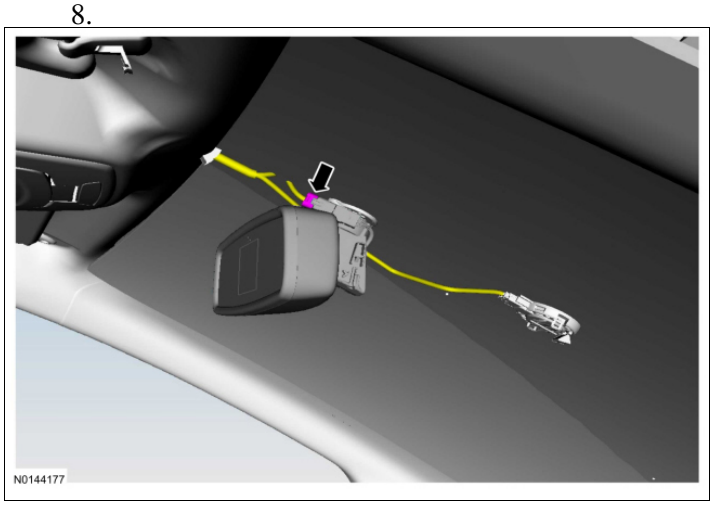


Mirror Type 3

7.

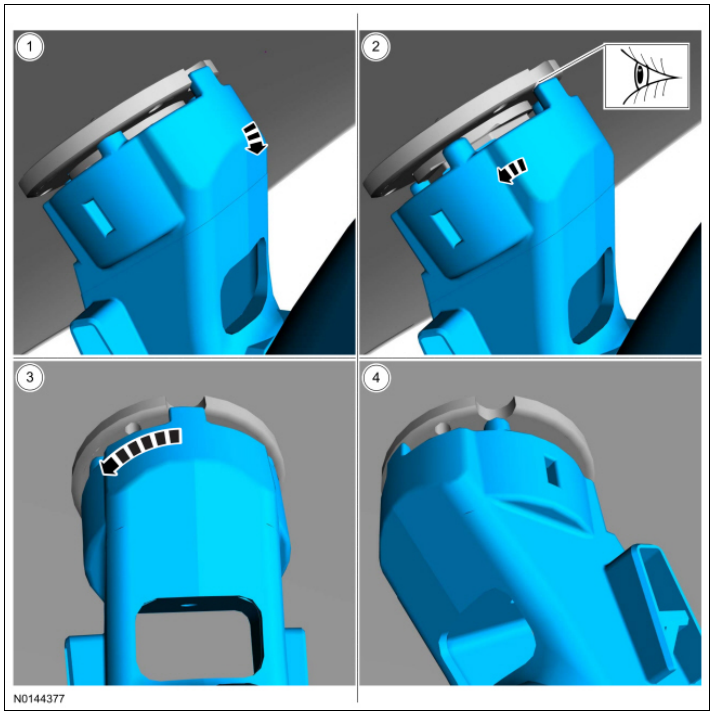


8.



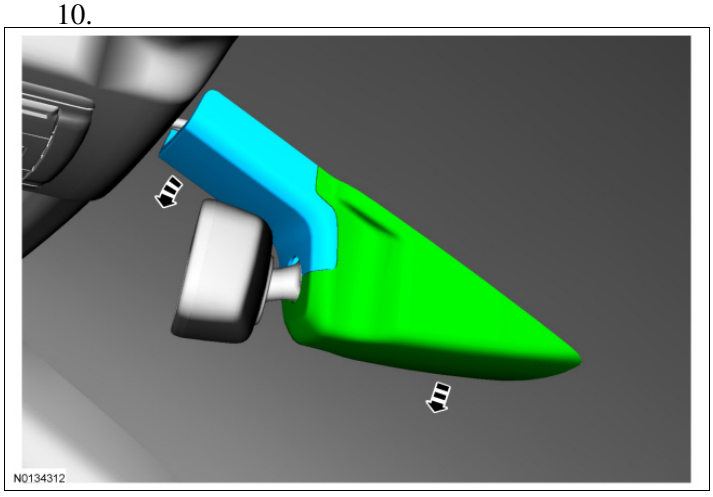
9.

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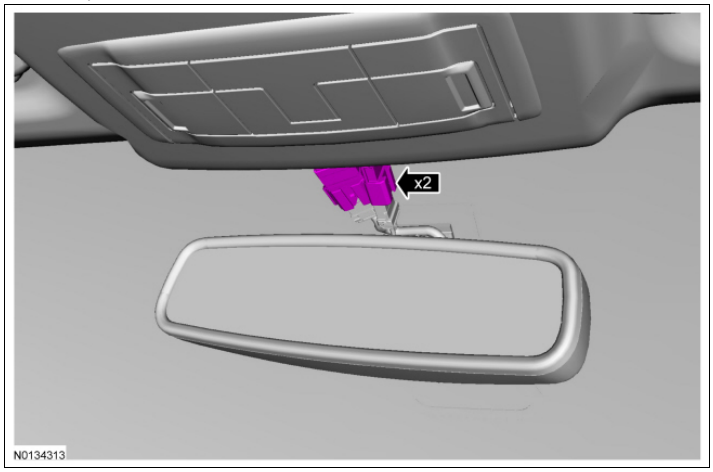


Mirror Type 4

10.

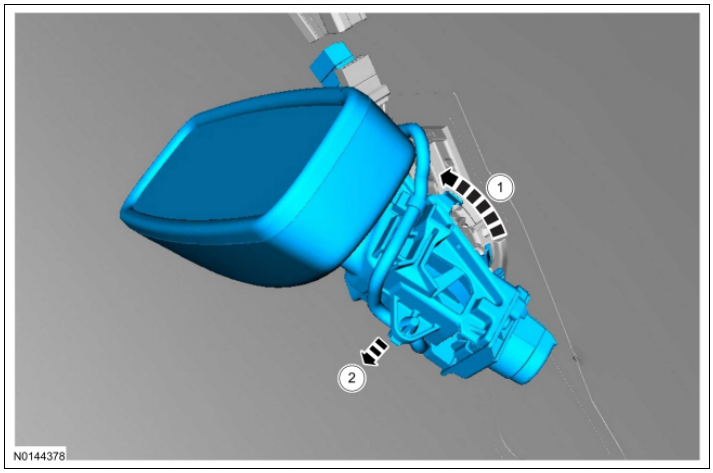


11.



12. ***NOTICE:*** **To prevent damage to the mirror or base, rotate the mirror base with hands only do not use tools.**

    NOTICE: **To prevent damage to the mirror wiring, do not rotate the mirror head beyond 180 degrees.**

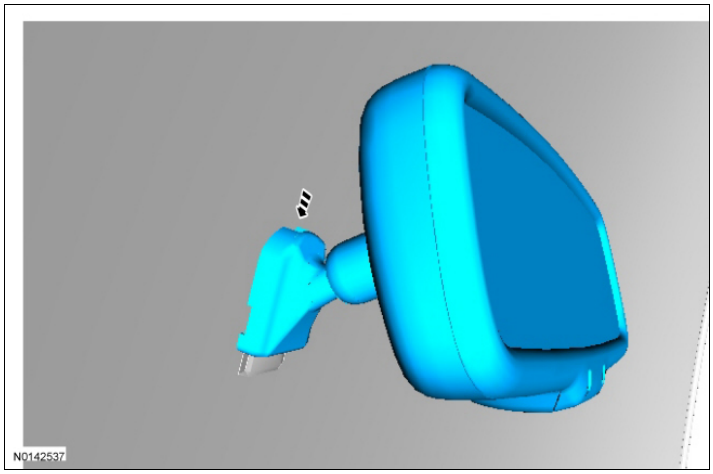


Installation

Mirror Type 1

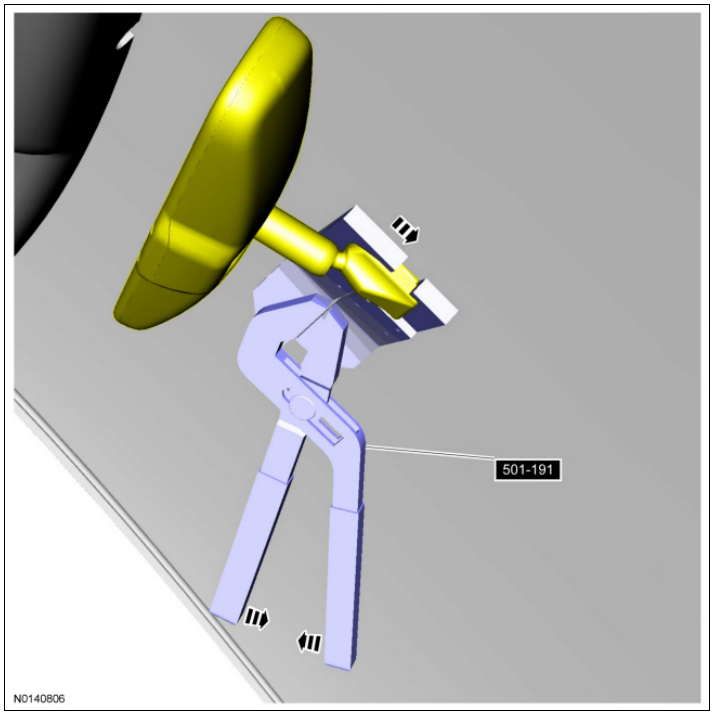
NOTE: Click here to view a video version of this procedure.

1. Slide the interior rear view mirror mount over the windshield bracket from the top.

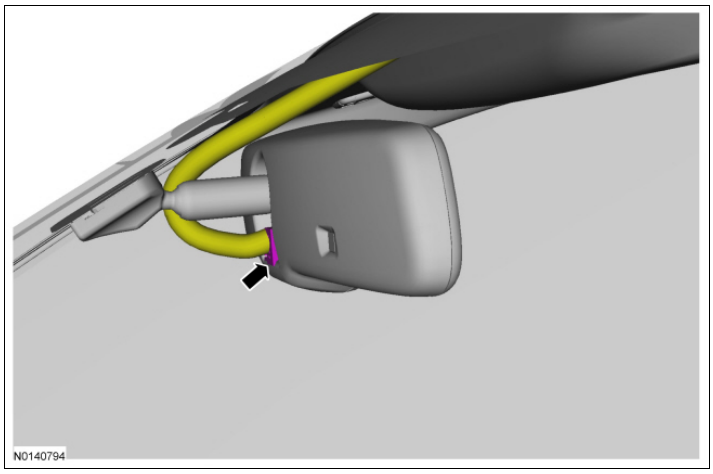


2. **NOTE:** An audible click will be heard as the mirror fully seats.

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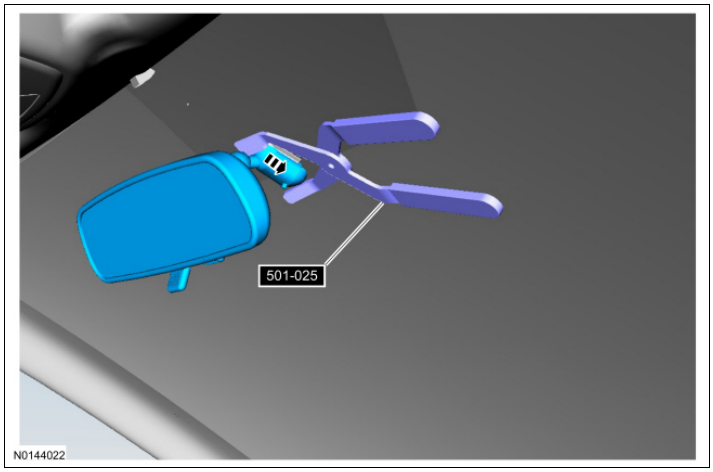
3. If equipped.



4. If equipped with compass module, check the compass zone and calibration. Refer to General Procedures in Section 413-01 or Section 419-11.

Mirror Type 2

5.



6. If equipped with a compass module which requires calibration, check the compass zone adjustment and calibration. Refer to General Procedures in Section 413-01 or Section 419-11.

Mirror Type 3

7. To install, reverse the removal procedure.

Mirror Type 4

8. To install, reverse the removal procedure.
   - If a new mirror has been installed, download the IPM-A configuration information from the scan tool to the new IPM-A .
   - If a new mirror has been installed, perform camera alignment using a scan tool.

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Material

Item	Specification	Fill Capacity
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

Torque Specifications

Description	Nm	lb-ft	lb-in
Front Seat			
Cushion frame-to-seat track nuts	36	27	-
Occupant Classification System Module (OCSM)-to-bracket screws	2	-	18
Recliner-to-cushion frame bolts	55	41	-
Safety belt buckle and pretensioner nuts	36	27	-
Safety belt retractor belt anchor bolt	40	30	-
Seat track horizontal screw block bolt	28	21	-
Seat track-to-floor bolts [a]	-	-	-
Seat track-to-Occupant Classification Sensor (OCS) rail bolts	25	18	-
Side air bag module bolts	10	-	89
Supplemental Restraint System (SRS) seat position sensor-to-seat track bolt	6	-	53
60/40 Bench - Second Row			
40 percent bench lower latch bolts	40	30	-
40 percent bench safety belt buckle bolt	55	41	-
40 percent bench seat-to-floor nuts and bolts [a]	-	-	-
40 percent bench upper latch bolts	40	30	-
40 percent bench upper pivot latch bolts	40	30	-
60 percent bench cable tether-to-floor bolt (Explorer/Mountaineer) [a]	-	-	-
60 percent bench cable tether-to-riser frame nut (Explorer/Mountaineer)	55	41	-
60 percent bench inboard latch-to-backrest frame bolts	40	30	-
60 percent bench inboard latch-to-riser frame front bolt	121	89	-
60 percent bench outboard latch-to-backrest frame bolts	40	30	-
60 percent bench outboard latch-to-riser frame bolts	40	30	-
60 percent bench safety belt anchor bolt	121	89	-
60 percent bench safety belt retractor bolt	75	55	-
60 percent bench seat-to-floor nuts and bolts [a]	-	-	-
60 percent bench upper latch-to-backrest frame bolts (Sport Trac)	25	18	-
60 percent bench upper pivot latch bolts	40	30	-
Floor studs (M10) [b]	30	22	-
Floor studs (M12) [b]	35	26	-
Seat latch striker bolts (Sport Trac)	30	22	-

60/40 E-Z Entry - Second Row			
40 percent E-Z entry cushion frame-to-kneeling mechanism bolts	45	33	-
40 percent E-Z entry cushion frame-to-latch feet assembly bolts	45	33	-
40 percent E-Z entry damper rod-to-kneeling mechanism bolt	8	-	71
40 percent E-Z entry inboard recliner and safety belt buckle-to-cushion frame bolt	55	41	-
40 percent E-Z entry inboard/outboard recliner-to-cushion frame bolts	55	41	-
40 percent E-Z entry kneeling mechanism-to-mounting plate nuts	41	30	-
40 percent E-Z entry mounting plate-to-floor nuts and bolts [a]	-	-	-
40 percent E-Z entry recliner-to-backrest frame bolts [a]	-	-	-
60 percent E-Z entry cushion frame-to-kneeling mechanism bolt	55	41	-
60 percent E-Z entry cushion frame-to-latch foot assembly bolt	40	30	-
60 percent E-Z entry inboard recliner-to-kneeling mechanism bolt	55	41	-
60 percent E-Z entry inboard recliner-to-latch foot assembly bolt	55	41	-
60 percent E-Z entry inboard/outboard recliner-to-backrest frame bolts [a]	-	-	-
60 percent E-Z entry inboard/outboard recliner-to-cushion frame bolts	55	41	-
60 percent E-Z entry kneeling mechanism-to-mounting plate nuts	41	30	-
60 percent E-Z entry mounting plate-to-floor nuts and bolts [a]	-	-	-
60 percent E-Z entry safety belt anchor bolt	55	41	-
60 percent E-Z entry safety belt buckle assembly bolts	40	30	-
60 percent E-Z entry safety belt retractor bolt	75	55	-
E-Z entry floor stud (M10) [b]	30	22	-
Bucket - Second Row			
Bucket floor stud [b]	30	22	-
Bucket front spring hinge bolts	23	17	-
Bucket lower latch bolts	40	30	-
Bucket outboard lower latch nuts	40	30	-
Bucket safety belt buckle bolt	47	35	-
Bucket seat-to-floor nuts and bolts [a]	-	-	-
Bucket upper latch bolts	23	17	-
Third Row			
Cushion pivot link assembly-to-cushion frame nuts	22	16	-
Cushion pivot link assembly-to-floor mounting bracket nuts	22	16	-
Floor mounting bracket center front/rear nut	40	30	-
Floor mounting bracket center stud (M10) [b]	30	22	-
Floor mounting bracket front bolt	40	30	-
Floor mounting bracket LH/RH bolts	20	-	177
Floor mounting bracket LH/RH nut	20	-	177
Floor mounting bracket LH/RH studs (M8) [b]	15	-	133
Head restraint-to-backrest frame bolts	25	18	-
Hinge-to-backrest frame bolts	25	18	-
Hinge-to-cushion frame bolt	25	18	-
Latch-to-backrest frame bolts	25	18	-
Latch-to-cushion frame bolt	25	18	-
Latch-to-floor mounting bracket nuts	22	16	-

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Safety belt buckle assembly-to-latch nut	75	55	-

[a] Refer to procedure in this section.
[b] Apply threadlock before installing.

Seats

Front Seats

The front seats can be equipped with the following serviceable items and systems:

- Manual seat tracks
- 6-way power seat tracks
- Heated seats
- Memory driver seat with easy entry/easy exit (if feature enabled) (Explorer/Mountaineer only)
- Manual lumbar
- Manual recline
- Power lumbar (driver seat only)
- Power recline (driver seat only)
- Seat side air bags
- Occupant Classification Sensor (OCS) system on passenger seat

Memory Seats

The power driver seat and power adjustable pedals are controlled by the Driver Seat Module (DSM) only when the vehicle is equipped with the programmable/recall memory option. This system allows automatic positioning of the driver power bucket seat, exterior power mirrors and adjustable pedals to 2 programmable positions. Memory positions can be stored at any time. A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the selector lever out of PARK or NEUTRAL. For information on programming memory positions or recalling a stored memory position, refer to Memory Position Programming in this section. For information on Remote Keyless Entry (RKE) transmitter programming, refer to Section 501-14 .

The DSM is located underneath the driver seat cushion. For information on installing a new DSM , refer to Section 419-10 . Programmable Module Installation (PMI) must be carried out when installing a new DSM . Refer to Section 418-01 .

This section only diagnoses concerns specific to the memory seat. To diagnose a memory adjustable pedal concern, refer to Section 206-00 .

Easy Entry/Easy Exit

The easy entry/easy exit feature can be enabled/disabled using a scan tool. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to Driver Controls in the Owner's Literature or Section 413-01 for information on the message center.

Heated Seats

This system allows the electrical heating of the front seats on passenger demand.

The serviceable components of the system are:

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- the seat heating elements, located in the seat cushion and backrest.
- the heated seat control switch, located in the lower center of the instrument panel.

Manual Lumbar

The manual lumbar is adjusted by a knob mounted on the side of the seat cushion side shield.

Power Lumbar

The driver seat has an electro-mechanical lumbar adjuster. The lumbar adjustment switch is on the side of the seat cushion side shield and is part of the seat control switch.

Manual Recline

The manual recline can be adjusted by a handle mounted on the outboard side of the cushion side shield.

Power Recline

The driver seat has an electro-mechanical backrest adjuster. The backrest adjustment switch is located on the side of the seat cushion side shield and is part of the seat control switch.

Seat Side Air Bags

The driver and passenger seat side air bags are attached to the seat backrest frame. If a seat side air bag deployment has occurred or for more information, refer to Section 501-20B .

Occupant Classification Sensor (OCS) System

The OCS system is standard equipment on all front passenger seats. For information on diagnosing or servicing the OCS system, refer to Section 501-20B .

Second Row Seating

60/40 E-Z Entry Seat

The 60/40 E-Z entry seat can be equipped on Explorer and Mountaineer vehicles with third row seating.

The seat is equipped with the following serviceable items and systems:

- Backrest recline and forward fold down
- Front legs kneel for a level load floor
- Pivot forward to the E-Z entry position
- 60 percent seat integrated safety belt retractor
- Folding head restraints

60/40 Bench Seat

The 60/40 bench seat can be equipped on Explorer and Mountaineer vehicles with 5 passenger seating and on all Explorer Sport Tracs.

The seat is equipped with the following serviceable systems:

- Backrest forward fold down for a level load floor

- 60 percent seat integrated safety belt retractor

Bucket seats

The bucket seats can be equipped on Explorer and Mountaineer vehicles with third row seating.

The seat is equipped with the following serviceable systems:

- Backrest recline and forward fold down
- Pivot forward to the E-Z entry position

Third Row Seating

NOTE: The Smart Junction Box (SJB) may also be identified as the Generic Electronic Module (GEM).

Explorer and Mountaineer vehicles can be equipped with a 50/50 third row seat.

The seat can be equipped with the following serviceable items and systems:

- Manual forward folding backrest
- Power forward folding backrest
- Power fold seat control switches in the LH quarter trim panel
- Folding head restraints

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Seats

Special Tool(s)

 ST2574-A	Flex Probe Kit 105-R025C or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

Driver and Passenger Power Seats Without Memory

The 10-way power seat feature (driver seat only) moves the seat in 10 possible directions: the seat can be moved forward or backward and the front and back of the cushion can be moved up and down independently. The backrest of the seat can be moved forward and backward, and the lumbar in and out. All 10 positions are controlled by one switch. The power seat feature operates independent of the position of the ignition.

The 6-way power seat feature moves the seat in 6 possible directions: the seat can be moved forward or backward and the front and back of the cushion can be moved up and down independently. The power seat feature operates independent of the position of the ignition.

The power seat motors are hardwired to the seat control switch. The circuits are normally at ground through the seat control switch. An individual circuit is switched to voltage when a specific adjustment position is selected.

Power Driver Seat With Memory

NOTE: A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL gear and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the gearshift lever out of PARK or NEUTRAL.

The driver power memory seat is controlled by the Driver Seat Module (DSM). The memory seat feature allows the driver to program a personalized seat position that can be recalled using the memory switch or a Remote Keyless Entry (RKE) transmitter. There are 2 memory settings possible. The adjustable pedal (if equipped) positions are also stored and recalled with the driver memory seat positions.

The driver seat control switch provides voltage to the DSM when activated. The NEUTRAL position of each driver seat control switch position is a ground state through the seat control switch contacts. A voltage input causes the DSM to power the appropriate motor until the input is removed. Ground is the normal state of the motor circuits through the DSM and is not switched to control the motors. The DSM internally switches the appropriate circuit from ground to voltage for operating the motors.

As the seat is adjusted, the DSM constantly monitors the motor position sensors to record the current seat position. The DSM will remove voltage from the motor upon termination of the seat control switch input or if the DSM does not see movement from the motor by monitoring the position sensor.

The DSM communicates DTC and other information using the Medium Speed Controller Area Network (MS-CAN) communication bus. It should be noted for diagnostics that because Controller Area Network (CAN) bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to Section 418-00 for information concerning MS-CAN bus communication.

Easy Entry/Easy Exit

The easy entry/easy exit feature moves the driver seat backwards about 50.8 mm (2 in) when the ignition key is removed from the ignition switch. The DSM receives a key out command over the MS-CAN communication network and powers the driver seat rearward. This function will not operate if the seat is less than the 50.8 mm (2 in) travel distance to the end of the track or the function has been disabled. The DSM will also cancel this operation if a valid input command is received from the driver seat control switch, memory SET switch or exterior mirror control switch.

The DSM will record the current driver seat positions before powering the seat for an easy exit operation. This recorded position will be used to return the driver seat to this position on the easy entry operation. During easy entry operation, the seat is returned to the position previous to the easy exit operation.

The easy entry/easy exit feature can be enabled/disabled using a scan tool. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's Literature or Section 413-01 for information on the message center.

Heated Seats

The driver and passenger heated seats share a common ignition and battery feed to the heated seat control switch assembly. The ignition feed supplies voltage to the logic board and illumination of the heated seat switch assembly and the battery feed is used to provide voltage to the heater mats. The heated seat switch assembly uses a shared ground for the logic board and illumination.

When a heated seat switch is pressed with the ignition switch in RUN or START, a momentary ground is provided to the logic board of the heated seat switch assembly. The logic board then activates an internal relay in the heated seat switch assembly that provides voltage to a bi-metallic thermostat that is part of the seat cushion heater mat.

The driver seat cushion and backrest heater mats are wired in series as are the passenger seat cushion and backrest heater mats. The heated seat system is designed to maintain the temperature by the opening (no voltage to the heated seat mats) and closing (voltage supplied to the heated seat mats) of the bi-metallic thermostat.

The heated seat will remain ON until the heated seat switch is pressed or until ignition voltage is removed from the heated seat switch assembly.

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Normal heat cycle may require several minutes to initially warm the seat. The seat should be occupied to correctly test for normal operation. Temperature measuring devices do not provide an accurate method for testing heated seat operation as surface temperatures are subject to human and environmental characteristics. Correct testing requires heater mat resistance measurements which have tight tolerances affecting the length of time for the heater mats to reach maximum operating temperature.

Second Row 60/40 E-Z Entry Seats

The 7-passenger second row E-Z entry seat backrest will:

- recline to 5 different positions.
  - To recline either the 60 percent or the 40 percent backrest, while sitting in the seat, turn the recliner handle and push back to the desired position. With the backrest adjusted, release the recliner handle and the backrest will stay where positioned. To return the backrest, turn the recliner handle and allow the backrest to come forward with the spring load of the recliners.
- fold down.
  - **NOTE:** Make sure that the head restraint is in the down position and no objects such as books, purses or briefcases are on the floor in front of the second row seats before folding the backrest down.

    NOTE: The backrest cannot be returned to the upright (vertical) position until the kneeling mechanism is returned to the standing (upright) position and the latch feet assembly is latched to the mounting plate strikers.

    To fold down either the 60 percent or the 40 percent seat backrest, lower the head restraint by pulling on the release strap. Turn the recliner handle or pull the third row occupant release strap and fold the backrest forward and down until it lays flat. To return the seat backrest to the upright (vertical) position, lift and pivot the top of the backrest toward the rear of the vehicle, rotating the backrest until you hear a click, locking it in the upright (vertical) position. Make sure the seat backrest is locked in position.

The 7-passenger, second row E-Z entry seats can be positioned in 2 functional positions. The E-Z entry seat will:

- kneel to create a level cargo area (load floor) after the backrest has been folded down.
  - **NOTE:** To kneel the seat, the backrest must be folded forward and all the way down. Remove anything between the backrest and cushion that may prevent the backrest from folding all the way down.

    The front legs of the seat will pivot forward and lower (kneel) the seat creating a level load floor with the rear cargo area of the vehicle. Fold the backrest forward and all the way down. Lift the kneeling mechanism release handle in the back of the backrest and moderately push the seat forward and down into the kneel position. To stand the seat back up from the load floor position, lift up with moderate force at the front of the seat cushion frame, pivot the seat up and toward the rear of the vehicle until the kneeling mechanism is locked in place. Make sure the kneeling mechanism is locked in position by pushing the seat forward and down. Lift and pivot the top of the backrest toward the rear of the vehicle, rotating the backrest until you hear a click, locking it in the upright (vertical) position. Make sure the seat backrest is locked in position.
- fold up out of the way (E-Z entry position), after the backrest has been folded down, to allow access to the third row seats through the second row doors.
  - **NOTE:** To release the latch feet from the mounting plate strikers and position the seat to the E-Z entry position, the backrest must be folded forward and all the way down. Remove

anything between the backrest and cushion that may prevent the backrest from folding all the way down.

NOTE: The recliner handle or third row occupant release strap must be released once the backrest is folded down then actuated a second time to release the seat from the mounting plate strikers.

Fold the backrest forward and down. Once the backrest is positioned down, release the recliner handle or third row occupant release strap. Turn the recliner handle or pull the third row occupant release strap a second time until the seat releases from the mounting plate strikers. Lift up on the rear of the seat, pivoting it forward, away from the third row seats and up to the E-Z entry position. To return the seat, push the rear of the seat down with moderate force to latch the seat to the mounting plate strikers. Make sure the seat is latched to the mounting plate strikers by lifting up on the rear of the seat. Lift and pivot the top of the backrest toward the rear of the vehicle, rotating the backrest until you hear a click, locking it in the upright (vertical) position. Make sure the seat backrest is locked in position.

Third Row Power-Fold Seat

NOTICE: **To prevent possible damage to the third row seat or the safety belts, make sure that the safety belts are not fastened when moving the seat to the load floor position.**

NOTICE: **Make sure that no objects such as books, purses or briefcases are on the floor in front of the third row seats or on the seat cushion before lowering the backrest(s) or the seat may not fold all the way down.**

NOTE: The Smart Junction Box (SJB) may also be identified as the Generic Electronic Module (GEM).

For the third row power-fold seat to operate, a shared ground is supplied by the SJB to both of the power-fold seat relays, enabling the seats to then be moved by pressing one of the third row power-fold seat control switches. The third row power-fold seat operates only when the vehicle is in PARK and the liftgate glass or liftgate door are open.

The third row power-fold seat relays will be provided ground on the coil side from the SJB for 30 minutes when the transmission selector is in PARK, and the liftgate, or liftgate glass is open. The ground will be disabled 30 minutes after turning the vehicle OFF. If the ground is disabled after 30 minutes, the ground can be enabled by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

The third row power-fold seat motors transfer movement to a drive screw and bracket assembly to raise and lower the seat backrest and cushion.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

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Mechanical	Electrical
• Switch(es) • Seat tracks obstructed or damaged • Power lumbar assembly damaged • Power recline assembly damaged	• Driver power seat fuse: ♦ Battery Junction Box (BJB) fuse 14 (40A) • Passenger power seat fuse: ♦ BJB fuse 10 (30A) • Driver Seat Module (DSM) fuses (vehicles with memory seats only): ♦ BJB fuse 14 (30A) ♦ Smart Junction Box (SJB) fuse 1 (20A) • Third row power-fold seat fuses: ♦ BJB fuse 5 (30A) (left) ♦ BJB fuse 12 (30A) (right) • Heated seat fuses: ♦ BJB fuse 28 (20A) ♦ SJB fuse 18 (10A) • Wiring harness • Loose or corroded connections • Seat control switch(es) • Power seat motor(s) • Memory SET switch • DSM • Heated seat control switch(es) • Seat cushion heater • Seat back heater • Lumbar control switch • Power lumbar motor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern is with the power seat (non-memory seat) or heated seat and the cause is not visually evident, verify the symptom and GO to Symptom Chart .

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the concern is with the memory seat or the third row power-fold seat and the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

6. **NOTE:** The Vehicle Communication Module (VCM) indicator prove out confirms voltage and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

8. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

9. Clear the CMDTCs and carry out the self-test diagnostics for the DSM or SJB .

10. If the DTCs retrieved are related to the concern, go to Driver Seat Module (DSM) DTC Chart or Smart Junction Box (SJB) DTC Chart. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Driver Seat Module (DSM) DTC Chart

DTC	Description	Retrieved	Action
B1317	Continuous	Battery Voltage High	GO to Pinpoint Test V .
B1318	Continuous	Battery Voltage Low	GO to Pinpoint Test V .
B1342	ECU is Faulted	On-Demand and Continuous	INSTALL a new Driver Seat Module (DSM) and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test.
B1530	Memory SET Switch Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B1534	Memory 1 Switch Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B1538	Memory 2 Switch Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B1663	Seat Driver Front Up/Down Motor Stalled	On-Demand	If the motor does not operate, GO to Pinpoint Test I . If motor operates, GO to Pinpoint Test J .
B1664	Seat Driver Rear Up/Down Motor Stalled	On-Demand	If the motor does not operate, GO to Pinpoint Test I . If motor operates, GO to Pinpoint Test J .
B1665	Seat Driver Forward/Backward Motor Stalled	On-Demand	If the motor does not operate, GO to Pinpoint Test I . If motor operates, GO to Pinpoint Test J .
B1666	Seat Driver Recline Motor Stalled	On-Demand	If the motor does not operate, GO to Pinpoint Test I . If motor operates, GO to Pinpoint Test J .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .

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B1711	Seat Driver Front Up Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1719	Seat Driver Forward Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test I .
B1952	Seat Rear Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test J .
B1953	Seat Rear Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test J .
B1957	Seat Front Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test J .
B1961	Seat Recline Forward/Backward Position Feedback Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	On-Demand and Continuous	GO to Pinpoint Test J .
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B2084	Memory Set Indicator Short to Ground	On-Demand and Continuous	GO to Pinpoint Test J .
B2143	Non Volatile Memory Failure (EEPROM)	Continuous	REPEAT the self-test. CLEAR the DTCs. If the DTC resets, INSTALL a new DSM and CARRY OUT

			Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test.
B2477	Module Configuration Failure	Continuous	**NOTE:** This DTC indicates PMI has not been done to a newly installed module or configuration data has been lost. Presence of this DTC alone does not prevent basic seat operation from the seat control switch. CARRY OUT Programmable Module Installation (PMI) on the DSM . REFER to Section 418-01 . REPEAT the self-test. If PMI is successful, the DTC will not be present. If DTC reappears, INSTALL a new DSM . REFER to Section 419-10 .
U1900	Controller Area Network (CAN) Communication Bus Fault - Receive Error	On-Demand and Continuous	**NOTE:** Do not install a new DSM as part of repair for a DSM DTC U1900 fault. The DSM is not the source of the fault when DTC U1900 is present. CLEAR the DTC. REPEAT the self-test. If the DTC is retrieved again, REFER to Section 418-00 to diagnose the Medium Speed Controller Area Network (MS-CAN) concern.
U2050	No Application Present	Continuous	INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test.
All Other DTCs	-	-	REFER to the Master DTC Chart in Section 419-10 .

Smart Junction Box (SJB) DTC Chart

NOTE: The Smart Junction Box (SJB) may also be identified as the Generic Electronic Module (GEM).

DTC	Description	Source	Action
B2794	Third Row Power Fold Circuit Failure	On-Demand and Continuous	GO to Pinpoint Test S .
All Other DTCs	-	-	REFER to the Master DTC Chart in Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

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NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. Refer to Inspection and Verification in this section.

NOTE: During testing, wire colors may change as they pass through connectors.

Refer to Inspection and Verification, the Driver Seat Module (DSM) DTC Chart, Smart Junction Box (SJB) DTC Chart and the Symptom Chart for direction to the appropriate pinpoint test.

Pinpoint Test A: The Power Seat is Inoperative - Driver Seat With Power Recliner

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is supplied battery voltage on circuit SBB14 (BN/RD) and ground on circuit GD133 (BK). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest to the desired position. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

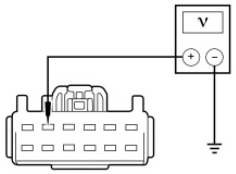
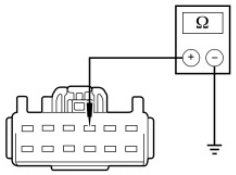
- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST A: THE POWER SEAT IS INOPERATIVE - DRIVER SEAT WITH POWER RECLINER

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
A1 CHECK CIRCUIT SBB14 (BN/RD) FOR VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Control Switch C352. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected.**	**Yes** GO to A2 . **No** VERIFY Battery Junction Box (BJB) fuse 14 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation. DISCONNECT the battery ground cable.

Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment. • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat control switch C352-5, circuit SBB14 (BN/RD), harness side and ground.  N0010816 • **Is the voltage greater than 10 volts?**	CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
A2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between driver seat control switch C352-3, circuit GD133 (BK), harness side and ground.  N0010815 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test B: The Power Seat is Inoperative - Driver Seat Without Power Recliner

PINPOINT TEST A: THE POWER SEAT IS INOPERATIVE - DRIVER SEAT WITH POWER RECLINER

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Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is supplied battery voltage on circuit SBB14 (BN/RD) and ground on circuit GD133 (BK). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

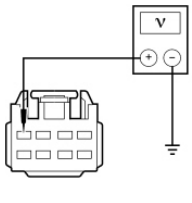
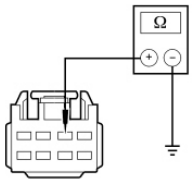
- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST B: THE POWER SEAT IS INOPERATIVE - DRIVER SEAT WITHOUT POWER RECLINER

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
B1 CHECK CIRCUIT SBB14 (BN/RD) FOR VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Control Switch C3016. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat control switch C3016-4, circuit SBB14 (BN/RD), harness side and ground.	**Yes** GO to B2 . **No** VERIFY Battery Junction Box (BJB) fuse 14 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

 N0010817 • **Is the voltage greater than 10 volts?**	
B2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between driver seat control switch C3016-2, circuit GD133 (BK), harness side and ground.  N0010818 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test C: The Power Seat is Inoperative - Passenger Seat

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is supplied battery voltage on circuit SBB10 (YE/RD) and ground on circuit GD151 (BK/GN). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an

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entire power seat track.

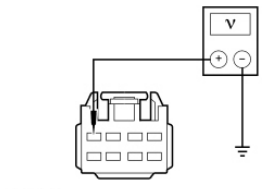
This pinpoint test is intended to diagnose the following:

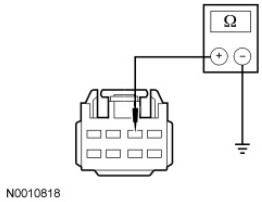
- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST C: THE POWER SEAT IS INOPERATIVE - PASSENGER SEAT

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
C1 CHECK CIRCUIT SBB10 (YE/RD) FOR VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Safety Belt Buckle Pretensioner C3202. • Disconnect: Passenger Seat Side Air Bag C3050. • Disconnect: Passenger Seat Control Switch C355. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between passenger seat control switch C355-4, circuit SBB10 (YE/RD), harness side and ground.  N0010817 • **Is the voltage greater than 10 volts?**	**Yes** GO to C2 . **No** VERIFY Battery Junction Box (BJB) fuse 10 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle and pretensioner C3202. CONNECT passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
C2 CHECK CIRCUIT GD151 (BK/GN) FOR AN OPEN	

• Measure the resistance between passenger seat control switch C355-2, circuit GD151 (BK/GN), harness side and ground.  N0010818 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle and pretensioner C3202. CONNECT passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle and pretensioner C3202. CONNECT passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test D: The Power Seat Moves But is Loose

Normal Operation

The power seat movement should be smooth and the seat cushion should not rock during or after operation.

This pinpoint test is intended to diagnose the following:
- Loose fastening hardware
- Seat track component

PINPOINT TEST D: THE POWER SEAT MOVES BUT IS LOOSE

Test Step	Result / Action to Take
D1 CHECK THE FASTENING HARDWARE	
• Inspect for loose fastening hardware on the affected seat. • **Is the fastening hardware loose?**	**Yes** TIGHTEN all fastening hardware to specification. TEST the system for normal operation.

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	No IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test E: The Power Seat Moves But is Noisy

Normal Operation

The power seat should move quietly during operation. Some noise is acceptable.

This pinpoint test is intended to diagnose the following:

- Misaligned seat track
- Seat track component
- Object obstructing seat movement

PINPOINT TEST E: THE POWER SEAT MOVES BUT IS NOISY

Test Step	Result / Action to Take
E1 CHECK SEAT TRACK ALIGNMENT	
• Check the alignment of the track to the floor and the track to the seat. • **Is the track out of alignment?**	**Yes** ALIGN the track to the seat and the floor. TEST the system for normal operation. **No** IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test F: The Power Seat Does Not Make Full Travel

Normal Operation

The power seat should travel fully horizontal (forward/rearward) and vertical (front up/down and rear up/down).

This pinpoint test is intended to diagnose the following:

- An obstruction
- Seat track components

PINPOINT TEST F: THE POWER SEAT DOES NOT MAKE FULL TRAVEL

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take

F1 CHECK FOR AN OBSTRUCTION IN THE SEAT TRACK	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Remove the affected seat. Refer to Seat - Front in this section. • **Are there any obstructions in the track?**	**Yes** REMOVE the obstruction(s) and GREASE the track(s). REPOWER the SRS . REFER to Section 501-20B . TEST the system for normal operation. **No** IDENTIFY the cause and REPAIR as necessary. REPOWER the SRS . REFER to Section 501-20B . TEST the system for normal operation.

Pinpoint Test G: The Power Seat Does Not Operate Correctly - Driver Seat With Power Recline

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is supplied battery voltage on circuit SBB14 (BN/RD) and ground on circuit GD133 (BK). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recliner motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recliner motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recliner mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track motor (seat track)
- Power recliner mechanism

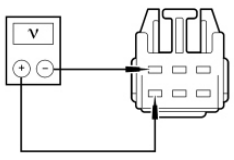
PINPOINT TEST G: THE POWER SEAT DOES NOT OPERATE CORRECTLY - DRIVER SEAT WITH POWER RECLINE

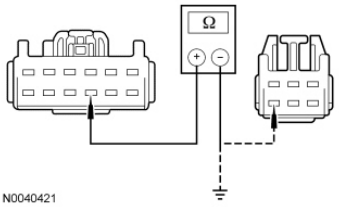
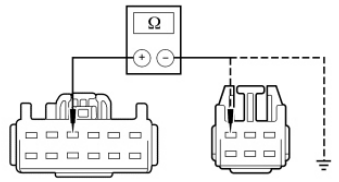
NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take

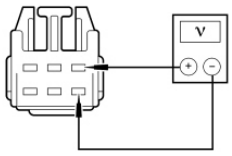
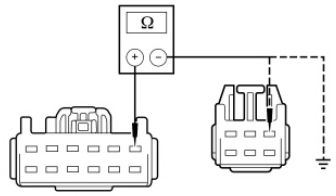
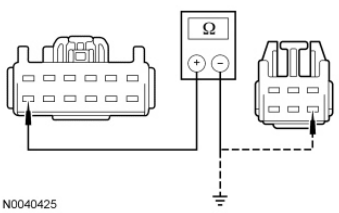
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G1 CHECK THE HORIZONTAL DIRECTION MOTOR FOR CORRECT OPERATION	
• Operate the driver power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to G2 . **No** GO to G3 .
G2 CHECK THE RECLINER MOTOR FOR CORRECT OPERATION	
• Recline the driver backrest forward and rearward. • **Will the seat backrest recline forward and rearward?**	**Yes** GO to G6 . **No** GO to G13 .
G3 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat motor C353-6, circuit CPS28 (GN), harness side and C353-3, circuit CPS23 (GN/VT), harness side, while pushing the driver seat control switch forward and rearward.  N0040420 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to G4 .
G4 CHECK CIRCUIT CPS28 (GN) FOR AN OPEN AND SHORT TO GROUND	

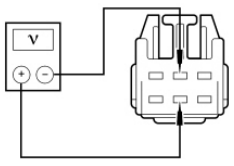
• Disconnect: Driver Seat Control Switch C352. • Measure the resistance between: ♦ driver seat control switch C352-9, circuit CPS28 (GN), harness side and driver seat motor C353-6, circuit CPS28 (GN), harness side. ♦ driver seat control switch C352-9, circuit CPS28 (GN), harness side and ground.  • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** GO to G5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
G5 CHECK CIRCUIT CPS23 (GN/VT) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ driver seat control switch C352-4, circuit CPS23 (GN/VT), harness side and driver seat motor C353-3, circuit CPS23 (GN/VT), harness side. ♦ driver seat control switch C352-4, circuit CPS23 (GN/VT), harness side and ground.  • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049.

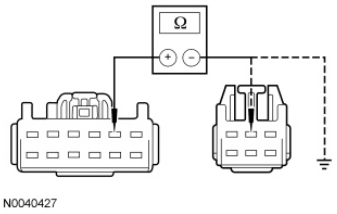
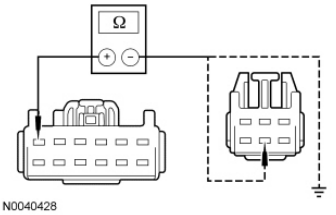
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	REPOWER the SRS . REFER to Section 501-20B .
G6 DETERMINE THE SEAT HEIGHT ADJUST FAILURE	
• Operate the seat front and rear height adjustments. • **Does the seat front and rear height adjust up and down?**	**Yes** If only the front height adjust motor operates, GO to G7 . If only the rear height adjust motor operates, GO to G10 . **No** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
G7 CHECK THE VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat motor C353-1, circuit CPS27 (BU/BN), harness side and C353-4, circuit CPS26 (YE/BU), harness side, while depressing the rear tilt switch up and down.	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to G8 .

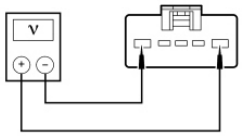
 N0040423 • **Is the voltage greater than -10 volts when the rear tilt switch is pressed down, greater than +10 volts when the rear tilt switch is pressed up and 0 volt when the switch is in the rest position?**	
G8 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Driver Seat Control Switch C352. • Measure the resistance between: ♦ driver seat control switch C352-1, circuit CPS27 (BU/BN), harness side and driver seat motor C353-1, circuit CPS27 (BU/BN), harness side. ♦ driver seat control switch C352-1, circuit CPS27 (BU/BN), harness side and ground.  N0040424 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** GO to G9 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
G9 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ driver seat control switch C352-12, circuit CPS26 (YE/BU), harness side and driver seat rear motor C353-4, circuit CPS26 (YE/BU), harness side. ♦ driver seat control switch C352-12, circuit CPS26 (YE/BU), harness side and ground.  N0040425 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

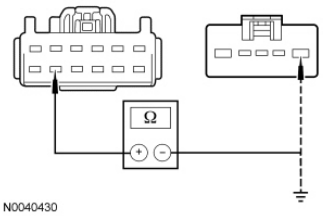
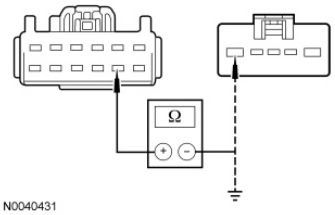
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and ground?	**No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
G10 CHECK VOLTAGE TO DRIVER SEAT FRONT HEIGHT MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat motor C353-2, circuit CPS25 (WH/VT), harness side and C353-5, circuit CPS24 (GY), while pushing the front tilting switch up and down.  N0040426 • **Is the voltage greater than +10 volts when the front tilt switch is pressed down, greater than -10 volts when the front tilt switch is pressed up and 0 volt when the switch is in the rest position?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to G11 .
G11 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN AND SHORT TO GROUND	

• Disconnect: Driver Seat Control Switch C369. • Measure the resistance between: ♦ driver seat control switch C352-2, circuit CPS25 (WH/VT), harness side and driver seat motor C353-2, circuit CPS25 (WH/VT), harness side. ♦ driver seat control switch C352-2, circuit CPS25 (WH/VT), harness side and ground.  N0040427 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** GO to G12 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
G12 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ driver seat control switch C352-6, circuit CPS24 (GY), harness side, and driver seat motor C353-5, circuit CPS24 (GY), harness side. ♦ driver seat control switch C352-6, circuit CPS24 (GY), harness side and ground.  N0040428 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049.

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	REPOWER the SRS . REFER to Section 501-20B .
G13 CHECK VOLTAGE TO THE DRIVER SEAT RECLINER MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Recliner Motor C3187. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat recliner motor C3187-1, circuit CPS29 (WH/BN), harness side and C3187-5, circuit CPS30 (VT/BN), while pushing the recline switch forward and rearward.  N0040429 • **Is the voltage greater than +10 volts when the switch is pushed forward, greater than -10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new driver seat recliner motor. REFER to Seat Recliner Motor in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to G14 .
G14 CHECK CIRCUIT CPS29 (WH/BN) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Driver Seat Control Switch C352. • Measure the resistance between: ♦ driver seat control switch C352-11, circuit CPS29 (WH/BN), harness side and driver seat recliner motor C3187-1, circuit CPS29 (WH/BN), harness side. ♦ driver seat control switch C352-11, circuit CPS29 (WH/BN), harness side and ground.	**Yes** GO to G15 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049.

 N0040430 • **Is the resistance less than 5 ohms between the driver seat recliner motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	REPOWER the SRS . REFER to Section 501-20B .
G15 CHECK CIRCUIT CPS30 (VT/BN) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ driver seat control switch C352-8, circuit CPS30 (VT/BN), harness side, and driver seat recliner motor C3187-5, circuit CPS30 (VT/BN), harness side. ♦ driver seat control switch C352-8, circuit CPS30 (VT/BN), harness side and ground.  N0040431 • **Is the resistance less than 5 ohms between the driver seat recliner motor and the driver seat control switch; and greater than 10,000 ohms between the seat control switch and ground?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test H: The Power Seat Does Not Operate Correctly - Driver Seat Without Power Recline

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

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Normal Operation

The driver seat control switch is supplied battery voltage on circuit SBB14 (BN/RD) and ground on circuit GD133 (BK). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

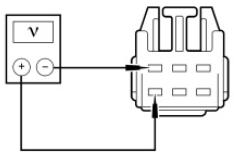
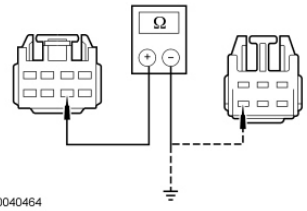
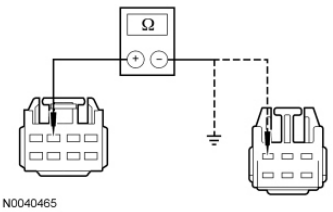
- Wiring, terminals or connectors
- Seat control switch
- Seat track motor (seat track)

PINPOINT TEST H: THE POWER SEAT DOES NOT OPERATE CORRECTLY - DRIVER SEAT WITHOUT POWER RECLINE

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

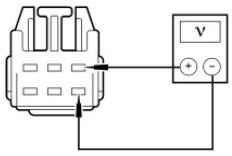
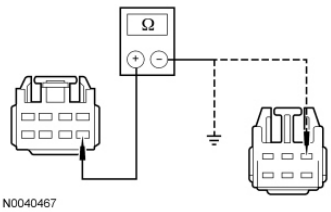
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
H1 CHECK HORIZONTAL DIRECTION MOTOR FOR CORRECT OPERATION	
• Operate the driver power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to H5 . **No** GO to H2 .
H2 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat motor C353-6, circuit CPS28 (GN), harness side and C353-3, circuit CPS23 (GN/VT), harness side, while pushing the driver seat control switch forward and rearward.	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No**

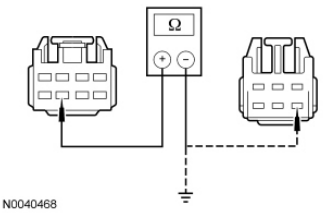
 N0040420 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	GO to H3 .
H3 CHECK CIRCUIT CPS28 (GN) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between: ♦ driver seat control switch C3016-6, circuit CPS28 (GN), harness side and driver seat motor C353-6, circuit CPS28 (GN), harness side. ♦ driver seat control switch C3016-6, circuit CPS28 (GN), harness side and ground.  N0040464 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** GO to H4 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
H4 CHECK CIRCUIT CPS23 (GN/VT) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ driver seat control switch C3016-3, circuit CPS23 (GN/VT), harness side and driver seat motor C353-3, circuit CPS23 (GN/VT), harness side. ♦ driver seat control switch C3016-3, circuit CPS23 (GN/VT), harness side and ground.  N0040465	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049.

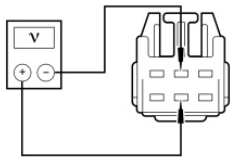
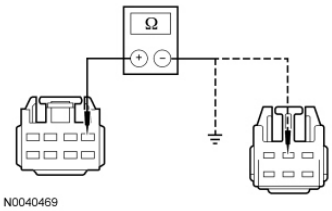
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• **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
H5 DETERMINE THE SEAT HEIGHT ADJUST FAILURE	
• Operate the seat front and rear height adjustments. • **Does the seat front and rear height adjust up and down?**	**Yes** If only the front height adjust motor operates, GO to H6 . If only the rear height adjust motor operates, GO to H9 . **No** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
H6 CHECK VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201.	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery

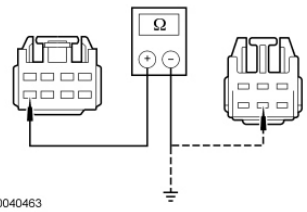
• Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Motor C353. • **⚠ WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat motor C353-1, circuit CPS27 (BU/BN), harness side and C353-4, circuit CPS26 (YE/BU), harness side, while depressing the rear tilt switch up and down.  N0040466 • **Is the voltage greater than -10 volts when the rear tilt switch is pressed down, greater than +10 volts when the rear tilt switch is pressed up and 0 volt when the switch is in the rest position?**	ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to H7 .
H7 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between: ♦ driver seat control switch C3016-5, circuit CPS27 (BU/BN), harness side and driver seat motor C353-1, circuit CPS27 (BU/BN), harness side. ♦ driver seat control switch C3016-5, circuit CPS27 (BU/BN), harness side and ground.  N0040467 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** GO to H8 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
H8 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN AND SHORT TO GROUND	

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• Measure the resistance between: ♦ driver seat control switch C3016-7, circuit CPS26 (YE/BU), harness side and driver seat motor C353-4, circuit CPS26 (YE/BU), harness side. ♦ driver seat control switch C3016-7, circuit CPS26 (YE/BU), harness side and ground.  • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
H9 CHECK VOLTAGE TO THE DRIVER SEAT FRONT HEIGHT MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between driver seat motor C353-2, circuit CPS25 (WH/VT), harness side and C353-5, circuit CPS24 (GY), while pushing the rear tilting switch up and	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

down.  N0040426 • **Is the voltage greater than +10 volts when the front tilt switch is pressed down, greater than -10 volts when the front tilt switch is pressed up and 0 volt when the switch is in the rest position?**	**No** GO to H10 .
H10 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Driver Seat Control Switch C3016. • Measure the resistance between: ♦ driver seat control switch C3016-1, circuit CPS25 (WH/VT), harness side and driver seat motor C353-2, circuit CPS25 (WH/VT), harness side. ♦ driver seat control switch C3016-1, circuit CPS25 (WH/VT), harness side and ground.  N0040469 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	**Yes** GO to H11 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
H11 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ driver seat control switch C3016-8, circuit CPS24 (GY), harness side, and driver seat motor C353-5, circuit CPS24 (GY), harness side. ♦ driver seat control switch C3016-8, circuit CPS24 (GY), harness side and ground.	**Yes** INSTALL a new driver seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air

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 • **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**	bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test I: The Memory Seat is Inoperative/Does Not Operate Correctly - Does Not Operate Horizontally/Vertically/Recline

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 149 , Component Testing for component testing.

Normal Operation

The driver seat control switch is supplied battery voltage on circuit SBP01 (RD) and ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable Driver Seat Module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner mechanism uses a single motor to move the seat backrest forward and rearward.

Battery voltage is also supplied to DSM on circuits SBP01 (RD) and SBB14 (BN/RD). Ground is supplied to the DSM on circuits GD133 (BK) and GD143 (BK/VT).

Each motor, in the memory power seat track and power recliner mechanism contains a Hall-effect position sensor. The DSM supplies a signal feed circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. Refer to Principles of Operation in this section or the Owner's Literature for information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate in one or more directions when using the seat control switch. If the memory seat moves in all directions using the seat control switch, GO to

Pinpoint Test J .

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During the self-test, the DSM attempts to operate the appropriate seat track motor and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1666 - Seat Driver Recline Motor Stalled	During the self-test, the DSM attempts to operate the recliner motor and uses the recliner motor position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no motor movement is still monitored after 250 milliseconds, the DSM disables the output.
• B1703 - Seat Driver Recline Forward Switch Circuit Short to Battery • B1707 - Seat Driver Recline Rearward Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1711 - Seat Driver Front Up Switch Circuit Short to Battery • B1715 - Seat Driver Front Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1719 - Seat Driver Forward Switch Circuit Short to Battery • B1723 - Seat Driver Rearward Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
	If voltage is sensed on the switch input circuit during the DSM self-test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes

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• B1727 - Seat Driver Rear Up Switch Circuit Short to Battery • B1731 - Seat Driver Rear Down Switch Circuit Short to Battery	the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch
- Missing status information (Controller Area Network (CAN) communication bus message):
  - ♦ ignition switch status
  - ♦ gear selector position
- Power seat track
- Power recliner motor
- DSM

PINPOINT TEST I: THE MEMORY SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE HORIZONTALLY/VERTICALLY/RECLINE

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

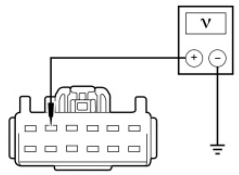
NOTE: Verify the PID(s) states agree with the ignition switch and transmission gear selector in all positions before proceeding with memory seat diagnosis.

Test Step	Result / Action to Take
I1 CHECK DSM TRANSMISSION GEAR SELECTED (TRANSGEAR) PID STATES	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: TRANSGEAR (PRNDL). • Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states: ♦ Drive1 ♦ Drive2 ♦ Drive3 ♦ D6_PRK ♦ NTRL ♦ REV ♦ D6_PRK	**Yes** GO to I2 . **No** To diagnose a transmission gear selector (PRNDL) status concern, REFER to Section 307-01A or Section 307-01B .

• **Do the PID states agree with the selected positions?**	
I2 CHECK THE IGNITION SWITCH STATUS (IGN_SW) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: IGN_SW. • Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states: ♦ Off ♦ Accessory ♦ Run ♦ Start • **Do the PID states agree with the selected positions?**	**Yes** GO to I3 . **No** To diagnose an ignition switch status concern, REFER to Section 211-05 .
I3 RETRIEVE THE DTCs	
• Using the switches, attempt to operate the memory seat and adjustable memory pedals in all directions through the full range of travel. • **NOTE:** During the self-test, each memory motor will be requested to move for one second. If a motor is near the end of travel, that position sensor feedback will not change as expected for one second resulting in a false DTC. • Place the memory seat and adjustable memory pedals in central travel positions. • Enter the following diagnostic mode on the scan tool: Self Test - DSM . • **Are any DSM DTCs retrieved?**	**Yes** If DTCs B1663, B1664, B1665 and B1666 are all retrieved, GO to I12 . If DTC B1663, GO to I22 . If DTC B1664, GO to I25 . If DTC B1665, GO to I28 . If DTC B1666, GO to I31 . If DTC B1703, GO to I5 . If DTC B1707, GO to I5 . If DTC B1711, GO to I5 . If DTC B1715, GO to I5 . If DTC B1719, GO to I5 . If DTC B1723, GO to I5 . If DTC B1727, GO to I5 . If DTC B1731, GO to I5 . If DTC B1342, INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. For any other DSM DTCs, REFER to the Driver Seat Module (DSM) DTC Chart.

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	No GO to I4 .
I4 MONITOR THE DSM PIDs AND CHECK FOR CORRECT MEMORY SEAT SWITCH INPUTS	
• Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PIDs. ♦ Driver Power Seat Front Up/Down Switch (SFNT_SW) ♦ Driver Power Seat Forward/Backward Switch (SFWD_SW) ♦ Driver Power Seat Recline Switch Status (SRCL_SW) ♦ Driver Power Seat Rear Up/Down Switch (SREARSW) • Operate the seat control switch in all positions while monitoring the DSM driver seat switch input status PIDs. • **Do the PID values agree with the switch positions?**	**Yes** GO to I11 . **No** VERIFY Smart Junction Box (SJB) fuse 1 (20A) is OK. If SJB fuse 1 (20A) fails while operating the seat control switch, DISCONNECT seat control switch C352 and GO to I9 . If SJB fuse 1 (20A) is OK, GO to I5 .
I5 CHECK THE SEAT CONTROL SWITCH	
• Ignition OFF. • Remove the seat control switch. Refer to Seat Control Switch in this section. • Check the seat control switch. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the seat control switch OK?**	**Yes** GO to I6 . **No** INSTALL a new seat control switch. REFER to Seat Control Switch in this section. REPEAT the self-test. CLEAR the DTCs.
I6 CHECK CIRCUIT SBP01 (RD) FOR VOLTAGE TO THE SEAT CONTROL SWITCH	
• Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between seat control switch C352-5, circuit SBP01 (RD), harness side and ground.	**Yes** GO to I7 . **No** VERIFY SJB fuse 1 (20A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

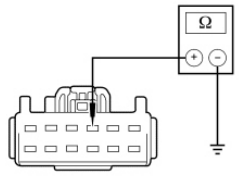


N0010816

- **Is the voltage greater than 10 volts?**

I7 CHECK CIRCUIT GD133 (BK) FOR AN OPEN

- Measure the resistance between seat control switch C352-3, circuit GD133 (BK), harness side and ground.



N0010815

- **Is the resistance less than 5 ohms?**

Yes
GO to I8 .

No
REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

I8 CHECK SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DSM C341b.
- Ignition ON.
- Measure for voltage between the following seat control switch C352 pins, harness side and ground.

Connector	Circuit
C352-9	CPS28 (GN)
C352-4	CPS23 (GN/VT)
C352-2	CPS25 (WH/VT)
C352-6	CPS24 (GY)
C352-11	CPS29 (WH/BN)
C352-8	CPS30 (VT/BN)
C352-12	CPS26 (YE/BU)
C352-1	CPS27 (BU/BN)

Yes
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

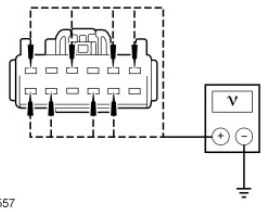
CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

No
GO to I9 .

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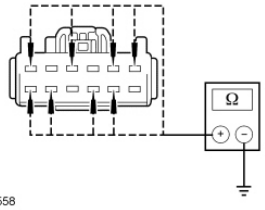


- **Is voltage present on any circuits?**

I9 CHECK SEAT CONTROL SWITCH TO DSM CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the following seat control switch C352 pins, harness side and ground.

Connector	Circuit
C352-9	CPS28 (GN)
C352-4	CPS23 (GN/VT)
C352-2	CPS25 (WH/VT)
C352-6	CPS24 (GY)
C352-11	CPS29 (WH/BN)
C352-8	CPS30 (VT/BN)
C352-12	CPS26 (YE/BU)
C352-1	CPS27 (BU/BN)



- **Are the resistances greater than 10,000 ohms?**

Yes
GO to I10 .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

I10 CHECK SEAT CONTROL SWITCH TO DSM CIRCUITS FOR AN OPEN

- Measure the resistance between the following seat control switch C352 pins, harness side and DSM C341b pins, harness side.

Seat Control Switch Connector	Circuit	DSM Connector
C352-9	CPS28 (GN)	C341b-15

Yes
INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt

C352-4	CPS23 (GN/VT)	C341b-3
C352-2	CPS25 (WH/VT)	C341b-14
C352-6	CPS24 (GY)	C341b-2
C352-11	CPS29 (WH/BN)	C341b-17
C352-8	CPS30 (VT/BN)	C341b-5
C352-12	CPS26 (YE/BU)	C341b-4
C352-1	CPS27 (BU/BN)	C341b-16

- **Are the resistances less than 5 ohms?**

buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

I11 CHECK THE DSM FOR CORRECT OUTPUTS USING A SCAN TOOL AND DSM ACTIVE COMMANDS

- Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PIDs.
  - ♦ Front Motor Up (FRONT_UP)
  - ♦ Front Motor Down (FRONT_DWN)
  - ♦ Rear Motor Up (REAR_UP)
  - ♦ Rear Motor Down (REAR_DWN)
  - ♦ Horizontal Motor Forward (HORZ_FWD)
  - ♦ Horizontal Motor Backward (HORZ_BWD)
  - ♦ Recline Motor Forward (RECL_FWD)
  - ♦ Recline Motor Backward (RECL_BWD)
- Toggle the DSM active commands ON and OFF while monitoring the seat movement.
- **Does the driver seat operate correctly using the active commands?**

Yes
INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

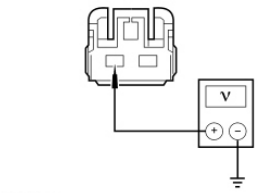
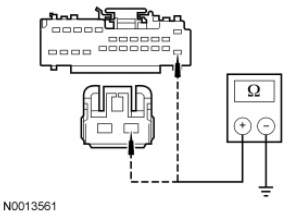
REPOWER the SRS . REFER to Section 501-20B .

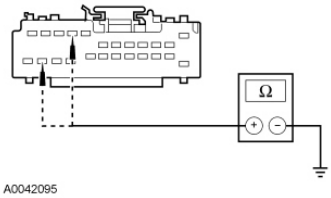
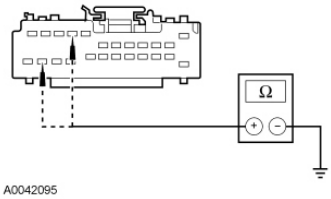
No
If no seat movement, GO to I12 .

If no front vertical seat movement, GO to I22 .

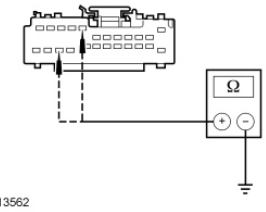
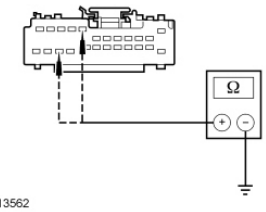
If no rear vertical seat

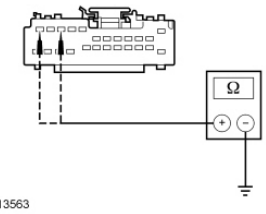
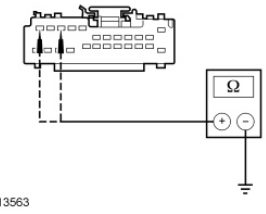
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	movement, GO to I25 . If no horizontal seat movement, GO to I28 . If no recline seat movement, GO to I31 .
I12 CHECK DSM CIRCUIT SBB14 (BN/RD) FOR VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: DSM C341a. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between DSM C341a-2, circuit SBB14 (BN/RD), harness side and ground.  N0013560 • **Is the voltage greater than 10 volts?**	**Yes** GO to I13 . **No** VERIFY Battery Junction Box (BJB) fuse 14 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I13 CHECK CIRCUITS GD133 (BK) AND GD143 (BK/VT) FOR AN OPEN	
• Disconnect: DSM C341c. • Measure the resistance between: ♦ DSM C341a-1, circuit GD133 (BK), harness side and ground. ♦ DSM C341c-13, circuit GD143 (BK/VT), harness side and ground.  N0013561	**Yes** GO to I14 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049.

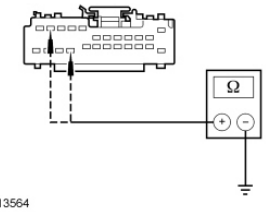
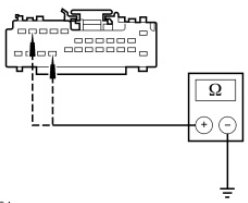
• **Is the resistance less than 5 ohms?**	REPOWER the SRS . REFER to Section 501-20B .
I14 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND	
• Disconnect: DSM C341b. • Measure the resistance between: ♦ DSM C341b-9, circuit CPS03 (VT/GY), harness side and ground. ♦ DSM C341b-23, circuit CPS02 (GY/YE), harness side and ground.  A0042095 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to I16 . **No** GO to I15 .
I15 CHECK FRONT HEIGHT POWER SEAT MOTOR CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO GROUND	
• Disconnect: Power Seat Motor C353. • Measure the resistance between: ♦ DSM C341b-9, circuit CPS03 (VT/GY), harness side and ground. ♦ DSM C341b-23, circuit CPS02 (GY/YE), harness side and ground.  A0042095 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201.

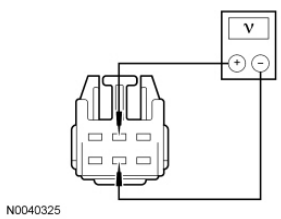
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	CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I16 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND	
• Measure the resistance between: ♦ DSM C341b-8, circuit CPS05 (BU/WH), harness side and ground. ♦ DSM C341b-22, circuit CPS04 (YE/OG), harness side and ground.  N0013562 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to I18 . **No** GO to I17 .
I17 CHECK THE REAR HEIGHT POWER SEAT MOTOR CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO GROUND	
• Disconnect: Power Seat Motor C353. • Measure the resistance between: ♦ DSM C341b-8, circuit CPS05 (BU/WH), harness side and ground. ♦ DSM C341b-22, circuit CPS04 (YE/OG), harness side and ground.  N0013562 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201.

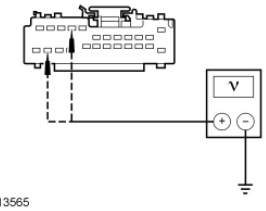
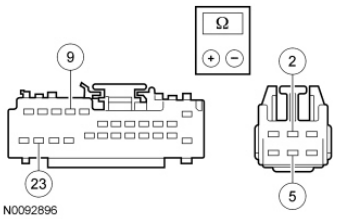
	CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I18 CHECK CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND	
• Measure the resistance between: ♦ DSM C341b-10, circuit CPS06 (GN/WH), harness side and ground. ♦ DSM C341b-12, circuit CPS01 (GN/BU), harness side and ground.  N0013563 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to I20 . **No** GO to I19 .
I19 CHECK THE HORIZONTAL POWER SEAT MOTOR CIRCUITS CPS06 (GN/WH) AND CPS01 (GN/BU) FOR A SHORT TO GROUND	
• Disconnect: Power Seat Motor C353. • Measure the resistance between: ♦ DSM C341b-10, circuit CPS06 (GN/WH), harness side and ground. ♦ DSM C341b-12, circuit CPS01 (GN/BU), harness side and ground.  N0013563 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt

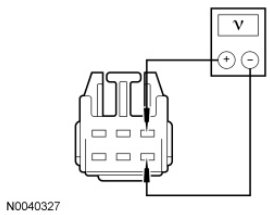
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	buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I20 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO GROUND	
• Measure the resistance between: ♦ DSM C341b-11, circuit CPS07 (GY/BN), harness side and ground. ♦ DSM C341b-21, circuit CPS08 (VT/OG), harness side and ground.  N0013564 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I21 .
I21 CHECK THE DRIVER POWER SEAT RECLINER MOTOR CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO GROUND	
• Disconnect: Driver Power Seat Recliner Motor C3187. • Measure the resistance between: ♦ DSM 341b-11, circuit CPS07 (GY/BN), harness side and ground. ♦ DSM C341b-21, circuit CPS08 (VT/OG), harness side and ground.  N0013564 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new driver seat recliner motor. REFER to Seat Recliner Motor in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

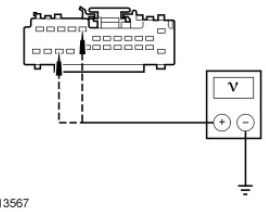
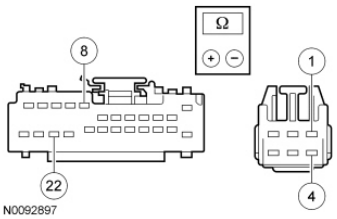
	No REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I22 CHECK THE FRONT HEIGHT POWER SEAT MOTOR FOR CORRECT OPERATION	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Power Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PIDs. ♦ Front Motor Up (FRONT_UP) ♦ Front Motor Down (FRONT_DWN) • Measure the voltage between power seat motor C353-2, circuit CPS03 (VT/GY) and C353-5, circuit CPS02 (GY/YE), harness side while toggling DSM active commands front motor up and front motor down, ON and OFF.  N0040325 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I23 .

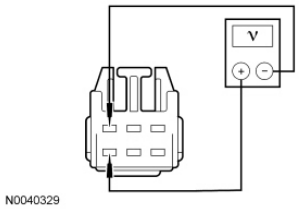
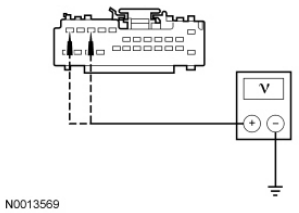
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I23 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR A SHORT TO VOLTAGE	
• Disconnect: DSM C341b. • Measure the voltage between: ♦ DSM C341b-9, circuit CPS03 (VT/GY), harness side and ground. ♦ DSM C341b-23, circuit CPS02 (GY/YE), harness side and ground.  N0013565 • **Is voltage present on either circuit?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I24 .
I24 CHECK CIRCUITS CPS03 (VT/GY) AND CPS02 (GY/YE) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between: ♦ DSM C341b-9, circuit CPS03 (VT/GY), harness side and power seat motor C353-2, circuit CPS03 (VT/GY), harness side. ♦ DSM C341b-23, circuit CPS02 (GY/YE), harness side and power seat motor C353-5, circuit CPS02 (GY/YE), harness side.  N0092896 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201.

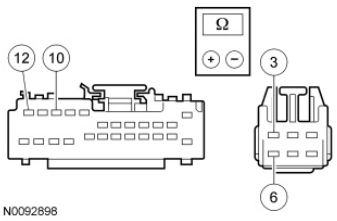
	CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I25 CHECK THE REAR HEIGHT MOTOR FOR CORRECT OPERATION	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Power Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PIDs. ♦ Rear Motor Up (REAR_UP) ♦ Rear Motor Down (REAR_DWN) • Measure the voltage between power seat motor C353-1, circuit CPS05 (BU/WH), harness side and C353-4, circuit CPS04 (YE/OG), harness side while toggling DSM active commands rear motor up and rear motor down, ON and OFF.  N0040327 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I26 .
I26 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR A SHORT TO VOLTAGE	
• Disconnect: DSM C341b. • Measure the voltage between: ♦ DSM C341b-8, circuit CPS05 (BU/WH), harness side and ground. ♦ DSM C341b-22, circuit CPS04 (YE/OG), harness side and ground.	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt

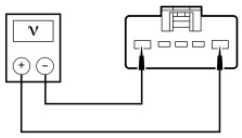
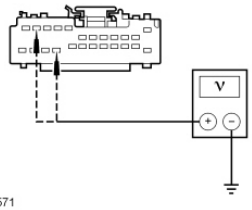
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 • **Is voltage present on either circuit?**	buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I27 .
I27 CHECK CIRCUITS CPS05 (BU/WH) AND CPS04 (YE/OG) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between: ♦ DSM C341b-8, circuit CPS05 (BU/WH), harness side and power seat motor C353-1, circuit CPS05 (BU/WH), harness side. ♦ DSM C341b-22, circuit CPS04 (YE/OG), harness side and rear height power seat motor C353-4, circuit CPS04 (YE/OG), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I28 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION	

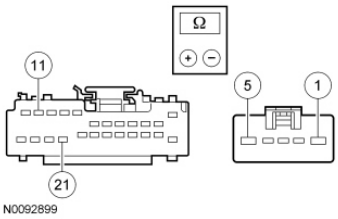
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Power Seat Motor C353. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PIDs. ♦ Horizontal Motor Forward (HORZ_FWD) ♦ Horizontal Motor Backward (HORZ_BWD) • Measure the voltage between power seat motor C353-3, circuit CPS01 (GN/BU) and C353-6, circuit CPS06 (GN/WH), harness side while toggling DSM active commands horizontal motor forward and horizontal motor backward, ON and OFF.  N0040329 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I29 .
I29 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR A SHORT TO VOLTAGE	
• Disconnect: DSM C341b. • Measure the voltage between: ♦ DSM C341b-10, circuit CPS06 (GN/WH), harness side and ground. ♦ DSM C341b-12, circuit CPS01 (GN/BU), harness side and ground.  N0013569 • **Is voltage present on either circuit?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

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	No GO to I30 .
I30 CHECK CIRCUITS CPS01 (GN/BU) AND CPS06 (GN/WH) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between: ♦ DSM C341b-10, circuit CPS06 (GN/WH), harness side and horizontal power seat motor C353-6, circuit CPS06 (GN/WH), harness side. ♦ DSM C341b-12, circuit CPS01 (GN/BU), harness side and horizontal power seat motor C353-3, circuit CPS01 (GN/BU), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
I31 CHECK THE DRIVER SEAT POWER RECLINER MOTOR FOR CORRECT OPERATION	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Seat Power Recliner Motor C3187. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag**	**Yes** INSTALL a new driver seat recliner assembly. REFER to Seat Recliner Motor in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt

module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment. • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PIDs. ♦ Recline Motor Forward (RECL_FWD) ♦ Recline Motor Backward (RECL_BWD) • Measure the voltage between driver seat power recliner motor C3187-1, circuit CPS07 (GY/BN) and C3187-5, circuit CPS08 (VT/OG), harness side while toggling DSM active commands recliner motor forward and recliner motor backward, ON and OFF.  N0040377 • **Is voltage present when the motor is commanded ON and no voltage present when commanded OFF?**	buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I32 .
I32 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR A SHORT TO VOLTAGE	
• Disconnect: DSM C341b. • Measure the voltage between: ♦ DSM C341b-11, circuit CPS07 (GY/BN), harness side and ground. ♦ DSM C341b-21, circuit CPS08 (VT/OG), harness side and ground.  N0013571 • **Is voltage present on either circuit?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to I33 .
I33 CHECK CIRCUITS CPS07 (GY/BN) AND CPS08 (VT/OG) FOR AN OPEN	

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• Ignition OFF. • Measure the resistance between: ♦ DSM C341b-11, circuit CPS07 (GY/BN), harness side and recliner power seat motor C3187-1, circuit CPS07 (GY/BN), harness side. ♦ DSM C341b-21, circuit CPS08 (VT/OG), harness side and recliner power seat motor C3187-5, circuit CPS08 (VT/OG), harness side.  N0092899 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test J: The Memory Seat Does Not Operate Correctly - Does Not Operate Using the Memory SET Switch

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation

The driver seat control switch is supplied battery voltage on circuit SBP01 (RD) and ground on circuit GD133 (BK). When pressed, the seat control switch supplies the voltage and ground to the applicable Driver Seat Module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner mechanism uses a single motor to move the seat backrest forward and rearward.

Battery voltage is also supplied to DSM on circuits SBP01 (RD) and SBB14 (BN/RD). Ground is supplied to the DSM on circuits GD133 (BK) and GD143 (BK/VT).

Each motor, in the memory power seat track and power recliner mechanism contains a Hall-effect position sensor. The DSM supplies a signal feed circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat track and backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. Refer to Principles of Operation in this section or the Owner's Literature for information on programming the DSM for storing memory seat positions.

The following pinpoint test diagnoses a memory seat that does not operate correctly using the memory SET switch. If the memory seat does not move in all directions using the seat control switch, GO to Pinpoint Test I
.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1530 - Memory SET Switch Circuit Short to Ground • B1534 - Memory 1 Switch Circuit Short to Ground • B1538 - Memory 2 Switch Circuit Short to Ground	If a short to ground is sensed on the switch input circuit during the DSM self-test, the DTC is set. If activity is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During the self-test, the DSM attempts to operate the seat track motors and uses the motor's position sensor to monitor movement. If no motor movement is sensed, a DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1666 - Seat Driver Recline Motor Stalled	During the self-test, the DSM attempts to operate the recliner motor and uses the recliner motor position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no motor movement is still monitored after 250 milliseconds, the DSM disables the output.
• B1952 - Seat Rear Up/Down Position Feedback Circuit Short to Battery	If a short to voltage condition is present on the affected motor's position sensor (Hall effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one second increments.

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• B1956 - Seat Front Up/Down Position Feedback Circuit Short to Battery • B1960 - Seat Recline Forward/Backward Position Feedback Circuit Short to Battery • B1964 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	
• B1953 - Seat Rear Up/Down Position Feedback Circuit Short to Ground • B1957 - Seat Front Up/Down Position Feedback Circuit Short to Ground • B1961 - Seat Recline Forward/Backward Position Feedback Circuit Short to Ground • B1965 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	If a short to ground condition is present on the affected motor's position sensor (Hall effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one second increments.
• B2084 - Memory SET Indicator Short to Ground	If a short to ground or open condition is present on the memory SET switch indicator output circuit, the DTC is set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Memory SET switch
- Missing status information (Controller Area Network (CAN) communication bus message):
  - ♦ ignition switch status
  - ♦ gear selector position
- Remote entry transmitter
- Memory power seat track
- Recliner mechanism
- DSM

PINPOINT TEST J: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE USING THE MEMORY SET SWITCH

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

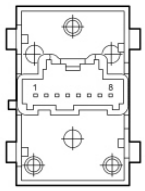
NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

NOTE: Verify the PID(s) states agree with the ignition switch and transmission gear selector in all positions before proceeding with memory seat diagnosis.

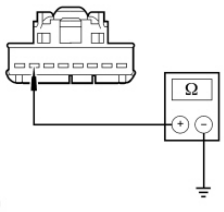
Test Step	Result / Action to Take
J1 CHECK DSM TRANSMISSION GEAR SELECTED (TRANSGEAR) PID STATES	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: TRANSGEAR (PRNDL). • Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states: ♦ Drive1 ♦ Drive2 ♦ Drive3 ♦ D6_PRK ♦ NTRL ♦ REV ♦ D6_PRK • **Do the PID states agree with the selected positions?**	**Yes** GO to J2 . **No** To diagnose a transmission gear selector (PRNDL) status concern, REFER to Section 307-01A or Section 307-01B .
J2 CHECK THE IGNITION SWITCH STATUS (IGN_SW) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: IGN_SW PID. • Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states: ♦ Off ♦ Accessory ♦ Run ♦ Start • **Do the PID states agree with the selected positions?**	**Yes** GO to J3 . **No** To diagnose an ignition switch status concern, REFER to Section 211-05 .
J3 RETRIEVE THE DTCs	
• **NOTE:** During the self-test, each memory motor will be requested to move for one second. If a motor is near the end of travel, that position sensor feedback will not change as expected for one second resulting in a false DTC. • Place the memory seat and adjustable memory pedals in central travel positions. • Enter the following diagnostic mode on the scan tool: Self Test - DSM .	**Yes** If the memory SET indicator fails to illuminate during the self-test, GO to J7 . If DTC B2084, GO to J7 . If DTCs B1952, B1956, B1960 and B1964 are all retrieved, GO to J10 .

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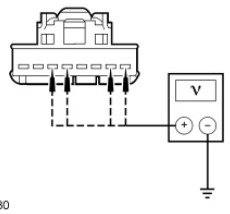
• **NOTE:** During the self-test, document when the memory SET indicator illuminates and turns off. • **Are any DTCs retrieved or does the memory SET indicator fail to illuminate during the self-test?**	If DTCs B1953, B1957, B1961 and B1965 are all retrieved, GO to J10 . If DTC B1530, GO to J5 . If DTC B1534, GO to J5 . If DTC B1538, GO to J5 . If DTC B1663, GO to J11 . If DTC B1664, GO to J14 . If DTC B1665, GO to J17 . If DTC B1666, GO to J20 . If DTC B1952, GO to J14 . If DTC B1953, GO to J14 . If DTC B1956, GO to J11 . If DTC B1957, GO to J11 . If DTC B1960, GO to J20 . If DTC B1961, GO to J20 . If DTC B1964, GO to J17 . If DTC B1965, GO to J17 . If DTC B1342, INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. For any other DSM DTCs, REFER to the Driver Seat Module (DSM) DTC Chart. **No** GO to J4 .
J4 MONITOR THE DSM PIDs AND CHECK THE DSM FOR CORRECT MEMORY SET SWITCH INPUTS	
• Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: Memory Set/Recall Input Switch Status. ♦ Memory 1 recall switch status (MEM_1) ♦ Memory 2 recall switch status (MEM_2) ♦ Memory SET switch status (MEM_S)	**Yes** GO to J10 . **No** GO to J5 .

• Monitor the DSM memory SET switch, memory SET/recall 1 switch and memory SET/recall 2 switch PID while activating the memory SET switch, recall 1 and recall 2 buttons. • **Do the PID values agree with the switch button positions?**	
J5 CHECK THE MEMORY SET SWITCH	
• Ignition OFF. • Remove the memory SET switch. Refer to Memory Set Switch in this section. • Using the following table to check the memory SET switch, measure the resistance between the memory SET switch pins, component side, while pressing the indicated switch buttons and compare the results to the table. **Switch Button / Pins / Ohms** Memory Switch 1 / 7 and 2 / Less than 5 Memory Switch 2 / 7 and 6 / Less than 5 Memory SET Switch / 7 and 5 / Less than 5  A0074536 • **NOTE:** Refer to multimeter user's manual for testing diodes. • Using the diode testing meter function and the following table, connect the meter leads to the memory SET switch pins, component side. Measure the voltages and compare the results to the table, to check the switch indicator. **Positive Lead / Negative Lead / Volts** Pin 1 / Pin 7 / Greater than 0.3 Pin 7 / Pin 1 / OL • Carry out the Memory SET Switch Component Test. • **Is the memory SET switch OK?**	**Yes** GO to J6 . **No** INSTALL a new memory SET switch. REFER to Memory Set Switch in this section. REPEAT the self-test. CLEAR the DTCs.
J6 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the resistance between memory SET switch C2094-7, circuit GD145 (BK/BU), harness side and ground.  N0040379 • **Is the resistance less than 5 ohms?**	**Yes** GO to J7 . **No** REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J7 CHECK CIRCUITS CPS55 (YE/GY), CPS15 (VT/WH), RPS14 (BN/YE) AND CPS16 (YE) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: DSM C341c. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Measure the voltage between the following memory SET switch C2094 pins, harness side and ground:	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to J8 .

Connector	Circuit
C2094-1	CPS55 (YE/GY)
C2094-2	CPS15 (VT/WH)
C2094-5	RPS14 (BN/YE)
C2094-6	CPS16 (YE)



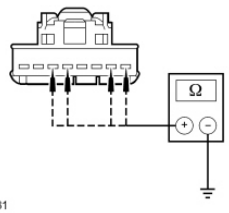
N0040380

- **Is voltage present on any circuits?**

J8 CHECK CIRCUITS CPS55 (YE/GY), CPS15 (VT/WH), RPS14 (BN/YE) AND CPS16 (YE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the following memory SET switch C2094 pins, harness side and ground:

Connector	Circuit
C2094-1	CPS55 (YE/GY)
C2094-2	CPS15 (VT/WH)
C2094-5	RPS14 (BN/YE)
C2094-6	CPS16 (YE)



N0040381

- **Are the resistances greater than 10,000 ohms?**

Yes
GO to J9 .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

J9 CHECK MEMORY SET SWITCH CIRCUITS FOR AN OPEN

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<table>
<tr>
<td>
• Measure the resistance between the following memory SET switch C2094 pins and DSM C341c pins:
<table>
<tr><th>Memory SET Switch</th><th>Circuit</th><th>DSM</th></tr>
<tr><td>C2094-1</td><td>CPS55 (YE/GY) (YE)</td><td>C341c-8</td></tr>
<tr><td>C2094-2</td><td>CPS15 (VT/WH)</td><td>C341c-15</td></tr>
<tr><td>C2094-5</td><td>RPS14 (BN/YE)</td><td>C341c-3</td></tr>
<tr><td>C2094-6</td><td>CPS16 (YE)</td><td>C341c-4</td></tr>
</table>
• Are the resistances less than 5 ohms?
</td>
<td>
Yes
INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

REPOWER the SRS . REFER to Section 501-20B .

No
REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable.

CONNECT driver safety belt buckle and pretensioner C3201.

CONNECT driver seat side air bag module C3049.

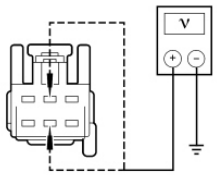
REPOWER the SRS . REFER to Section 501-20B .
</td>
</tr>
<tr><td>J10 MONITOR THE DSM PIDs</td><td></td></tr>
<tr>
<td>
• Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: Driver Seat/Pedal Sensor Output Status.
♦ Driver Power Seat Front Up/Down Sense (SFNT_MT)
♦ Driver Power Seat Forward/Backward Sense (SFWD_MT)
♦ Driver Power Seat Recline Sense (SRCL_MT)
♦ Driver Power Seat Rear Up/Down Sense (SREARMT)
• Monitor the memory seat, and adjustable memory pedals sensor PIDs.
• Using the switches, operate the memory seat and adjustable memory pedals in all directions through the full range of travel while monitoring the PIDs.
• Does each PID indicate the sensor is operational throughout each associated motor's full range of travel?
</td>
<td>
Yes
INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs.

No
If front up/down position sensor PID indicates not present, GO to J11 .

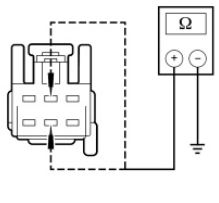
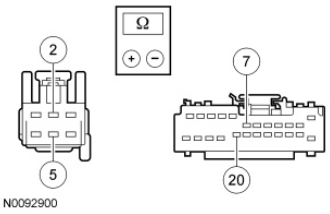
If rear up/down position sensor PID indicates not present, GO to J14 .

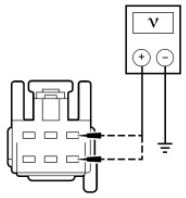
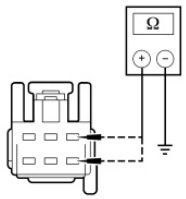
If forward/rearward position sensor PID indicates not present, GO to J17 .

If recline position sensor PID indicates not present, GO to J20 .
</td>
</tr>
</table>

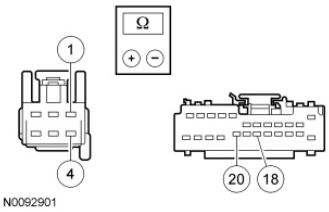
	For a memory adjustable pedal sensor concern, REFER to Section 206-00 .
J11 CHECK CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: DSM C341b. • Disconnect: Memory Seat Position Sensor C357. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Measure the voltage between: ♦ memory seat position sensor C357-2, circuit VPS10 (BU/GN), harness side and ground. ♦ memory seat position sensor 357-5, circuit RPS13 (GN/OG), harness side and ground.  N0040383 • **Is voltage present on either circuit?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to J12 .
J12 CHECK CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between: ♦ memory seat position sensor C357-2, circuit VPS10 (BU/GN), harness side and ground. ♦ memory seat position sensor 357-5, circuit RPS13 (GN/OG), harness side and ground.	**Yes** GO to J13 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201.

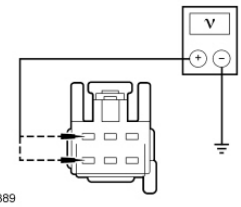
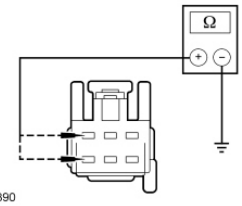
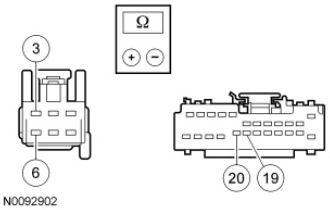
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 N0040384 • **Are the resistances greater than 10,000 ohms?**	CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J13 CHECK CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR AN OPEN	
• Measure the resistance between: ♦ memory seat position sensor C357-2, circuit VPS10 (BU/GN), harness side and DSM C341b-7, circuit VPS10 (BU/GN), harness side. ♦ memory seat position sensor 357-5, circuit RPS13 (GN/OG), harness side and DSM C341b-20, circuit RPS13 (GN/OG), harness side.  N0092900 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J14 CHECK CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: DSM C341b.	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201.

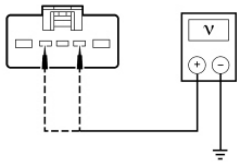
• Disconnect: Memory Seat Position Sensor C357. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between: ♦ memory seat position sensor C357-1, circuit VPS11 (GN/BN), harness side and ground. ♦ memory seat position sensor C357-4, circuit RPS13 (GN/OG), harness side and ground.  N0040386 • **Is voltage present on either circuit?**	CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to J15 .
J15 CHECK CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between: ♦ memory seat position sensor C357-1, circuit VPS11 (GN/BN), harness side and ground. ♦ memory seat position sensor C357-4, circuit RPS13 (GN/OG), harness side and ground.  N0040387 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to J16 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J16 CHECK CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) AND FOR AN OPEN	
• Measure the resistance between: ♦ memory seat position sensor C357-1, circuit VPS11 (GN/BN), harness side and DSM C341b-18, circuit VPS11 (GN/BN), harness side. ♦ memory seat position sensor C357-4, circuit RPS13 (GN/OG), harness side and DSM	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable.

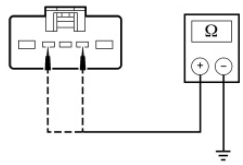
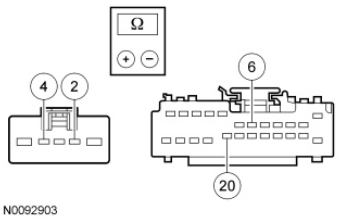
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C341b-20, circuit RPS13 (GN/OG), harness side.  • **Are the resistances less than 5 ohms?**	CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J17 CHECK CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) AND FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: DSM C341b. • Disconnect: Memory Seat Position Sensor C357. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between: ♦ memory seat position sensor C357-3, circuit VPS09 (BN/BU), harness side and ground. ♦ memory seat position sensor C357-6, circuit RPS13 (GN/OG), harness side and ground.	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to J18 .

 N0040389 • **Is voltage present on either circuit?**	
J18 CHECK CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between: ♦ memory seat position sensor C357-3, circuit VPS09 (BN/BU), harness side and ground. ♦ memory seat position sensor C357-6, circuit RPS13 (GN/OG), harness side and ground.  N0040390 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to J19 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J19 CHECK CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) FOR AN OPEN	
• Measure the resistance between: ♦ memory seat position sensor C357-3, circuit VPS09 (BN/BU), harness side and DSM C341b-19, circuit VPS09 (BN/BU), harness side. ♦ memory seat position sensor C357-6, circuit RPS13 (GN/OG), harness side and DSM C341b-20, circuit RPS13 (GN/OG), harness side.  N0092902 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver seat track assembly. REFER to Seat Track in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable.

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	CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J20 CHECK CIRCUITS RPS13 (GN/OG) AND VPS12 (GY/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: DSM C341b. • Disconnect: Driver Seat Recliner Motor C3187. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between: ♦ driver seat recliner motor C3187-2, circuit RPS13 (GN/OG), harness side and ground. ♦ driver seat recliner motor C3187-4, circuit VPS12 (GY/OG), harness side and ground.  N0040392 • **Is voltage present on either circuit?**	**Yes** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to J21 .
J21 CHECK CIRCUITS RPS13 (GN/OG) AND VPS12 (GY/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between: ♦ driver seat recliner motor C3187-2, circuit RPS13 (GN/OG), harness side and ground. ♦ driver seat recliner motor C3187-4, circuit VPS12 (GY/OG), harness side and ground.	**Yes** GO to J22 . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground

 N0040393 • **Are the resistances greater than 10,000 ohms?**	cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
J22 CHECK CIRCUITS 449 (BN/PK) AND 452 (GY/RD) FOR AN OPEN	
• Measure the resistance between: ♦ driver seat recliner motor C3187-2, circuit RPS13 (GN/OG), harness side and DSM C341b-20, circuit RPS13 (GN/OG), harness side. ♦ driver seat recliner motor C3187-4, circuit VPS12 (GY/OG), harness side and DSM C341b-6, circuit VPS12 (GY/OG), harness side.  N0092903 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new driver seat recliner assembly. REFER to Seat Recliner Motor in this section. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test K: Easy Exit/Easy Entry is Inoperative/Does Not Operate Correctly

Normal Operation

The Driver Seat Module (DSM) receives a transmission park and key in/out command over the Medium Speed Controller Area Network (MS-CAN) communication network and powers the driver seat rearward about 51 mm (2 in).

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This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Easy exit/easy entry not enabled
- Missing status information (Controller Area Network (CAN) communication bus message):
  - ♦ ignition switch status
  - ♦ gear selector position
- Key-in-ignition warning switch
- Instrument Cluster (IC) module
- DSM

PINPOINT TEST K: EASY EXIT/EASY ENTRY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

NOTE: The transmission gear selector must be in PARK and the driver seat must be at least 51 mm (2 in) from its rear stopping point for the easy entry/easy exit feature to function.

NOTE: Make sure all memory seat DTC and symptom based faults are corrected before proceeding with easy entry/easy exit diagnosis. Verify the PID(s) states agree with the ignition switch and transmission gear selector in all positions before proceeding with easy entry/easy exit diagnosis.

Test Step	Result / Action to Take
K1 CHECK THE DRIVER POWER SEAT OPERATION	
• Ignition ON. • Check the message center to verify the easy entry/easy exit feature is enabled. ♦ The easy entry/easy exit feature can be enabled/disabled using a scan tool in module programming. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's Literature or Section 413-01 for information on the message center. • Using the seat control switch, verify the driver power seat operates fully forward and rearward. • **NOTE:** During the self-test, each memory motor will be requested to move for one second. If a motor is near the end of travel, that position sensor feedback will not change as expected for one second resulting in a false DTC. • Place the memory seat and adjustable memory pedals in central travel positions. • Connect the scan tool. • Enter the following diagnostic mode on the scan tool: Self Test - DSM .	**Yes** REFER to the Driver Seat Module (DSM) DTC Chart. **No** If disabled, ENABLE the easy entry/easy exit feature with the message center. REFER to the Owner's Literature - Driver Controls for easy entry/easy exit feature enable/disable instructions. TEST the system for normal operation. If OK, INSTRUCT the customer on correct system operation. If easy entry/easy exit is enabled and the seat does not move horizontally from the seat control switch, GO to Pinpoint Test I . Otherwise, GO to K2 .

• **Are any DSM DTCs retrieved?**	
K2 CHECK DSM TRANSMISSION GEAR SELECTED (TRANSGEAR) PID STATES	
• Enter the following diagnostic mode on the scan tool: DataLogger - DSM - PID: TRANSGEAR (PRNDL). • Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANSGEAR states: ♦ Drive1 ♦ Drive2 ♦ Drive3 ♦ D6_PRK ♦ NTRL ♦ REV ♦ D6_PRK • **Do the PID states agree with the selected positions?**	**Yes** GO to K3 . **No** To diagnose a transmission gear selector (PRNDL) status concern, REFER to Section 307-01A or Section 307-01B .
K3 CHECK THE IGNITION KEY IN/OUT (IGN_KEY) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - IC Module - PID: IGN_KEY PID. • Insert and remove the ignition key into the ignition lock cylinder while monitoring the following IC module PID IGN_SW states: ♦ In ♦ Out • Monitor the IC module PID IGN_SW with the key in and out of the ignition switch. • **Do the IC module PID states agree?**	**Yes** INSTALL a new DSM and CARRY OUT Programmable Module Installation (PMI). REFER to Section 419-10 . REPEAT the self-test. CLEAR the DTCs. **No** To diagnose the key-in-ignition warning switch fault, REFER to Section 413-01 .

Pinpoint Test L: The Power Seat Does Not Operate Correctly - Passenger Seat

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is supplied battery voltage on circuit SBB10 (YE/RD) and ground on circuit GD151 (BK/GN). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

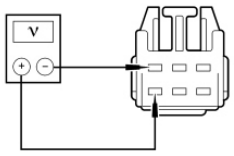
- Wiring, terminals or connectors
- Seat control switch
- Seat track motor (seat track)

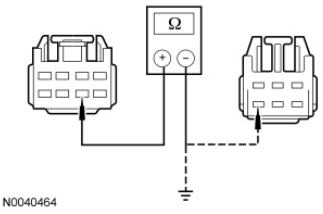
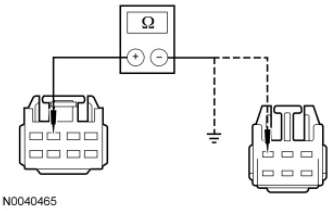
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PINPOINT TEST L: THE POWER SEAT DOES NOT OPERATE CORRECTLY - PASSENGER SEAT

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

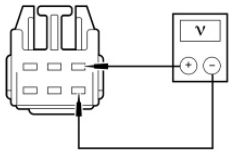
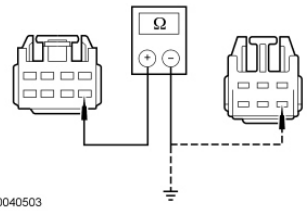
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
L1 CHECK HORIZONTAL DIRECTION MOTOR FOR CORRECT OPERATION	
• Operate the passenger power seat forward and rearward. • **Will the seat move horizontally?**	**Yes** GO to L5 . **No** GO to L2 .
L2 CHECK VOLTAGE TO THE PASSENGER SEAT HORIZONTAL MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Safety Belt Buckle Pretensioner C3202. • Disconnect: Passenger Seat Side Air Bag C3050. • Disconnect: Passenger Seat Motor C3015. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between passenger seat motor C3015-6, circuit CPS38 (GN/BU), harness side and C3015-3, circuit CPS33 (WH), harness side, while pushing the passenger seat control switch forward and rearward.  N0040420 • **Is the voltage greater than -10 volts when the switch is pushed forward, greater than +10 volts when the switch is pushed rearward and 0 volt when the switch is in a rest position?**	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B . **No** GO to L3 .

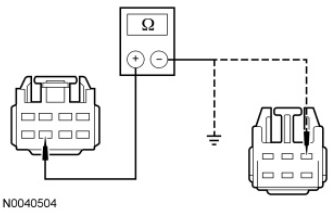
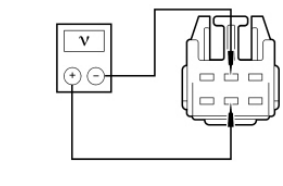
L3 CHECK CIRCUIT CPS38 (GN/BU) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Passenger Seat Control Switch C355. • Measure the resistance between: ♦ passenger seat control switch C355-6, circuit CPS38 (GN/BU), harness side and passenger seat motor C3015-6, circuit CPS38 (GN/BU), harness side. ♦ passenger seat control switch C355-6, circuit CPS38 (GN/BU), harness side and ground.  N0040464 • **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**	**Yes** GO to L4 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
L4 CHECK CIRCUIT CPS33 (WH) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ passenger seat control switch C355-3, circuit CPS33 (WH), harness side and passenger seat motor C3015-3, circuit CPS33 (WH), harness side. ♦ passenger seat control switch C355-3, circuit CPS33 (WH), harness side and ground.  N0040465 • **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT passenger safety belt buckle and pretensioner C3202.

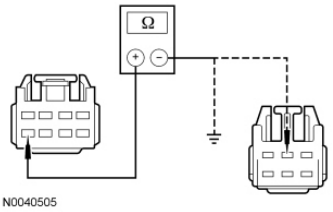
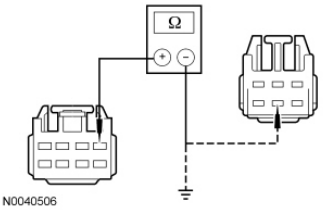
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	CONNECT passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
L5 DETERMINE SEAT TILTING FAILURE	
• Determine seat tilting failure. • **Can the seat be tilted forward or backward?**	**Yes** If only forward tilting operates, GO to L6 . If only rear tilting operates, GO to L9 . **No** INSTALL a new passenger seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
L6 CHECK VOLTAGE TO THE PASSENGER SEAT REAR HEIGHT MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Safety Belt Buckle Pretensioner C3202. • Disconnect: Passenger Seat Side Air Bag C3050. • Disconnect: Passenger Seat Motor C3015. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between passenger seat motor C3015-1, circuit CPS37 (WH/BU), harness side and C3015-4, circuit CPS36 (YE/GY), harness side, while depressing the rear tilt	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .

switch up and down.  N0040466 • **Is the voltage greater than -10 volts when the rear tilt switch is pressed down, greater than +10 volts when the rear tilt switch is pressed up and 0 volt when the switch is in the rest position?**	**No** GO to L7 .
L7 CHECK CIRCUIT CPS36 (YE/GY) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Passenger Seat Control Switch C355. • Measure the resistance between: ♦ passenger seat control switch C355-5, circuit CPS36 (YE/GY), harness side and passenger seat motor C3015-4, circuit CPS36 (YE/GY), harness side. ♦ passenger seat control switch C355-5, circuit CPS36 (YE/GY), harness side and ground.  N0040503 • **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**	**Yes** GO to L8 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
L8 CHECK CIRCUIT CPS37 (WH/BU) FOR AN OPEN AND SHORT TO GROUND	
• Measure the resistance between: ♦ passenger seat control switch C355-7, circuit CPS37 (WH/BU), harness side and passenger seat motor C3015-1, circuit CPS37 (WH/BU), harness side. ♦ passenger seat control switch C355-7, circuit CPS37 (WH/BU), harness side and ground.	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202.

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 N0040504 • **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**	CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
L9 CHECK THE VOLTAGE TO THE PASSENGER SEAT FRONT HEIGHT MOTOR	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Passenger Seat Safety Belt Buckle Pretensioner C3202. • Disconnect: Passenger Seat Side Air Bag C3050. • Disconnect: Passenger Seat Motor C3015. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Measure the voltage between passenger seat motor C3015-2, circuit CPS35 (VT/GN), harness side and C3015-5, circuit CPS34 (GY/BU), while pushing the rear tilting switch up and down.  N0040426	**Yes** INSTALL a new passenger seat track assembly. REFER to Seat Track in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B . **No** GO to L10 .

• **Is the voltage greater than +10 volts when the front tilt switch is pressed down, greater than -10 volts when the front tilt switch is pressed up and 0 volt when the switch is in the rest position?**	
L10 CHECK CIRCUIT CPS35 (VT/GN) FOR AN OPEN AND SHORT TO GROUND	
• Disconnect: Passenger Seat Control Switch C355. • Measure the resistance between: ♦ passenger seat control switch C355-8, circuit CPS35 (VT/GN), harness side and passenger seat motor C3015-2, circuit CPS35 (VT/GN), harness side. ♦ passenger seat control switch C355-8, circuit CPS35 (VT/GN), harness side and ground.  N0040505 • **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**	**Yes** GO to L11 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .
L11 CHECK CIRCUIT CPS34 (GY/BU) FOR AN OPEN	
• Measure the resistance between: ♦ passenger seat control switch C355-1, circuit CPS34 (GY/BU), harness side, and passenger seat motor C3015-5, circuit CPS34 (GY/BU), harness side. ♦ passenger seat control switch C355-1, circuit CPS34 (GY/BU), harness side and ground.  N0040506 • **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**	**Yes** INSTALL a new passenger seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable.

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	CONNECT the passenger safety belt buckle and pretensioner C3202. CONNECT the passenger seat side air bag module C3050. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test M: The Heated Seats are Inoperative

Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

The driver and passenger heated seats share a common ignition and battery feed to the heated seat control switch assembly. Ignition feed circuit CBP18 (GY/OG) supplies voltage to the logic board and illumination of the heated seat switch assembly and the battery feed circuit SBB28 (GN/RD) is used to provide voltage to the heater mats. The heated seat switch assembly uses shared ground GD145 (BK/BU) for the logic board and illumination.

When a heated seat switch is pressed with the ignition switch in RUN or START, a momentary ground is provided to the logic board of the heated seat switch assembly. The logic board then activates an internal relay in the heated seat switch assembly that provides voltage via circuit CHS02 (YE/BU) (driver seat) or CHS07 (GY/BU) (front passenger seat) to the bi-metallic thermostat that is part of the seat cushion heater mat.

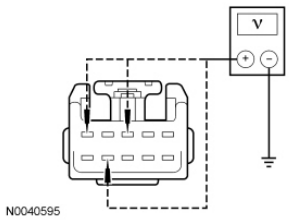
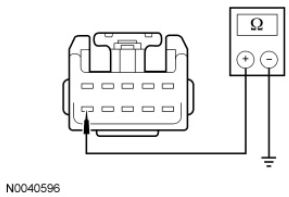
The driver seat cushion and backrest heater mats are wired in series as are the passenger seat cushion and backrest heater mats. The heated seat system is designed to maintain the temperature by the opening (no voltage to the heated seat elements) and closing (voltage supplied to the heated seat elements) of the bi-metallic thermostat.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Heated seat switch
- Heated seat relay
- Heated seat mat

PINPOINT TEST M: THE HEATED SEATS ARE INOPERATIVE

Test Step	Result / Action to Take
M1 CHECK HEATED SEAT SWITCH OPERATION	
• Ignition ON. • Press both heated seat switches to ON. • **Does one or both heated seat switch indicators illuminate?**	**Yes** If one or both indicators illuminate, GO to Pinpoint Test N . **No** GO to M2 .

M2 CHECK VOLTAGE TO HEATED SEAT SWITCH CIRCUITS	
• Ignition OFF. • Disconnect: Heated Seat Switch C2347. • Ignition ON. • Measure the voltage between the following heated seat switch C2347 pins, harness side and ground. **Connector / Circuit** C2347-9 — CBP18 (GY/OG) C2347-5 — SBB28 (GN/RD) C2347-3 — SBB28 (GN/RD)  N0040595 • **Are the voltages greater than 10 volts?**	**Yes** GO to M3 . **No** VERIFY Battery Junction Box (BJB) fuse 28 (20A) and Smart Junction Box (SJB) fuse 18 (10A) are OK. If OK, REPAIR circuit CBP18 (GY/OG) or SBB28 (GN/RD). If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation.
M3 CHECK HEATED SEAT SWITCH GROUND CIRCUIT	
• Ignition OFF. • Measure the resistance between heated seat switch C2347-10, circuit GD145 (BK/BU), harness side and ground.  N0040596 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new heated seat switch. REFER to Heated Seat Switch in this section. **No** REPAIR circuit GD145 (BK/BU). TEST the system for normal operation.

Pinpoint Test N: The Heated Seat is Inoperative - Driver or Passenger

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Refer to Wiring Diagrams Cell 119 , Climate Controlled Seats for schematic and connector information.

Normal Operation

The driver and passenger heated seats share a common ignition and battery feed to the heated seat control switch assembly. Ignition feed circuit CBP18 (GY/OG) supplies voltage to the logic board and illumination of the heated seat switch assembly and the battery feed circuit SBB28 (GN/RD) is used to provide voltage to the heater mats. The heated seat switch assembly uses shared ground GD145 (BK/BU) for the logic board and illumination.

When a heated seat switch is pressed with the ignition switch in RUN or START, a momentary ground is provided to the logic board of the heated seat switch assembly. The logic board then activates an internal relay in the heated seat switch assembly that provides voltage via circuit CHS02 (YE/BU) (driver seat) or CHS07 (GY/BU) (front passenger seat) to the bi-metallic thermostat that is part of the seat cushion heater mat.

The driver seat cushion and backrest heater mats are wired in series as are the passenger seat cushion and backrest heater mats. The heated seat system is designed to maintain the temperature by the opening (no voltage to the heated seat elements) and closing (voltage supplied to the heated seat elements) of the bi-metallic thermostat.

This pinpoint test is intended to diagnose the following:

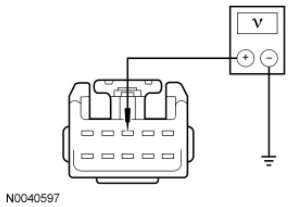
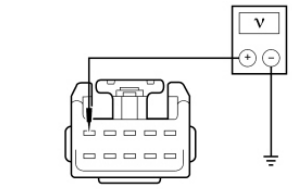
- Fuse(s)
- Wiring, terminals or connectors
- Heated seat switch
- Heated seat relay
- Heated seat mat

PINPOINT TEST N: THE HEATED SEAT IS INOPERATIVE - DRIVER OR PASSENGER

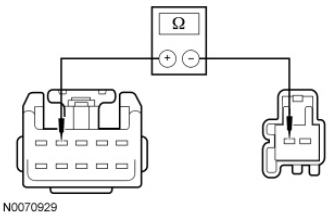
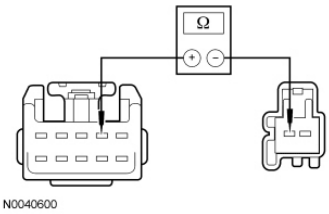
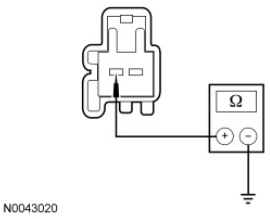
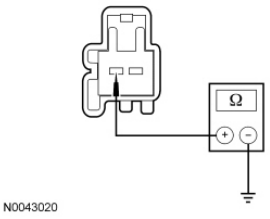
NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

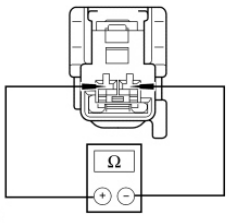
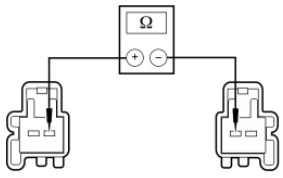
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
N1 CHECK CIRCUIT SSB28 (GN/RD) FOR VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • For heated seat diagnostics on the driver seat, carry out the following: ♦ disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. ♦ disconnect: Driver Seat Side Air Bag C3049. • For heated seat diagnostics on the passenger seat, carry out the following: ♦ disconnect: Passenger Seat Safety Belt Buckle Pretensioner C3202. ♦ disconnect: Passenger Seat Side Air Bag C3050.	**Yes** GO to N2 . **No** VERIFY Battery Junction Box (BJB) fuse 28 (20A) is OK. If OK, REPAIR circuit SBB28 (GN/RD). If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation. DISCONNECT the battery ground cable.

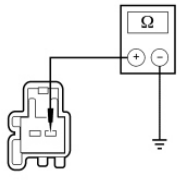
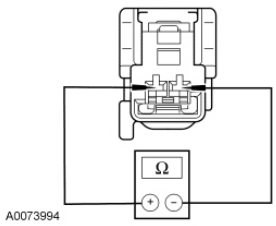
• Disconnect: Heated Seat Switch C2347 . • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • For driver seat, measure the voltage at heated seat switch C2347-3, circuit SBB28 (GN/RD), harness side and ground.  N0040597 • For passenger seat, measure the voltage at heated seat switch C2347-5, circuit SBB28 (GN/RD), harness side and ground.  N0040598 • **Is the voltage greater than 10 volts?**	CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N2 CHECK CIRCUIT CHS02 (YE/BU) (DRIVER) OR CHS07 (GY/BU) (PASSENGER) FOR AN OPEN	
• Ignition OFF. • Disconnect: Heated Seat Cushion Element C364 (Driver) or C334 (Passenger). • For driver seat, measure the resistance between heated seat switch C2347-4, circuit CHS02 (YE/BU), harness side and driver heated seat cushion element C364-1, circuit CHS02 (YE/BU), harness side.	**Yes** GO to N3 . **No** REPAIR driver circuit CHS02 (YE/BU) or passenger circuit CHS07 (GY/BU). TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module

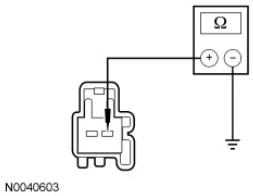
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 N0070929 • For passenger seat, measure the resistance between heated seat switch C2347-2, circuit CHS07 (GY/BU), harness side and passenger heated seat cushion element C334-1, circuit CHS07 (GY/BU), harness side.  N0040600 • **Is the resistance less than 5 ohms?**	C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N3 CHECK CIRCUIT CHS02 (YE/BU) (DRIVER) OR CHS07 (GY/BU) (PASSENGER) FOR A SHORT TO GROUND	
• For driver seat, measure the resistance between heated seat cushion element C364-1, circuit CHS02 (YE/BU), harness side and ground.  N0043020 • For passenger seat, measure the resistance between heated seat cushion element C334-1, circuit CHS07 (GY/BU), harness side and ground.  N0043020 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to N4 . **No** REPAIR driver circuit CHS02 (YE/BU) or passenger circuit CHS07 (GY/BU). TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N4 CHECK HEATED SEAT CUSHION ELEMENT FOR AN OPEN	

• Measure the resistance between driver heated seat cushion element C364-1 and C364-2, component side; or between passenger heated seat cushion element C334-1 and C334-2, component side.  A0073993 • **Is the resistance between 0.8 and 2.0 ohms?**	**Yes** GO to N5 . **No** INSTALL a new heated seat cushion element. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N5 CHECK DRIVER HEATED SEAT CIRCUIT CHS01 (GY/VT) OR PASSENGER CIRCUIT CHS06 (BU/BN) FOR AN OPEN	
• Disconnect: Seat Back Heater C365 (Driver) or C335 (Passenger). • Measure the resistance between driver heated seat cushion element C364-2, circuit CHS01 (GY/VT), harness side and driver heated seat backrest element C365-1, circuit CHS01 (GY/VT), harness side; or between passenger heated seat cushion element C334-2, circuit CHS06 (BU/BN), harness side and passenger heated seat backrest element C335-1, circuit CHS06 (BU/BN), harness side.  N0040601 • **Is the resistance less than 5 ohms?**	**Yes** GO to N6 . **No** REPAIR driver circuit CHS01 (GY/VT) or passenger circuit CHS06 (BU/BN). TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N6 CHECK DRIVER HEATED SEAT CIRCUIT CHS01 (GY/VT) OR PASSENGER CIRCUIT CHS06 (BU/BN) FOR A SHORT TO GROUND	

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• Measure the resistance between driver heated seat cushion element C364-2, circuit CHS01 (GY/VT) or passenger heated seat cushion element C334-2, circuit CHS06 (BU/BN), harness side and ground.  N0040602 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to N7 . **No** REPAIR driver circuit CHS01 (GY/VT) or passenger circuit CHS06 (BU/BN). TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N7 CHECK HEATED SEAT BACKREST ELEMENT FOR AN OPEN	
• Measure the resistance between driver heated seat backrest element C365-1 and C365-2, component side; or between passenger heated seat backrest element C335-1 and C335-2, component side.  A0073994 • **Is the resistance between 0.8 and 2.0 ohms?**	**Yes** GO to N8 . **No** INSTALL a new heated seat back element. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .
N8 CHECK DRIVER CIRCUIT GD133 (BK) OR PASSENGER CIRCUIT GD151 (BK/GN) FOR AN OPEN	
• Measure the resistance between driver heated seat backrest element C365-2, circuit GD133 (BK) or passenger C335-2, circuit GD151 (BK/GN), harness side and ground.	**Yes** INSTALL a new heated seat switch. REFER to Heated Seat Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable.

 • **Is the resistance less than 5 ohms?**	CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR driver circuit GD133 (BK) or passenger circuit GD151 (BK/GN). TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT safety belt buckle and pretensioner C3201 (driver) or C3202 (passenger). CONNECT seat side air bag module C3049 (driver) or C3050 (passenger). REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test O: The Power Lumbar is Inoperative

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation

The seat control switch is supplied battery voltage on circuit SBB14 (BN/RD) (power seat) or SBP01 (RD) (memory seat) and ground on circuit GD133 (BK). When the knob of the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the lumbar control switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

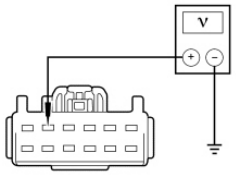
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Lumbar control switch
- Power lumbar motor assembly

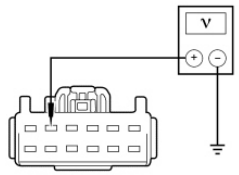
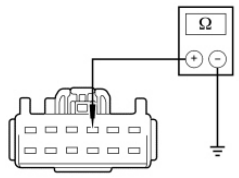
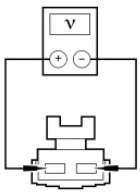
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PINPOINT TEST O: THE POWER LUMBAR IS INOPERATIVE

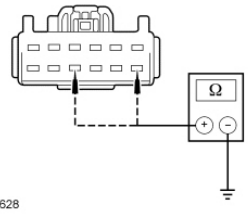
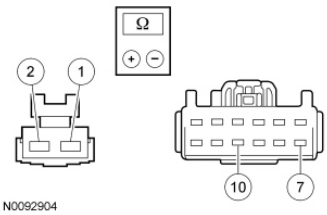
NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
O1 CHECK CIRCUIT SBB14 (BN/RD) (POWER SEAT) OR SBP01 (RD) (MEMORY SEAT) FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Safety Belt Buckle Pretensioner C3201. • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Seat Control Switch C352. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • For power seat, measure the voltage between seat control switch C352-5, circuit SBB14 (BN/RD), harness side and ground.  N0010816 • For memory seat, measure the voltage between seat control switch C352-5, circuit SBP01 (RD), harness side and ground.	**Yes** GO to O2 . **No** VERIFY Battery Junction Box (BJB) fuse 14 (40A) (power seat) or Smart Junction Box (SJB) fuse 1 (20A) (memory seat) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

 N0010816 • **Is the voltage greater than 10 volts?**	
O2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Measure the resistance between seat control switch C352-3, circuit GD133 (BK), harness side and ground.  N0010815 • **Is the resistance less than 5 ohms?**	**Yes** GO to O3 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
O3 CHECK THE LUMBAR MOTOR	
• Connect: Seat Control Switch C352. • Disconnect: Power Lumbar Motor C366. • Measure the voltage between power lumbar motor C366-1, circuit CPS18 (BN/WH), harness side and power lumbar motor C366-2, circuit CPS19 (GY/VT), harness side.  N0040627 • Operate the seat control switch in both directions. • **Is the voltage greater than 10 volts in both directions?**	**Yes** INSTALL a new power lumbar assembly. REFER to Lumbar Assembly in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** GO to O4 .
O4 CHECK CIRCUITS CPS19 (GY/VT) AND CPS18 (BN/GN) FOR A SHORT TO GROUND	

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• Disconnect: Seat Control Switch C352. • Measure the resistance between: ♦ seat control switch C352-7, circuit CPS19 (GY/VT), harness side and ground. ♦ seat control switch C352-10, circuit CPS18 (BN/GN), harness side and ground.  N0040628 • **Are the resistances greater than 10,000 ohms.**	**Yes** GO to O5 . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
O5 CHECK CIRCUITS CPS19 (GY/VT) AND CPS18 (BN/GN)/(BN/WH) FOR AN OPEN	
• Measure the resistance between: ♦ seat control switch C352-10, circuit CPS18 (BN/GN), harness side and power lumbar motor C366-1, circuit CPS18 (BN/WH), harness side. ♦ seat control switch C352-7, circuit CPS19 (GY/VT), harness side and power lumbar motor C366-2, circuit CPS19 (GY/VT), harness side.  N0092904 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new seat control switch. REFER to Seat Control Switch in this section. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** REPAIR the circuit. TEST the system for normal operation. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle and pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

Pinpoint Test P: The Seat Backrest Will Not Fold Down/Fold Upright - Second Row 60 Percent or 40 Percent E-Z Entry Seat

Normal Operation

When the recliner handle is turned, it releases the outboard recliner. This also turns a gear drive in the outboard recliner, resulting in the recliner release shaft turning in the opposite direction of the recliner handle. When the recliner release shaft is turned, it releases the inboard recliner. This allows the backrest to fold down.

When the backrest is down, there are 2 safeties that prevent the backrest from being positioned upright (vertical) under 2 different conditions. The first condition is if the latch feet are not completely latched around the mounting plate strikers. When this happens, the cable attached to the latch feet assembly outboard latch foot holds the outboard recliner outer lock out lever back, engaging the safety, preventing the backrest from being positioned upright (vertical) and locking in position. The second condition is if the kneeling mechanism is not completely locked in the standing (upright) position. When this happens, the cable attached to the kneeling mechanism inboard leg lever holds the outboard recliner inner lock out lever back, engaging the safety, preventing the backrest from being positioned upright (vertical).

If the backrest is not folded forward and all the way down, the seat will not kneel or go up into the E-Z entry position. The backrest cannot be returned to the upright (vertical) position until the kneeling mechanism is returned to the standing (upright) position and the latch feet assembly is latched to the mounting plate strikers.

This pinpoint test is intended to diagnose the following:

- Recliner handle or loose screw
- Inboard recliner
- Outboard recliner
- Cable assembly routing
- Cable assembly
- Kneeling mechanism release handle and cable
- Kneeling mechanism
- Latch feet assembly
- Recliner release shaft
- Cushion frame

PINPOINT TEST P: THE SEAT BACKREST WILL NOT FOLD DOWN/FOLD UPRIGHT - SECOND ROW 60 PERCENT OR 40 PERCENT E-Z ENTRY SEAT

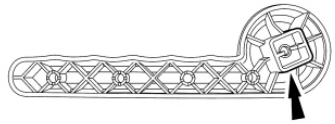
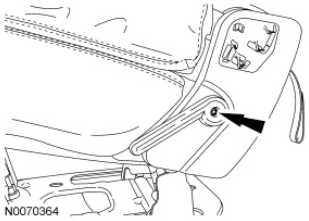
NOTE: Carry out this pinpoint test with the seat in vehicle and all fasteners tightened to specification.

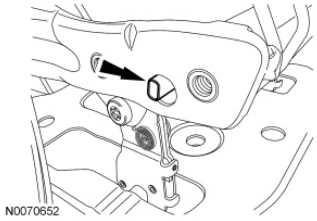
NOTE: The backrest cannot be returned to the upright (vertical) position until the kneeling mechanism is returned to the standing (upright) position and the latch feet assembly is latched to the mounting plate strikers.

NOTE: 40 percent seat shown, 60 percent similar.

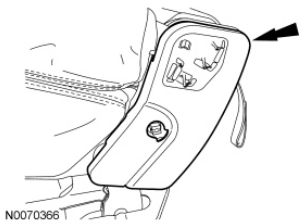
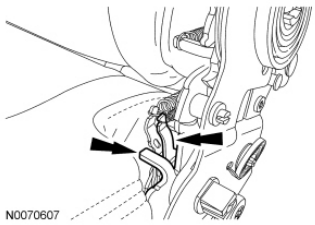
Test Step	Result / Action to Take
P1 CHECK THE RECLINER HANDLE	
NOTICE: **If the outboard recliner is binding, it may be the cause of recliner handle damage. After installing a new recliner handle, use care when checking backrest function as not to damage another recliner handle.**	**Yes** TIGHTEN the screw or INSTALL a new recliner handle. CHECK the seat for correct operation. If the backrest still does not function correctly, GO to P2 . **No** GO to P2 .

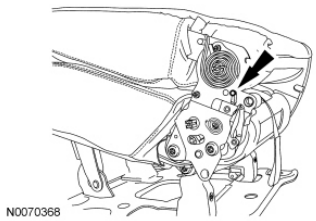
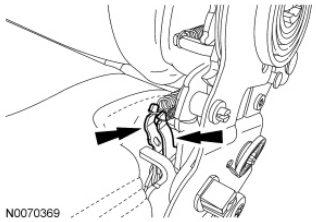
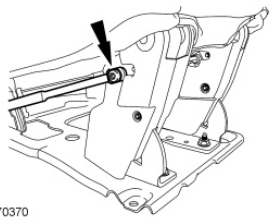
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• Make sure the recliner handle square drive is not damaged.  N0070365 • Make sure the recliner handle screw is tight.  N0070364 • **Is the recliner handle screw loose or is the square drive damaged?**	
P2 CHECK BACKREST FUNCTION	
• Cycle the backrest. ♦ Lower the head restraint by pulling on the strap. ♦ Turn the recliner handle or pull the third row occupant release strap and fold the backrest forward and down until it lays flat. ♦ Return the seat backrest to the upright (vertical) position. Make sure the seat backrest is locked in position. • **Does the backrest fold forward and down and can it be returned to lock in the upright (vertical) position?**	**Yes** Repeat folding the backrest forward and down and returning it to lock in the upright (vertical) position a few times to verify repeatability. INSTRUCT the customer on correct function of the seat from the principles of operation or Owner's Literature. **No** If the backrest does not fold forward and down, GO to P3 . If the backrest does not fold upright (vertical) and lock in position, GO to P5 .
P3 CHECK THE OUTBOARD RECLINER	
• ***NOTICE:*** **Do not pull too hard on the recliner handle. If the outboard recliner is binding, it may cause damage to the recliner handle.** • Turn the recliner handle and attempt to release the backrest to fold forward and down. • **Did only the outboard recliner release and the backrest move forward on that side while the inboard recliner did not release?**	**Yes** GO to P4 . **No** INSTALL a new outboard recliner. REFER to Seat Recliner - Second Row, 40 Percent E-Z Entry or Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry in this section. CHECK the seat for correct operation.
P4 CHECK THE INBOARD RECLINER AND RECLINER RELEASE SHAFT	

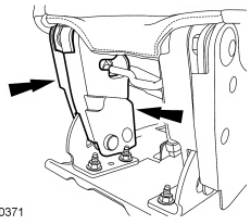
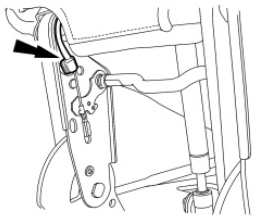
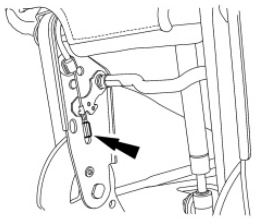
• **⚠ WARNING: Use care when the seat back frame is removed and when releasing the recliners from a backrest upright position. The recliners are spring-loaded, which may cause the recliner upper arms to fold with significant speed/force. Failure to follow this instruction may result in serious personal injury.** • Remove the outboard recliner. Refer to Seat Recliner - Second Row, 40 Percent E-Z Entry or Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry in this section. • **NOTE:** The recliner release shaft is splined to the inboard recliner. Before turning the recliner release shaft, make sure it is still attached to the inboard recliner stub. • Turn the recliner release shaft and release the inboard recliner. ♦ For 40 percent E-Z entry seat, turn the recliner release shaft counterclockwise. ♦ For 60 percent E-Z entry seat, turn the recliner release shaft clockwise.  N0070652 • **Did the inboard recliner release, folding the backrest forward and down?**	**Yes** The recliner release shaft should pass through the center of the cushion frame and not come in contact with anything other than the connection point at the inboard and outboard recliners. INSPECT the recliner release shaft for marks of being hit and binding. INSPECT the cushion frame opening where the recliner release shaft passes for anything that may come in contact with the recliner release shaft. INSPECT the cushion frame and inboard and outboard recliner attachment points. The recliners should meet flush, without any unwanted and obvious bends in their structures. MAKE SURE the recliner release shaft is not bent. Any bent parts can cause the recliner release shaft not to be centered in the cushion frame opening, resulting in binding of the recliner release shaft and inboard or outboard recliners. INSTALL new parts as necessary. CHECK the seat for correct operation. **No** INSTALL a new inboard recliner. REFER to Seat Recliner - Second Row, 40 Percent E-Z Entry or Seat Recliner - Inboard, Second Row, 60 Percent E-Z Entry in this section. CHECK the seat for correct operation.
P5 CHECK THE LATCH FEET ASSEMBLY AND KNEELING MECHANISM ARE LOCKED IN PLACE	
• **NOTE:** The backrest cannot be returned to the upright (vertical) position until the kneeling mechanism is returned to the standing (upright) position and the latch feet assembly is latched to the mounting plate strikers. • **NOTE:** Make sure the striker pockets in the floor do not have anything in them. • Make sure the latch feet are fully engaged around the mounting plate strikers. ♦ Turn the recliner release handle and unlatch the latch feet assembly from the mounting plate strikers. ♦ Lift and pivot the seat up to the E-Z entry position. ♦ Push the rear of the seat down with moderate force, latching the latch feet to	**Yes** REPEAT folding the backrest down and positioning the seat to the E-Z entry position and then back down, latching the latch feet assembly to the floor strikers. REPEAT kneeling the seat and then locking back in a standing (upright) position. ATTEMPT to latch the backrest in the upright (vertical) position. If the backrest latched in the upright (vertical) position again, INSTRUCT the customer that the latch feet assembly must be latched to the mounting plate strikers and the kneeling mechanism must be locked in

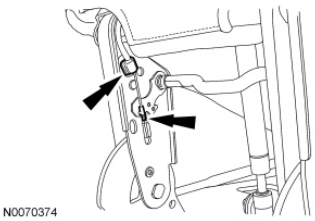
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the mounting plate strikers. Make sure the seat is latched to the mounting plate strikers by lifting up on the rear of the seat. • Make sure the kneeling mechanism is locked in the standing (upright) position. ♦ Lift the kneeling mechanism release handle in the back of the backrest and moderately push the seat forward and down into the kneel position. ♦ Left with moderate force at the front of the seat cushion frame, pivot the seat up and toward the rear of the vehicle until the kneeling mechanism is locked in place. ♦ Make sure the kneeling mechanism is locked in position by pushing the seat forward and down. • Attempt to latch the backrest in the upright (vertical) position. • **Did the backrest latch in the upright (vertical) position?**	place in a standing (upright) position before the backrest will latch in the upright (vertical) position. **No** GO to P6 .
P6 CHECK THE OUTBOARD RECLINER OUTER LOCK OUT LEVER	
• Remove the screw and recliner handle. • Remove the outboard recliner outboard cover.  N0070366 • **NOTE:** The outboard recliner inner cover has been removed for clarity. • The outboard recliner outer lock out lever must be forward and close to the forward stop bar to position the backrest in the upright (vertical) position.  N0070607 • **Is the outboard recliner outer lock out lever in the forward position?**	**Yes** INSTALL a new outboard recliner. REFER to Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry or Seat Recliner - Second Row, 40 Percent E-Z Entry in this section. CHECK the seat for correct operation. **No** GO to P7 .
P7 CHECK THE OUTBOARD RECLINER INNER AND OUTER LOCK OUT LEVERS	

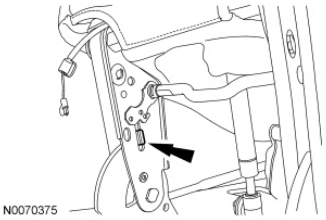
• Actuate the pin up and down at the side of the outboard recliner.  N0070368 • While actuating the pin up and down, monitor if the inner and outer lock out levers move in the outboard recliner.  N0070369 • **Did either or both lock out levers move?**	**Yes** If the inner lock out lever moved, GO to P8 . If the outer lock out lever moved, GO to P13 . If the inner and outer lock out levers both moved, INSTALL a new cable assembly from the outboard recliner to the outboard latch foot and inboard kneeling mechanism leg. CHECK the seat for correct operation. **No** INSTALL a new outboard recliner. REFER to Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry or Seat Recliner - Second Row, 40 Percent E-Z Entry in this section. CHECK the seat for correct operation.
P8 CHECK THE CABLE ASSEMBLY AT THE KNEELING MECHANISM INBOARD LEG TO THE OUTBOARD RECLINER	
• Remove the latch feet retracting link-to-kneeling mechanism bolt and separate the retracting link from the kneeling mechanism.  N0070370 • Release the cushion trim cover hook-and-loop strip at the front of the cushion to aide removal of the kneeling mechanism leg covers. • Remove the kneeling mechanism inboard leg inner and outer covers.	**Yes** ROUTE the cable assembly correctly or INSTALL a new cable assembly from the outboard recliner to the outboard latch foot and inboard kneeling mechanism leg. CHECK the seat for correct operation. **No** GO to P9 .

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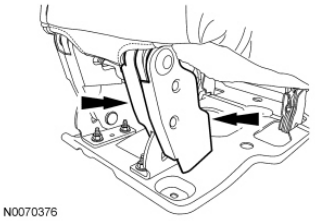
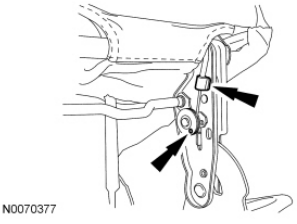
 N0070371 • Inspect the cable casing for pulling out of the anchor.  N0070372 • Inspect the cable assembly for any other obvious signs of kinking or damage. • Inspect the cable assembly for not being routed correctly. Refer to Seat Cushion - Second Row, 40 Percent E-Z Entry or Seat Cushion - Second Row, 60 Percent, E-Z Entry in this section. • **Is the cable assembly not routed correctly or is there casing and anchor damage?**	
P9 CHECK THE KNEELING MECHANISM IS LOCKED IN THE STANDING (UPRIGHT) POSITION	
• Using light finger pressure, try to move the sliding pin from side to side.  N0070373 • **Does the sliding pin move?**	**Yes** GO to P10 . **No** GO to P12 .
P10 CHECK THE KNEELING MECHANISM IS LOCKED IN THE STANDING (UPRIGHT) POSITION	
• Unlock the cable assembly anchor from the kneeling mechanism inboard leg and separate the cable end from the lever.	**Yes** GO to P11 . **No** INSTALL a new cable assembly from the outboard recliner to the outboard latch foot and inboard kneeling mechanism leg. CHECK the seat for correct operation.


N0070374

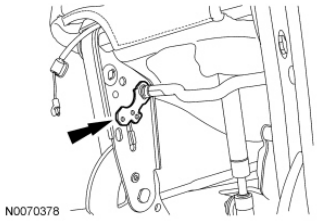
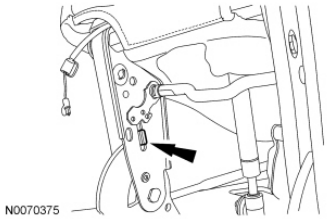
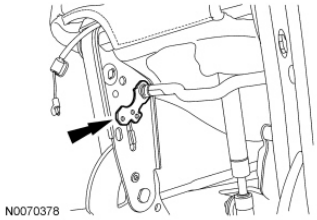
- Lift the kneeling mechanism release handle in the backrest and moderately push the seat forward and down into the kneel down load floor position. Lift with moderate force at the front of the seat cushion frame, pivot the seat up and toward the rear of the vehicle until the kneeling mechanism is locked in place. Make sure the kneeling mechanism is locked in position by pushing the seat forward and down.
- Using light finger pressure, try to move the sliding pin from side to side.

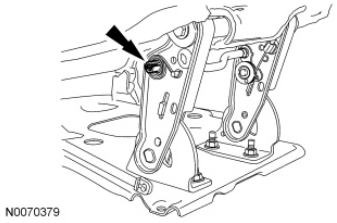
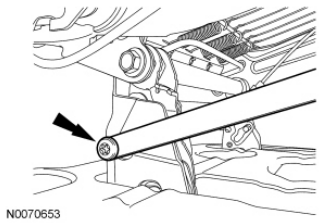
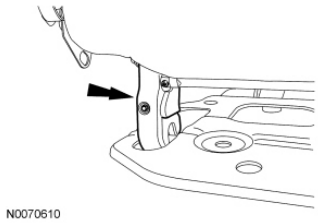

N0070375

- **Does the sliding pin move?**

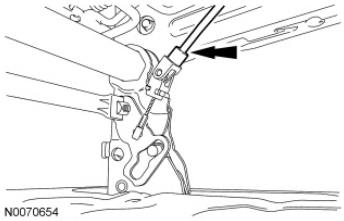
P11 CHECK THE RELEASE CABLE AT THE KNEELING MECHANISM	
• Remove the kneeling mechanism outboard leg inner and outer covers.  N0070376 • Unlock the release cable anchor from the kneeling mechanism outboard leg and separate the cable end from the pulley.  N0070377	**Yes** INSTALL a new kneeling mechanism. CHECK the seat for correct operation. **No** INSTALL a new kneeling mechanism release handle and cable. CHECK the seat for correct operation.

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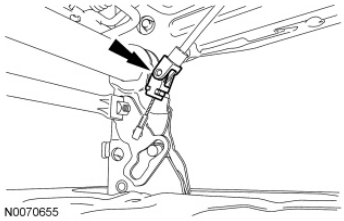
• *NOTICE:* **Do not put a wrench on the latch feet release bar to attempt to release the latches. Damage to the latch feet release bar or latch feet assembly may occur.** • Using the lever on the kneeling mechanism inboard leg, turn the lever and moderately push the seat forward and down into the kneel down load floor position. Lift up with moderate force at the front of the seat cushion frame, pivot the seat up and toward the rear of the vehicle until the kneeling mechanism is locked in place. Make sure the kneeling mechanism is locked in position by pushing the seat forward and down.  N0070378 • **NOTE:** Inboard leg sliding pin shown, outboard similar. • Using light finger pressure, try to move the inboard and outboard sliding pins from side to side.  N0070375 • **Do the sliding pins move?**	
P12 CHECK THE KNEELING MECHANISM INBOARD LEG LEVER FOR LOOSENESS	
• Turn the lever on the kneeling mechanism inboard leg back and forth.  N0070378 • While turning the lever on the kneeling mechanism inboard leg back and forth, monitor if the pivot	**Yes** INSTALL a new cable assembly from the outboard recliner to the outboard latch foot and inboard kneeling mechanism leg. CHECK the seat for correct operation. **No** INSTALL a new kneeling mechanism. CHECK the seat for correct operation.

moves at the same time without any delay in movement (movement must be synchronized and simultaneous). There must not be any play (wasted movement) from when the lever on the kneeling mechanism inboard leg is turned to when the pivot moves.  N0070379 • **When the lever on the kneeling mechanism inboard leg was actuated, did the pivot move at the same time and without any delay in movement?**	
P13 CHECK THE CABLE ASSEMBLY AT THE OUTBOARD LATCH FOOT	
• Remove the latch feet retracting link-to-latch feet assembly bolt and separate the latch feet retracting link from the inboard latch foot.  N0070653 • Remove the outboard latch foot cover.  N0070610 • Inspect the cable assembly at the outboard latch foot for the cable casing pulling out of the anchor (swivel).	**Yes** ROUTE the cable assembly correctly or INSTALL a new cable assembly from the outboard recliner to the outboard latch foot and inboard kneeling mechanism leg. CHECK the seat for correct operation. **No** GO to P14 .

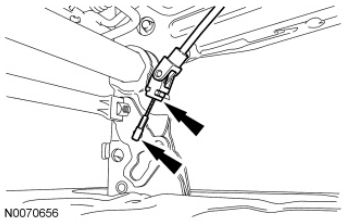
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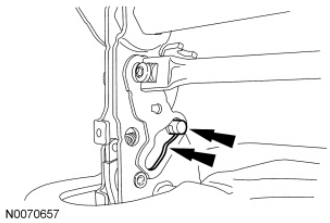


- Inspect the cable assembly swivel at the outboard latch foot for not operating freely.



- Inspect the cable assembly for any other obvious signs of kinking or damage.
- Inspect the cable assembly for not being routed correctly. Refer to Seat Cushion - Second Row, 40 Percent E-Z Entry or Seat Cushion - Second Row, 60 Percent, E-Z Entry in this section.
- **Is the cable assembly not routed correctly or is there casing and anchor damage?**

P14 CHECK THE OUTBOARD LATCH FOOT RELEASE LEVER	
• Separate the cable assembly anchor (swivel) at the outboard latch foot. Turn the cable end to align to the key way and separate the cable end from the outboard latch foot release lever.  • The pin on the outboard latch foot should be two-thirds of the way up, to the right of the bump, in the release lever slot or higher.	**Yes** INSTALL a new cable assembly from the outboard recliner to the outboard latch foot and inboard kneeling mechanism leg. CHECK the seat for correct operation. **No** INSTALL a new latch feet assembly. CHECK the seat for correct operation.

 N0070657 • **Is the pin on the outboard latch foot two-thirds of the way up, to the right of the bump, in the release lever slot or higher?**	

Pinpoint Test Q: The Seat Will Not Release/Latch to the Floor Strikers - Second Row 60 Percent and 40 Percent E-Z Entry Seat

Normal Operation

When the recliner handle is turned, it releases the outboard recliner. This also turns a gear drive in the outboard recliner, resulting in the recliner release shaft turning in the opposite direction of the recliner handle. When the recliner release shaft is turned, it releases the inboard recliner. This allows the backrest to fold down.

When the backrest is down, there are 2 safeties that prevent the backrest from being positioned upright (vertical) under 2 different conditions. The first condition is if the latch feet are not completely latched around the mounting plate strikers. When this happens, the cable attached to the latch feet assembly outboard latch foot holds the outboard recliner outer lock out lever back, engaging the safety, preventing the backrest from being positioned upright (vertical) and locking in position. The second condition is if the kneeling mechanism is not completely locked in the standing (upright) position. When this happens, the cable attached to the kneeling mechanism inboard leg lever holds the outboard recliner inner lock out lever back, engaging the safety, preventing the backrest from being positioned upright (vertical).

If the backrest is not folded forward and all the way down, the seat will not kneel or go up into the E-Z entry position. The backrest cannot be returned to the upright (vertical) position until the kneeling mechanism is returned to the standing (upright) position and the latch feet assembly is latched to the mounting plate strikers.

This pinpoint test is intended to diagnose the following:

- Recliner handle or loose screw
- Outboard recliner
- Cable assembly
- Latch feet retracting link
- Latch feet assembly
- Mounting plate

PINPOINT TEST Q: THE SEAT WILL NOT RELEASE/LATCH TO THE FLOOR STRIKERS - SECOND ROW 60 PERCENT AND 40 PERCENT E-Z ENTRY SEAT

NOTE: Carry out this pinpoint test with the seat in vehicle and all fasteners tightened to specification.

NOTE: The backrest must function correctly before any further testing of the seat can be done.

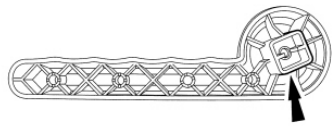
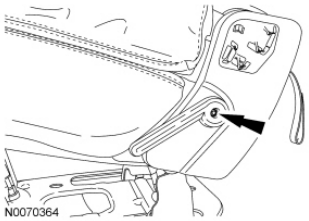
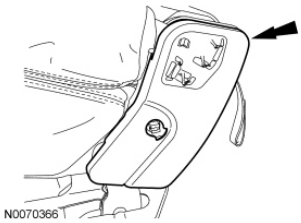
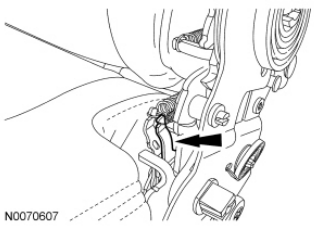
NOTE: To release the latch feet from the mounting plate strikers and position the seat to the E-Z entry position, the backrest must be folded forward and all the way down. Remove anything between the backrest and cushion that may prevent the backrest from folding all the way down. After folding the backrest forward

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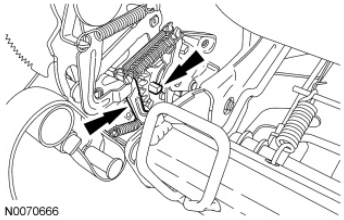
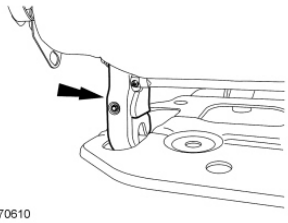
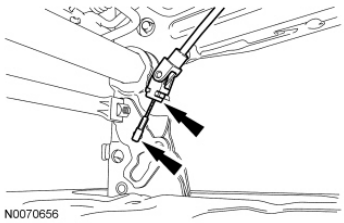
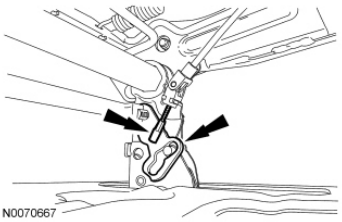
and down, release the recliner handle or third row strap, then turn the recliner handle or pull the third row strap a second time and lift up on the rear of the seat.

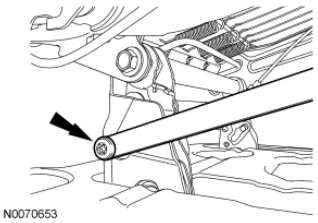
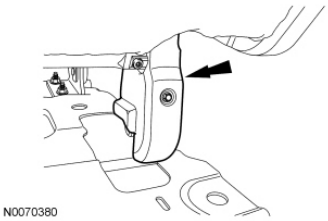
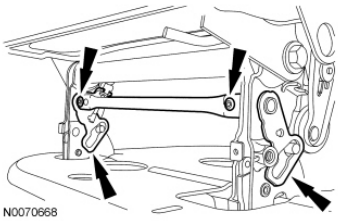
NOTE: 40 percent seat shown, 60 percent similar.

Test Step	Result / Action to Take
Q1 CHECK BACKREST FUNCTION	
• Cycle the backrest. ♦ Lower the head restraint by pulling on the strap. ♦ Turn the recliner handle or pull the third row occupant release strap and fold the backrest forward and down until it lays flat. ♦ Return the seat backrest to the upright (vertical) position. Make sure the seat backrest is locked in position. • **Does the backrest fold forward and down and can it be returned to lock in the upright (vertical) position?**	**Yes** If the backrest functions correctly, GO to Q2 . **No** If the backrest does not function correctly, GO to Pinpoint Test P .
Q2 CHECK THE LATCH FEET ASSEMBLY FUNCTION	
• **NOTE:** Remove anything between the backrest and cushion. If the backrest is not down all the way, the safety may not disengage. • Turn the recliner handle and fold the backrest forward and all the way down. • **NOTE:** After folding the backrest forward and down, the recliner handle has to be released and turned a second time before the latch feet assembly will release from the floor strikers. • Release the recliner handle and turn it a second time to release the latch feet from the floor strikers. • Push the rear of the seat down with moderate force to latch the seat to the mounting plate strikers. Make sure the seat is latched to the mounting plate strikers by lifting up on the rear of the seat. • If possible, repeat steps 2 and 3, making sure the function of the seat is repeatable. • **Will the latch feet release from the floor strikers and return to clasp around the mounting plate strikers?**	**Yes** EXPLAIN to the customer that the backrest must be all the way down and nothing can be between the cushion and backrest before the latch feet assembly will release from the mounting plate strikers and be able to return to clasp around the mounting plate strikers. **No** If the latch feet will not release from the floor strikers, GO to Q3 . If the latch feet will not clasp around the floor strikers, GO to Q8 .
Q3 CHECK THE RECLINER HANDLE	
NOTE: If the outboard recliner is binding, it may be the cause of recliner handle damaged. After installing a new recliner handle, use care when checking backrest function as not to damage another recliner handle. • Make sure the recliner handle square drive is not damaged.	**Yes** TIGHTEN the screw or INSTALL a new recliner handle. CHECK the seat for correct operation. If the latch feet still do not release from the floor strikers, GO to Q4 . **No** GO to Q4 .

 N0070365 • Make sure the recliner handle screw is tight.  N0070364 • **Is the recliner handle screw loose or is the square drive damaged?**	
Q4 CHECK THE OUTBOARD RECLINER OUTER LOCK OUT LEVER FUNCTION	
• Remove the outboard recliner inboard and outboard covers.  N0070366 • **NOTE:** Remove anything between the backrest and cushion that may prevent the backrest from folding all the way down. • Fold the backrest forward and all the way down. • ***NOTICE:*** **Do not pull too hard on the recliner handle. If the outboard recliner is binding, it may cause damage to the recliner handle.** • Turn the recliner handle back and forth and monitor the outboard recliner outer lock out lever.  N0070607 • **Does the outboard recliner outer lock out lever move while actuating the recliner handle back and forth?**	**Yes** GO to Q5 . **No** If the recliner handle moves and the outer lock out lever does not, INSTALL a new outboard recliner. REFER to Seat Recliner - Second Row, 40 Percent E-Z Entry or Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry in this section. CHECK the seat for correct operation. If the recliner handle does not move, GO to Q5 .
Q5 CHECK THE OUTBOARD RECLINER LEVER LOCATION	

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• With the backrest folded forward and all the way down and the recliner handle released, the outboard recliner lever must be positioned away from the post.  N0070666 • **Is the outboard recliner lever in any other position?**	**Yes** INSTALL a new outboard recliner. REFER to Seat Recliner - Second Row, 40 Percent E-Z Entry or Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry in this section. CHECK the seat for normal operation. **No** GO to Q6 .
Q6 CHECK THE OUTBOARD LATCH FOOT RELEASE LEVER	
• Remove the outboard latch foot cover.  N0070610 • Make sure the cable assembly casing and anchor (swivel) are attached at the outboard latch foot.  N0070656 • Turn the recliner handle back and forth and monitor if the cable moves the outboard latch foot release lever at the same time without any delay in movement (movement must be synchronized and simultaneous). There must not be any play (wasted movement) from when the recliner handle is turned to when the cable moves the outboard latch foot release lever.  N0070667	**Yes** GO to Q7 . **No** INSTALL a new cable assembly. CHECK the seat for normal operation.

• **When the recliner handle was actuated, did the cable move the outboard latch foot release lever at the same time and without any delay in movement?**	
Q7 CHECK THE LATCH FEET ASSEMBLY AND CABLE ASSEMBLY	
• Remove the latch feet retracting link-to-latch feet assembly bolt and separate the latch feet retracting link from the inboard latch foot.  N0070653 • Remove the inboard latch foot cover.  N0070380 • Turn the recliner handle back and forth and monitor if the cable moves the latch feet assembly outboard latch foot release lever, latch feet release bar and inboard latch foot release lever at the same time (movement must be synchronized and simultaneous). There must not be any play (wasted movement) between any of these components. Make sure the latch feet release rod meets flush with the latch feet assembly pivots and the screws are tight. Make sure that the latch feet release rod is free to move and the latch feet assembly is not binding.  N0070668 • **When the recliner handle was actuated, did the cable move the outboard latch foot release lever, latch feet release bar and inboard latch foot release lever at the same time and without any delay in movement?**	**Yes** INSTALL a new cable assembly. CHECK the seat for normal operation. **No** INSTALL a new latch feet assembly. CHECK the seat for normal operation.
Q8 CHECK THE OUTBOARD RECLINER	

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• Make sure the latch feet jaws are not in the closed position. If they are, turn the recliner handle to open the jaws. • Make sure the latch feet align to the floor strikers. • Make sure the recliner handle is not stuck in the up or release position. • **Is the recliner handle stuck in the up position?**	**Yes** INSTALL a new outboard recliner. REFER to Seat Recliner - Second Row, 40 Percent E-Z Entry or Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry in this section. CHECK the seat for normal operation. **No** INSTALL a new latch feet retracting link, latch feet assembly or mounting plate as necessary. CHECK the seat for normal operation.

Pinpoint Test R: The Seat Will Not Kneel/Stand - Second Row 60/40 E-Z Entry Seat

Normal Operation

When the recliner handle is turned, it releases the outboard recliner. This also turns a gear drive in the outboard recliner, resulting in the recliner release shaft turning in the opposite direction of the recliner handle. When the recliner release shaft is turned, it releases the inboard recliner. This allows the backrest to fold down.

When the backrest is down, there are 2 safeties that prevent the backrest from being positioned upright (vertical) under 2 different conditions. The first condition is if the latch feet are not completely latched around the mounting plate strikers. When this happens, the cable attached to the latch feet assembly outboard latch foot holds the outboard recliner outer lock out lever back, engaging the safety, preventing the backrest from being positioned upright (vertical) and locking in position. The second condition is if the kneeling mechanism is not completely locked in the standing (upright) position. When this happens, the cable attached to the kneeling mechanism inboard leg lever holds the outboard recliner inner lock out lever back, engaging the safety, preventing the backrest from being positioned upright (vertical).

If the backrest is not folded forward and all the way down, the seat will not kneel or go up into the E-Z entry position. The backrest cannot be returned to the upright (vertical) position until the kneeling mechanism is returned to the standing (upright) position and the latch feet assembly is latched to the mounting plate strikers.

This pinpoint test is intended to diagnose the following:
- Kneeling mechanism release handle and cable
- Kneeling mechanism

PINPOINT TEST R: THE SEAT WILL NOT KNEEL/STAND - SECOND ROW 60/40 E-Z ENTRY SEAT

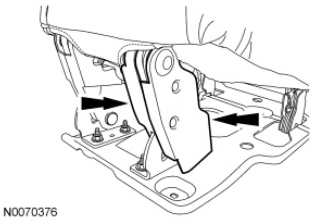
NOTE: Carry out this pinpoint test with the seat in vehicle and all fasteners tightened to specification.

NOTE: The backrest must function correctly before any further testing of the seat can be done.

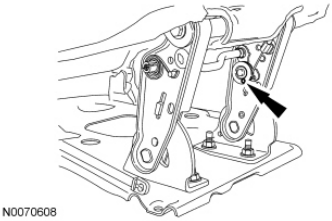
NOTE: To kneel the seat, the backrest must be folded forward and all the way down. Remove anything between the backrest and cushion.

Test Step	Result / Action to Take
R1 CHECK THE BACKREST FUNCTION	
• Cycle the backrest. ♦ Lower the head restraint by pulling on the strap. ♦ Turn the recliner handle or pull the third row occupant release strap and fold the backrest forward and down until it lays flat. ♦ Return the seat backrest to the upright (vertical) position. Make sure the seat backrest is locked in position. • **Does the backrest fold forward and down and can it be returned to lock in the upright (vertical) position?**	**Yes** If the backrest functions correctly, GO to R2 . **No** If the backrest does not function correctly, GO to Pinpoint Test P .
R2 CHECK THE KNEELING MECHANISM FUNCTION	
• **NOTE:** Remove anything between the backrest and cushion. If the backrest is not down all the way, the safety may not disengage to allow the kneeling mechanism to kneel when the release handle in the backrest is actuated. • Turn the recliner handle and fold the backrest forward and down. • Using moderate force, being careful not to break the handle, lift the kneeling mechanism release handle in the back of the backrest and moderately push the seat forward and down into the kneel position. • Lift from the bottom of the cushion frame with moderate force and pivot the seat up and toward the rear of the vehicle, rotating the seat rearward until an audible click is heard, locking the kneeling mechanism in a standing (upright) position. Make sure the kneeling mechanism is locked in position by pushing the seat forward and down. • If possible, repeat Steps 2 and 3, making sure the function of the seat is repeatable. • **Did the legs of the kneeling mechanism pivot down and kneel and return to lock in the standing (upright) position?**	**Yes** Explain to the customer that the backrest must be all the way down and nothing can be between the cushion and backrest before the kneeling mechanism will pivot down and kneel. **No** If the legs of the kneeling mechanism did not pivot down and kneel, GO to R3 . If the legs of the kneeling mechanism did not return to lock in the standing (upright) position, GO to R5 .
R3 CHECK CABLE END AND PULLEY CONNECTION LOCATION	
• Release the cushion trim cover hook-and-loop strip at the front of the cushion to aide removal of the kneeling mechanism leg covers. • Remove the kneeling mechanism outboard leg inner and outer cover.	**Yes** GO to R4 . **No** INSTALL a new kneeling mechanism release handle and cable. CHECK the seat for correct operation.

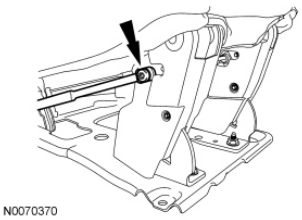
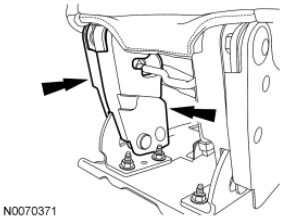
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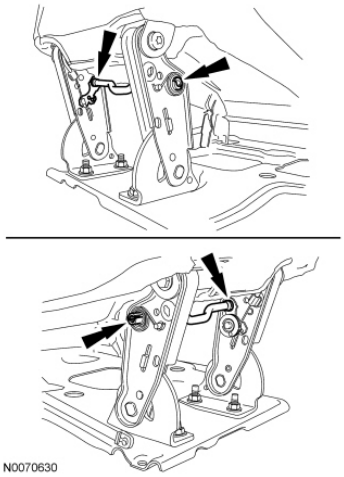

N0070376

- The cable end and pulley connection location must be at approximately the 5 o'clock position.

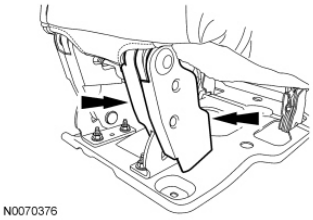
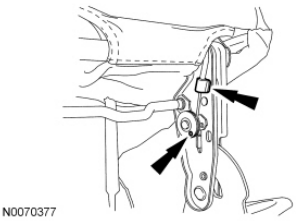

N0070608

- **Is the cable end and pulley connection point clocked at approximately the 5 o'clock position?**

R4 CHECK THE KNEELING MECHANISM	
- Remove the latch feet retracting link-to-kneeling mechanism bolt and separate the retracting link from the kneeling mechanism.  N0070370 - Remove the kneeling mechanism inboard leg inner and outer covers.  N0070371 - Using moderate force, being careful not to break the handle, lift the kneeling mechanism release handle and monitor that the pivots at the kneeling mechanism inboard and outboard legs are moving at the same time (movement must be synchronized and simultaneous). There must not be any play (wasted movement) from when the kneeling mechanism release handle is lifted to when the cable moves the pulley and lever on the kneeling mechanism outboard leg and transfers that movement through the cross rod to the lever on the kneeling mechanism inboard leg.	**Yes** INSTALL a new kneeling mechanism release handle and cable. CHECK the seat for normal operation. **No** INSTALL a new kneeling mechanism. CHECK the seat for normal operation.



- **When the kneeling mechanism release handle was actuated, did the cable move the pulley and lever on the kneeling mechanism outboard leg and transfer that movement through the cross rod to the lever on the kneeling mechanism inboard leg, making the pivots move at the same time and without any delay in movement?**

R5 CHECK CABLE END AND PULLEY CONNECTION LOCATION	
• Release the cushion trim cover hook-and-loop strip at the front of the cushion to aide removal of the kneeling mechanism leg covers. • Remove the kneeling mechanism outboard leg inner and outer cover.  • Unlock the cable casing from the kneeling mechanism outboard leg and separate the cable end from the pulley.  • Lift from the bottom of the cushion frame with moderate force and pivot the seat up and toward the rear of the vehicle, rotating the seat rearward until an audible click is heard, locking the kneeling mechanism in a standing (upright) position. Make sure the kneeling mechanism is locked in position by pushing the seat forward and down. • **Did the kneeling mechanism lock back in the standing (upright) position?**	**Yes** INSTALL a new kneeling mechanism release handle and cable. CHECK the seat for correct operation. **No** INSTALL a new kneeling mechanism. CHECK the seat for correct operation.

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Pinpoint Test S: The Power Seats are Inoperative - Third Row Power-Fold Seat

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

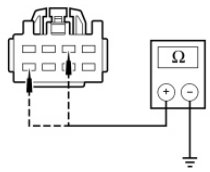
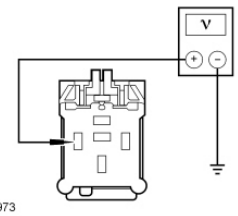
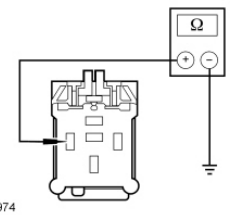
The third row power-fold seat relay is supplied battery voltage on circuits SBB12 (GN/RD) (right) and SBB05 (GY/RD) (left) and is hot at all times. The ground is supplied to each third row power-fold seat relay on the coil side through circuit CPS48 (BU) and controlled by the Smart Junction Box (SJB). The power-fold seat relays will be provided ground on the coil side from the SJB for 30 minutes when the transmission selector lever is in PARK, and the liftgate, or liftgate glass, is open. The ground will be disabled 30 minutes after turning the vehicle off. If the ground is disabled after 30 minutes, the ground can be enabled by opening any door, pressing the unlock key on the key fob, pressing any keyless keypad button or turning the ignition key.

- DTC B2794 Third Row Power Fold Circuit Failure - When SJB outputs to the left or right third row power-fold seat relay and short to voltage is present or when SJB output to the left or right third row power-fold seat relay is inactive and a short to ground is present, this DTC is set.

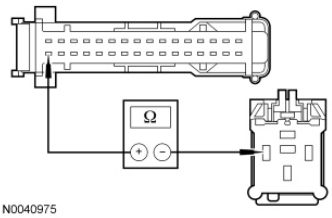
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- SJB

PINPOINT TEST S: THE POWER SEATS ARE INOPERATIVE - THIRD ROW POWER-FOLD SEAT

Test Step	Result / Action to Take
S1 CHECK DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - GEM or SJB . • **Are any DTCs present?**	**Yes** If DTC B2794 is present, GO to S3 . For any other SJB DTCs, REFER to the Smart Junction Box (SJB) DTC Chart in this section. **No** GO to S2 .
S2 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Ignition OFF. • Disconnect: Left Third Row Seat Control Switch C4179. • Measure the resistance between: ♦ left third row seat control switch C4179-2, circuit GD149 (BK/GY), harness side and ground. ♦ left third row seat switch C4179-8, circuit GD149 (BK/GY), harness side and ground.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 A0050617 • **Are the resistances less than 5 ohms?**	
S3 CHECK CIRCUIT CPS48 (BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Left Third Row Seat Relay C4183. • Disconnect: Right Third Row Seat Relay C4184. • Disconnect: SJB C2280b. • Ignition ON. • Measure the voltage between left third row seat relay C4183-85, circuit CPS48 (BU), harness side and ground.  N0040973 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. **No** GO to S4 .
S4 CHECK CIRCUIT CPS48 (BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between left third row seat relay C4183-85, circuit CPS48 (BU), harness side and ground.  N0040974 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S5 . **No** REPAIR the circuit. TEST the system for normal operation.
S5 CHECK CIRCUIT CPS48 (BU) FOR AN OPEN	
• Measure the resistance between SJB C2280b-32, circuit CPS48 (BU), harness side and left third row seat relay C4183-85, circuit CPS48 (BU), harness side.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the

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 • **Is the resistance less than 5 ohms?**	system for normal operation.

Pinpoint Test T: The Power Seat is Inoperative/Does Not Operate Correctly - Third Row Power-Fold Seat, Left

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The left third row power-fold seat relay coil side is supplied battery voltage on circuit SBB05 (GY/RD) and is hot at all times. The ground is supplied to each third row power-fold seat relay on the coil side through circuit CPS48 (BU) and controlled by the Smart Junction Box (SJB). When the left third row power-fold seat control switch is pressed, voltage is supplied through the switch side of the left third row power-fold seat relay on circuit SBB05 (GY/RD) and supplied ground on circuit GD149 (BK/GY). When pressing the left third row power-fold seat control switch in the opposite direction, the left third row power-fold seat control switch reverses the polarity to the left third row power-fold seat motor, which moves the third row seat backrest in the opposite direction.

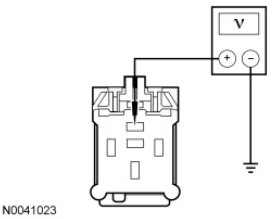
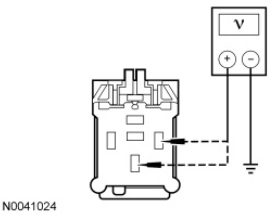
This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Left third row power-fold seat control switch
- Left third row power-fold seat relay
- Left third row power-fold seat motor

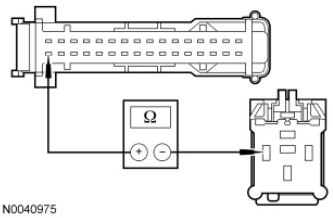
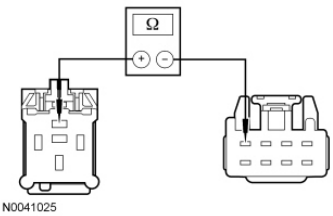
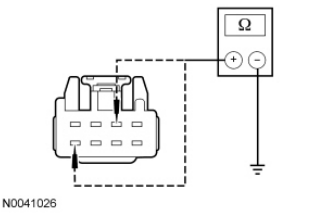
PINPOINT TEST T: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - THIRD ROW POWER-FOLD SEAT, LEFT

NOTE: The SJB may also be identified as the Generic Electronic Module (GEM).

Test Step	Result / Action to Take
T1 CHECK LH SEAT OPERATION	
• Turn the ignition on and place the transmission in NEUTRAL. • **Does the LH seat operate?**	**Yes** GO to T2 . **No** GO to T3 .
T2 CHECK CIRCUIT CPS53 (VT/BN) FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Disconnect: Left Third Row Seat Relay C4183. • Ignition ON. • Measure the voltage between left third row seat relay C4183-87, circuit CPS53 (VT/BN), harness side and ground.  N0041023 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new left third row seat relay. TEST the system for normal operation.
T3 CHECK CIRCUIT SBB05 (GY/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: Left Third Row Seat Relay C4183. • Measure the voltage between: ♦ left third row seat relay C4183-30, circuit SBB05 (GY/RD), harness side and ground. ♦ left third row seat relay C4183-86, circuit SBB05 (GY/RD), harness side and ground.  N0041024 • **Are the voltages greater than 10 volts?**	**Yes** GO to T4 . **No** VERIFY Battery Junction Box (BJB) fuse 5 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation.
T4 CHECK LEFT THIRD ROW SEAT RELAY	
• Carry out the component test on the left third row seat relay. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the relay pass?**	**Yes** GO to T5 . **No** INSTALL a new left third row seat relay. TEST the system for normal operation.
T5 CHECK CIRCUIT CPS48 (BU) FOR AN OPEN	
• Disconnect: Right Third Row Seat Relay C4184. • Disconnect: SJB C2280b. • Measure the resistance between left third row seat relay C4183-85, circuit CPS48 (BU), harness side and SJB C2280b-32, circuit CPS48 (BU).	**Yes** GO to T6 . **No** REPAIR the circuit. TEST the system for normal operation.

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 N0040975 • **Is the resistance less than 5 ohms?**	
T6 CHECK CIRCUIT CPS53 (VT/BN) FOR AN OPEN	
• Disconnect: Left Third Row Seat Control Switch C4179. • Measure the resistance between left third row seat relay C4183-87, circuit CPS53 (VT/BN), harness side and left third row seat switch C4179-4, circuit CPS53 (VT/BN), harness side.  N0041025 • **Is the resistance less than 5 ohms?**	**Yes** GO to T7 . **No** REPAIR the circuit. TEST the system for normal operation.
T7 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Measure the resistance between: ♦ left third row power-fold seat control switch C4179-8, circuit GD149 (BK/GY), harness side and ground. ♦ left third row power-fold seat control switch C4179-2, circuit GD149 (BK/GY), harness side and ground.  N0041026 • **Are the resistances less than 5 ohms?**	**Yes** GO to T8 . **No** REPAIR the circuit. TEST the system for normal operation.
T8 CHECK LEFT THIRD ROW POWER-FOLD SEAT CONTROL SWITCH	

- Disconnect: Left Third Row Power-Fold Seat Control Switch C4179.
- Using the following table, check the left third row power-fold seat control switch. Measure the resistance between the left third row power-fold seat control switch pins, component side, while pressing the indicated switch buttons and compare the results to the table. The resistance measurement must fall within the tolerance given.

Seat Control Switch Button Position	Pins	Results
Up	2 and 3	Greater than 5 ohms
Rest	2 and 3	Less than 5 ohms
Fold	2 and 3	Less than 5 ohms
Up	3 and 4	Less than 5 ohms
Rest	3 and 4	Greater than 5 ohms
Fold	3 and 4	Greater than 5 ohms
Up	4 and 7	Greater than 5 ohms
Rest	4 and 7	Greater than 5 ohms
Fold	4 and 7	Less than 5 ohms
Up	7 and 8	Less than 5 ohms
Rest	7 and 8	Less than 5 ohms
Fold	7 and 8	Greater than 5 ohms

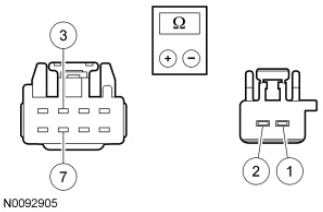
- Carry out the Third Row Power-Fold Seat Control Switch Component Test.
- **Did the switch pass?**

Yes
GO to T9 .

No
INSTALL a new switch. REFER to Seat Control Switch - Third Row in this section. TEST the system for normal operation.

T9 CHECK CIRCUITS CPS50 (BU/BN) AND CPS49 (BN/GN) FOR AN OPEN

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• Disconnect: Left Third Row Seat Motor C4181. • Measure the resistance between: ♦ left third row seat switch C4179-3, circuit CPS50 (BU/BN), harness side and left third row seat motor C4181-1, circuit CPS50 (BU/BN), harness side. ♦ left third row seat switch, C4179-7, circuit CPS49 (BN/GN), harness side and left third row seat motor C4181-2, circuit CPS49 (BN/GN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new left third row power seat motor. REFER to Seat Control Switch - Third Row in this section. TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

Pinpoint Test U: The Power Seat is Inoperative/Does Not Operate Correctly - Third Row Power-Fold Seat, Right

Refer to Wiring Diagrams Cell 120 , Power Seats for schematic and connector information.

Normal Operation

The right third row power-fold seat relay coil side is supplied battery voltage on circuit SBB12 (GN/RD) and is hot at all times. The ground is supplied to the right third row power-fold seat relay on the coil side through circuit CPS48 (BU) and controlled by the Smart Junction Box (SJB). When the right third row power-fold seat control switch is pressed, voltage is supplied through the switch side of the left third row power-fold seat relay on circuit SBB12 (GN/RD) and supplied ground on circuit GD149 (BK/GY). When pressing the right third row power-fold seat control switch in the opposite direction, the right third row power-fold seat control switch reverses the polarity to the right third row power-fold seat motor, which moves the third row seat backrest in the opposite direction.

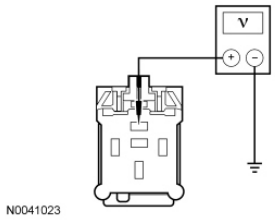
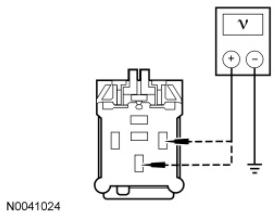
This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Right third row power-fold seat control switch
- Right third row power-fold seat relay
- Right third row power-fold seat motor
- SJB

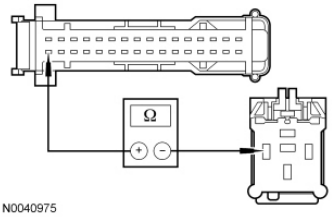
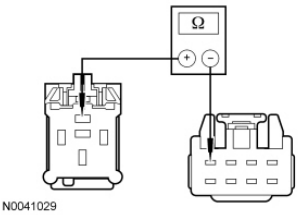
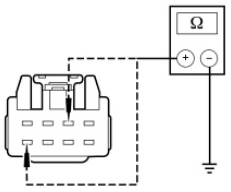
PINPOINT TEST U: THE POWER SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - THIRD ROW POWER-FOLD SEAT, RIGHT

NOTE: The SJB may also be identified as the Generic Electronic Module (GEM).

Test Step	Result / Action to Take
U1 CHECK RH SEAT OPERATION	

• Turn the ignition on and place the transmission in NEUTRAL. • **Does the RH seat operate?**	**Yes** GO to U2 . **No** GO to U3 .
U2 CHECK CIRCUIT CPS54 (WH/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Right Third Row Seat Switch C4184. • Ignition ON. • Measure the voltage between right third row seat relay C4184-87, circuit CPS54 (WH/OG), harness side and ground.  N0041023 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new right third row seat relay. TEST the system for normal operation.
U3 CHECK CIRCUIT SBB12 (GN/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: Right Third Row Seat Relay C4184. • Measure the voltage between: ♦ right third row seat relay C4184-30, circuit SBB12 (GN/RD), harness side and ground. ♦ right third row seat relay C4184-86, circuit SBB12 (GN/RD), harness side and ground.  N0041024 • **Are the voltages greater than 10 volts?**	**Yes** GO to U4 . **No** VERIFY Battery Junction Box (BJB) fuse 12 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. TEST the system for normal operation.
U4 CHECK RIGHT THIRD ROW SEAT RELAY	
• Carry out component test on the right third row seat relay. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the relay pass?**	**Yes** GO to U5 . **No** INSTALL a new right third row seat relay. TEST the system for normal operation.
U5 CHECK CIRCUIT CPS48 (BU) FOR AN OPEN	

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• Disconnect: Left Third Row Seat Relay C4183. • Disconnect: SJB C2280b. • Measure the resistance between right third row seat relay C4184-85, circuit CPS48 (BU), harness side and SJB C2280b-32, circuit CPS48 (BU), harness side.  N0040975 • **Is the resistance less than 5 ohms?**	**Yes** GO to U6 . **No** REPAIR the circuit. TEST the system for normal operation.
U6 CHECK CIRCUIT CPS54 (WH/OG) FOR AN OPEN	
• Disconnect: Right Third Row Seat Control Switch C4180. • Measure the resistance between right third row power-fold seat relay C4184-87, circuit CPS54 (WH/OG), harness side and right third row power-fold seat control switch C4180-4, circuit CPS54 (WH/OG), harness side.  N0041029 • **Is the resistance less than 5 ohms?**	**Yes** GO to U7 . **No** REPAIR the circuit. TEST the system for normal operation.
U7 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Measure the resistance between: ♦ right third row seat switch C4180-8, circuit GD149 (BK/GY), harness side and ground. ♦ right third row seat switch C4180-2, circuit GD149 (BK/GY), harness side and ground.  N0041030 • **Are the resistances less than 5 ohms?**	**Yes** GO to U8 . **No** REPAIR the circuit. TEST the system for normal operation.
U8 CHECK RIGHT THIRD ROW POWER-FOLD SEAT CONTROL SWITCH	

- Disconnect: Right Third Row Power-Fold Seat Control Switch C4180.
- Using the following table, check the right third row power-fold seat control switch. Measure the resistance between the right third row power-fold seat control switch pins, component side, while pressing the indicated switch buttons and compare the results to the table. The resistance measurement must fall within the tolerance given.

Seat Control Switch Button Position	Pins	Results
Up	2 and 3	Less than 5 ohms
Rest	2 and 3	Less than 5 ohms
Fold	2 and 3	Greater than 5 ohms
Up	3 and 4	Greater than 5 ohms
Rest	3 and 4	Greater than 5 ohms
Fold	3 and 4	Less than 5 ohms
Up	4 and 7	Less than 5 ohms
Rest	4 and 7	Greater than 5 ohms
Fold	4 and 7	Greater than 5 ohms
Up	7 and 8	Greater than 5 ohms
Rest	7 and 8	Less than 5 ohms
Fold	7 and 8	Less than 5 ohms

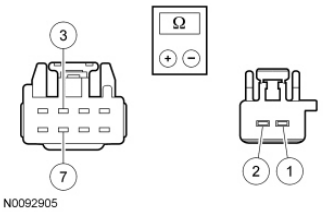
- Carry out the Third Row Power-Fold Seat Control Switch Component Test.
- **Did the switch pass?**

Yes
GO to U9 .

No
INSTALL a new switch. REFER to Seat Control Switch - Third Row in this section. TEST the system for normal operation.

U9 CHECK CIRCUITS CPS51 (VT/GY) AND CPS52 (YE/GN) FOR AN OPEN

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• Disconnect: Right Third Row Seat Motor C4182. • Measure the resistance between: ♦ right third row seat switch C4180-3, circuit CPS52 (YE/GN), harness side and right third row seat motor C4182-1, circuit CPS52 (YE/GN) harness side. ♦ right third row seat switch, C4180-7, circuit CPS51 (VT/GY), harness side and right third row seat motor C4182-2, circuit CPS51 (VT/GY), harness side.  N0092905 • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new right third row power seat motor. REFER to Power-Fold Seat Motor - Third Row in this section. TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

Pinpoint Test V: DTCs B1317 and B1318

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation - Driver Seat Module (DSM)

The Driver Seat Module (DSM) continuously monitors the input voltage for correct operation. If the DSM detects input voltage below 10 volts, it will store DTC B1318 in memory. If the DSM detects input voltage above 15 volts, it will store DTC B1317 in memory. If DTC B1317 or B1318 is set, the DSM disables the memory system outputs for the driver seat, memory mirrors, adjustable pedal and power adjustable steering column operation.

- DTC B1317 Battery Voltage High - If the DSM detects voltage above 15 volts, the DTC is set.
- DTC B1318 Battery Voltage Low - If the DSM detects voltage below 10 volts, the DTC is set.

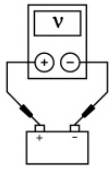
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- DSM

PINPOINT TEST V: DTCs B1317 AND B1318

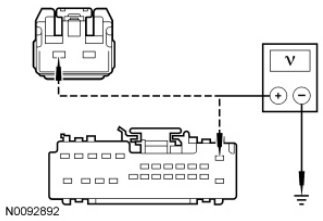
NOTE: DTC B1317, B1318 or B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

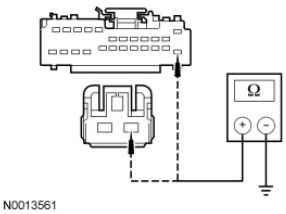
NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
V1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - ALL CMDTCs . • **Is DTC B1317, B1318 or B1676 present in one or more modules AND P0563, P0620, P0625, P0626 or P065B retrieved from the PCM?**	**Yes** REFER to Section 414-00 to diagnose the charging system. **No** GO to V2 .
V2 CHECK BATTERY CONDITION	
NOTE: DTC B1317, B1318 or B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on. • Ignition OFF. • Carry out the Battery Condition Test. Refer to Section 414-01 . • **Did the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). TEST the system for normal operation. If the battery passed the condition test and did not require a recharge, GO to V3 . **No** INSTALL a new battery. CLEAR all CMDTCs . TEST the system for normal operation.
V3 CHECK CHARGING SYSTEM VOLTAGE	
NOTE: Do not allow the engine speed to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine speed goes above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Start the engine. • Measure voltage of the battery with and without a load on the charging system as follows: ♦ Turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage. ♦ Turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage.  AJ0210-A	**Yes** GO to V4 . **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation.

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• **Are the voltage measurements between 13 and 15.2 volts?**	
V4 CHECK VOLTAGE TO THE DSM	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B . • Disconnect: Driver Seat Side Air Bag C3049. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201. • Disconnect: DSM C341a and C341c. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Connect the battery ground cable. Refer to Section 414-01 . • Ignition ON. • Measure the voltage between: ♦ DSM C341a-2, circuit SBB14 (BN/RD), harness side and ground. ♦ DSM C341c-1, circuit SBP01 (RD), harness side and ground.  • **Are the voltage measurements greater than 10 volts?**	**Yes** GO to V5 . **No** VERIFY the Battery Junction Box (BJB) fuse 14 (30A) and Smart Junction Box (SJB) 1 (20A) are OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify possible causes of the circuit short. CLEAR all CMDTCs . REPEAT the self-test. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .
V5 CHECK THE DSM GROUND CIRCUITS FOR AN OPEN	
• Ignition OFF. • Measure the resistance between: ♦ DSM C341a-1, circuit GD133 (BK), harness side and ground. ♦ DSM C341c-13, circuit GD143 (BK/VT), harness side and ground.	**Yes** GO to V6 . **No** REPAIR the circuit. CLEAR all CMDTCs . REPEAT the self-test. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3201. CONNECT driver seat side air bag module C3049.

 • Repeat this measurement while wiggling the harness. • **Are resistances less than 5 ohms?**	REPOWER the SRS . REFER to Section 501-20B .
V6 CHECK FOR CORRECT DSM OPERATION	
• Check the harness and component side connectors for the following: ♦ corrosion. ♦ damaged pins. ♦ pushed-out pins. • Connect: DSM C341a and C341c. • Make sure the DSM connectors are seated correctly. • Operate the memory seat and adjustable pedals to verify correct memory system operation. • Enter the following diagnostic mode on the scan tool: Self Test - DSM . • **Is DTC B1317 or B1318 still present?**	**Yes** INSTALL a new DSM . REFER to Section 419-10 . CLEAR all CMDTCs . REPEAT the self-test. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all CMDTCs . REPEAT the self-test. DISCONNECT the battery ground cable. CONNECT driver safety belt buckle pretensioner C3201. CONNECT driver seat side air bag module C3049. REPOWER the SRS . REFER to Section 501-20B .

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Memory Position Programming

Programming Memory Positions

NOTE: Memory positions can be stored at any time.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

1. **NOTE:** To program the Remote Keyless Entry (RKE) transmitter, refer to Section 501-14 .

   To set memory position(s) move the memory driver seat, memory exterior mirrors (if equipped), memory adjustable pedals (if equipped) and memory tilt steering column (if equipped) to the preferred position using the appropriate switch(es).

2. **NOTE:** Once the memory SET switch button is pressed, there is a 5-second time limit to input a memory position. If a memory position input is not received within the time limit, the operation is aborted and the memory SET switch LED (if equipped) is turned OFF.

   NOTE: If one of the following other inputs is received during the time limit, the operation is aborted and the memory SET switch LED (if equipped) is turned OFF:

   - Driver seat control switch
   - Memory SET switch button
   - Adjustable pedal control switch (if equipped)
   - Exterior mirror control switch (if equipped)
   - Power tilt steering column switch (if equipped)

   Press the memory SET switch button, activating the memory SET switch LED (if equipped).

3. Within 5 seconds (before the LED goes out) (if equipped), press memory SET switch button 1 or 2.

4. Repeat Steps 1 through 3 to initiate another memory position setting.

Recalling a Stored Memory Position

NOTE: A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL gear and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the gearshift lever out of PARK or NEUTRAL.

NOTE: Input from the driver seat control switch, memory SET switch, adjustable pedal control switch (if equipped), exterior mirror control switch (if equipped) or power tilt steering column switch (if equipped) during a memory recall will abort the memory recall.

1. The driver can recall the desired memory driver seat, memory exterior mirror (if equipped), memory adjustable pedal (if equipped) and memory tilt steering column (if equipped) positions by depressing either memory SET switch button 1 or 2. Depressing memory SET switch button 1 will initiate a recall of the positions stored for Memory 1. Depressing memory SET switch button 2 will initiate a recall of the positions stored for Memory 2.

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Seat - Front

Special Tool(s)

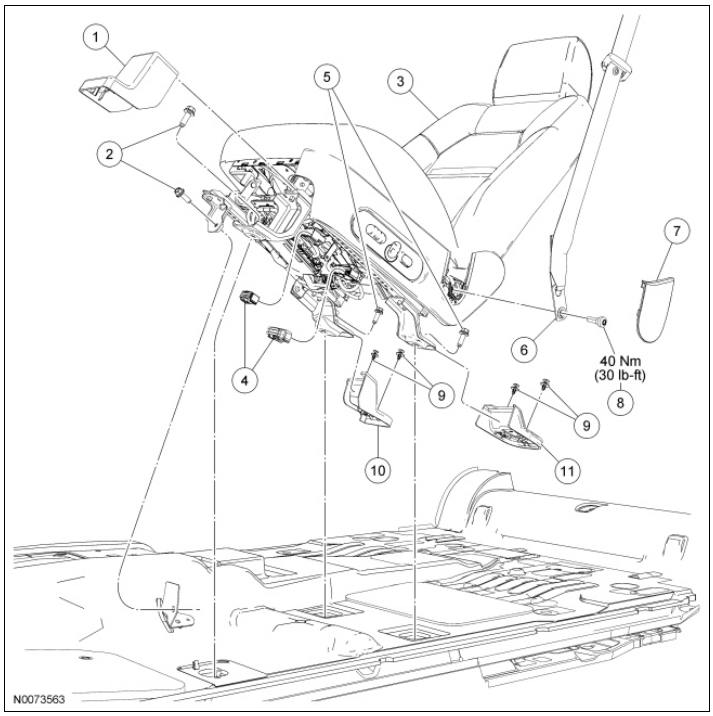
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

NOTE: Driver seat shown, passenger seat similar.

NOTE: The 4 seat track-to-floor bolts must be tightened in the sequence described in this procedure.



Item	Part Number	Description
1	62163	Seat track-to-floor bolt front cover
2	W711352	Seat track-to-floor front bolts
3	-	Seat

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4	-	Electrical connectors (part of 14A005)
5	W711352	Seat track-to-floor rear bolts
6	-	Safety belt retractor belt anchor (part of 611B09)
7	-	Cushion side shield cover (part of 62187)
8	-	Safety belt retractor belt anchor bolt (part of 611B09)
9	600A58	Scrivets
10	61749	Seat track-to-floor bolt rear inboard cover
11	61749	Seat track-to-floor bolt rear outboard cover

Removal

⚠ WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Pry out at the bottom, then slide up and remove the cushion side shield cover.

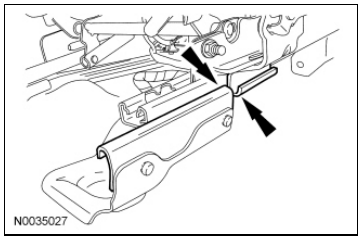
2. Remove the bolt and separate the safety belt anchor from the seat.

3. Remove the seat track-to-floor bolt front cover.
   - Pull up at the front to release the clips, then slide up and forward to remove.
     - ♦ The seat track must be back far enough for the rear of the cover to slide up and the locator tab to separate from the seat track.

4. **NOTE:** Driver seat track inboard rear mounting ear shown, passenger seat similar.

   Position the seat so that the seat track bracket does not engage the safety belt buckle and pretensioner bracket attached to the cushion frame.

   - If equipped with power seats, move the seat to its highest vertical position.



5. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

6. Remove the 2 seat track-to-floor front bolts.

7. Remove the 2 seat track-to-floor bolt rear covers.

8. Remove the 2 seat track-to-floor rear bolts.

9. **⚠ WARNING: The occupant classification sensor (OCS) rails have a built-in strain gauge which may operate incorrectly if an OCS rail is dropped by itself, dropped after it is installed to the front passenger seat or dropped after it is installed to a front passenger seat track assembly. Use care when handling an OCS rail before or after it is installed to the front passenger seat or seat track assembly. Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.**

   Tip the seat, release the wire harness pin-type retainers, disconnect the electrical connectors and remove the seat.

Installation

⚠ WARNING: Make sure the front passenger seat is correctly installed and fastened to the vehicle. Do not force the alignment to the floorpan mounting holes. If the seat does not align to the floorpan mounting holes, repair the seat or floorpan as needed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.

⚠ WARNING: After any crash, inspect the front passenger seat-to-floorpan mounting area for deformation and restore to its original condition, if deformed. Correct alignment of the occupant classification sensor (OCS) rails to the seat and floorpan is critical for correct OCS system operation. Incorrect operation of the OCS system increases the risk of serious personal injury or death in a crash.

All seats

1. Position the seat in the vehicle.

2. Tip the seat, connect the electrical connectors and install the wire harness pin-type retainers.
   - Always install a new pin-type retainer whenever the vehicle harness has been separated from the seat attachment point.

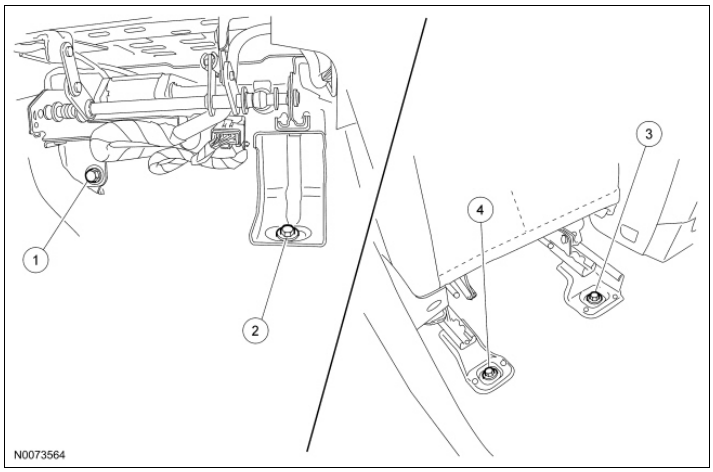
3. ***NOTICE:*** **Once the front inboard attachment bolt is hand-tightened to its angled bracket, make sure the 3 remaining holes in the track risers align to the floor mounting nuts without forcing them.**

   Start by hand all of the seat track-to-floor bolts, but do not tighten at this time.

Driver seat

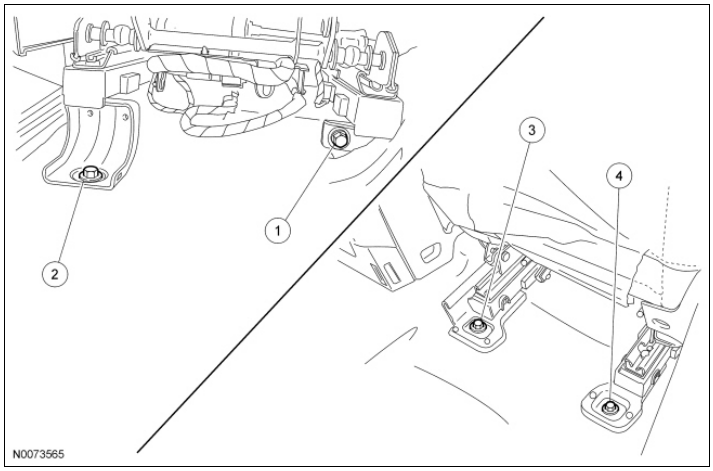
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4. Apply threadlock and start the 4 seat track-to-floor bolts by hand.
    - Tighten in the sequence shown to 40 Nm (30 lb-ft).



Passenger seat

5. Apply threadlock and start the 4 seat track-to-floor bolts by hand.
    - Tighten in the sequence shown to 40 Nm (30 lb-ft).



All seats

6. Install the seat track-to-floor bolt front cover and 2 rear covers.

7. Repower the SRS . **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

8. If necessary, position the seat then align the safety belt retractor belt anchor to the seat and install the bolt.
    - Tighten to 40 Nm (30 lb-ft).

9. Install the cushion side shield cover.

10. Check the active restraint system of the seat.
    - Make sure the safety belts and buckles are accessible to the occupants after installation.

Passenger seat

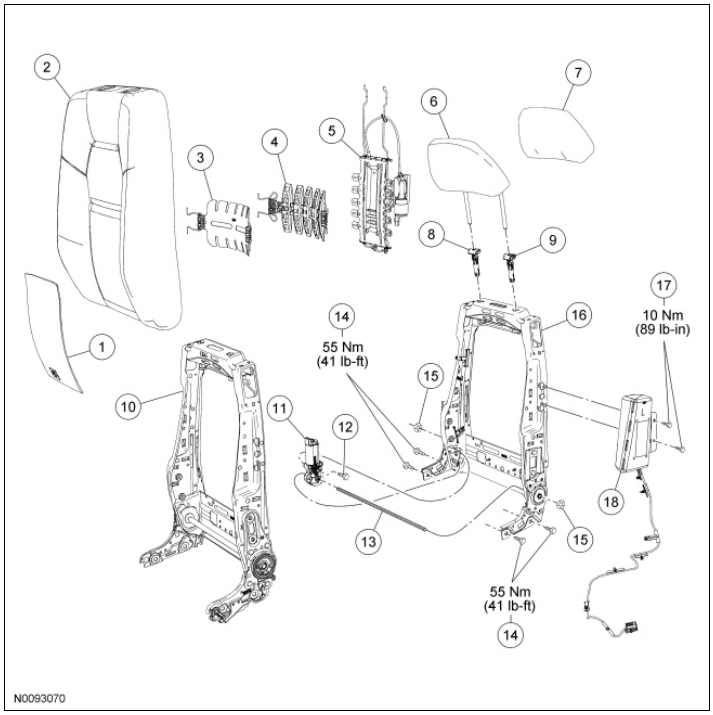
11. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat - Exploded View, Front

Front Seat Backrest

NOTE: Driver backrest shown, passenger backrest similar.



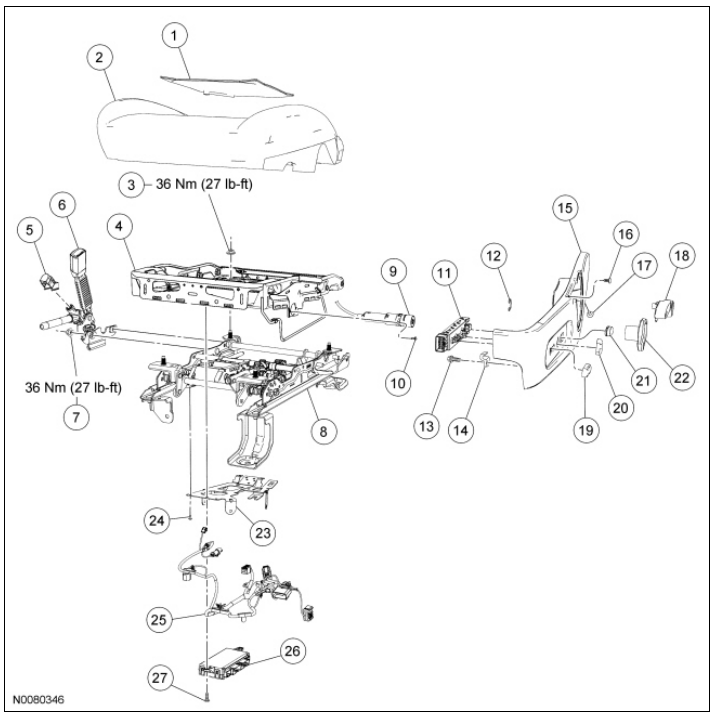
Item	Part Number	Description
1	14D696	Backrest heated seat mat (if equipped)
2	64417/ 64811	Backrest trim cover/ backrest foam pad
3	65500	Static lumbar (if equipped)
4	65500	Manual lumbar adjust assembly (if equipped)
5	65500	Power lumbar adjust assembly (if equipped)
6	611A08	Head restraint assembly
7	-	Head restraint cover
8	610A18	Inboard head restraint guide sleeve
9	610A16	Outboard head restraint guide sleeve
10	61018	Backrest frame (serviced with manual recliners) (if equipped)
11	14547	Power recline motor (if equipped)
12	-	Screw (if equipped) (part of 600A58)
13	62714	Recliner shaft (if equipped)
14	-	Recliner-to-cushion frame bolts (4 required) (part of 600A58)

15	-	One-way push clips (2 required) (if equipped) (part of 14547)
16	61018	Backrest frame (serviced with power recliners) (if equipped)
17	-	Side air bag module bolts (2 required)
18	611D11	Side air bag module

Driver Seat Cushion

NOTE: Power seat track shown, manual seat track similar.

NOTE: The retention bracket and screw can be used to repair cushion side shields that will not retain to the cushion frame wire.



Item	Part Number	Description
1	-	Cushion heated seat mat (if equipped)
2	62901/ 632A23	Cushion trim cover/ cushion foam pad
3	-	Cushion frame-to-seat-track nut (4 required) (part of 600A58)
4	63100	Cushion frame
5	-	Safety belt buckle and pretensioner electrical connector cover
6	61203	Safety belt buckle and pretensioner
7	-	Safety belt buckle and pretensioner nut (2 required) (part of 61203)
8	61711	Power seat track

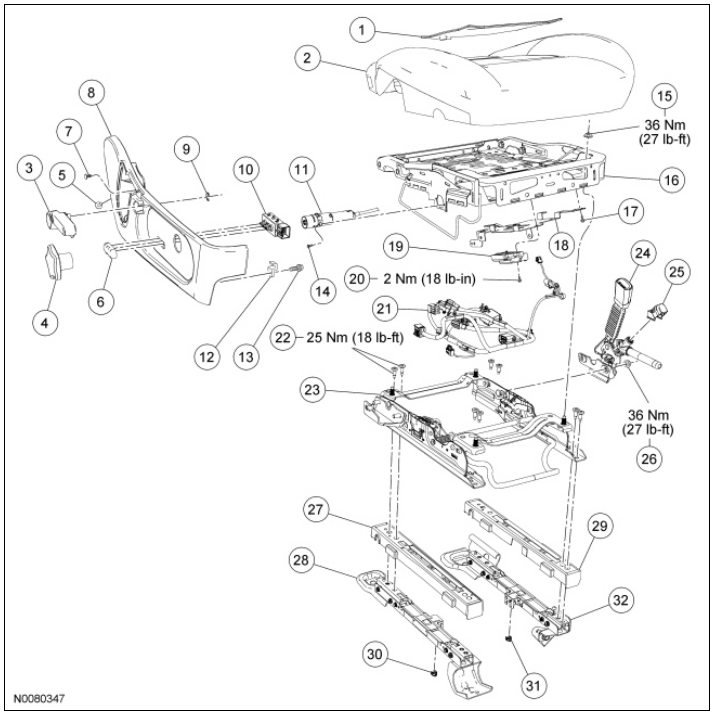
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9	610C00	Manual lumbar control (if equipped)
10	-	Manual lumbar control screw (2 required) (if equipped) (part of 600A58)
11	14A701	Seat control switch (if equipped)
12	-	Manual recline handle clip (if equipped) (part of 610A76)
13	W506943	Retention bracket screw (if equipped)
14	62256	Retention bracket (if equipped)
15	62187	Cushion side shield
16	-	Scrivet (part of 600A58)
17	-	Pin-type retainer (part of 600A58)
18	62622	Manual recline handle (if equipped)
19	14C715	Seat control switch knob (if equipped)
20	14711	Power recline switch knob (if equipped)
21	14711	Power lumbar switch knob (if equipped)
22	617B70	Manual lumbar control knob (if equipped)
23	14A163	Bracket
24	-	Screw (4 required) (part of 600A58)
25	14C719	Driver seat wire harness
26	14C708	Driver Seat Module (DSM) (if equipped)
27	-	Screw (2 required) (if equipped) (part of 600A58)

Passenger Seat Cushion

NOTE: Manual seat track shown, power seat track similar.

NOTE: The retention bracket and screw can be used to repair cushion side shields that will not retain to the cushion frame wire.



Item	Part Number	Description
1	14D698	Cushion heated seat mat (if equipped)
2	62900/ 632A22	Cushion trim cover/ cushion foam pad
3	62622	Manual recline handle (if equipped)
4	617B70	Manual lumbar control knob (if equipped)
5	-	Pin-type retainer (part of 600A58)
6	14C715	Seat control switch knob (if equipped)
7	-	Scrivet (part of 600A58)
8	62186	Cushion side shield
9	-	Manual recline handle clip (part of 610A76) (if equipped)
10	14A701	Seat control switch (if equipped)
11	610C00	Manual lumbar control (if equipped)
12	62256	Retention bracket (if equipped)
13	W506943	Retention bracket screw (if equipped)
14	-	Manual lumbar control screw (2 required) (if equipped) (part of 600A58)
15	-	Cushion frame-to-seat-track nut (4 required) (part of 600A58)
16	63100	Cushion frame
17	-	Screw (4 required) (part of 600A58)
18	14A163	Bracket
19	14B422	Occupant Classification System Module (OCSM)
20	-	Screw, OCSM (2 required) (part of 600A58)
21	14A699	Passenger seat wire harness
22	-	

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		Seat track-to-Occupant Classification Sensor (OCS) rail bolts (8 required) (part of 600A58)
23	61710	Manual seat track
24	61202	Safety belt buckle and pretensioner
25	-	Safety belt buckle and pretensioner electrical connector cover
26	-	Safety belt buckle and pretensioner nut (2 required) (part of 61203)
27	62126	Outboard OCS rail shield
28	61708	Outboard OCS rail
29	62127	Inboard OCS rail shield
30	-	Outboard OCS rail electrical connector (part of 14A699)
31	-	Inboard OCS rail electrical connector (part of 14A699)
32	61709	Inboard OCS rail

1. For additional information, refer to the procedures in this section.

Seat Backrest - Front

Removal and Installation

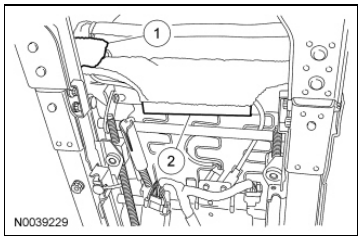
NOTE: Driver shown, passenger similar.

All seats

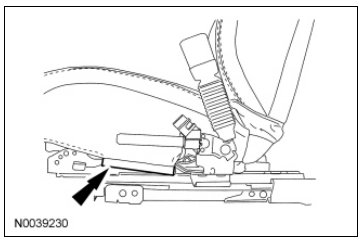
1. Remove the front seat. For additional information, refer to Seat - Front in this section.

2. Remove the cushion side shield in the following sequence.
    1. Remove the clip and manual recline handle (if equipped).
    2. Pull and remove the manual lumbar control knob (if equipped).
        - Make sure the lumbar is completely relaxed before removing the handle.
    3. Remove the scrivet.
    4. Remove the retention bracket screw and the retention bracket (if equipped).
    5. Release the cushion side shield front clip.
    6. From under the cushion side shield, release the 3 hook retainers.
    7. Pull out on the cushion side shield at the back and release the pin-type retainer.
    8. Separate the cushion trim cover elastic strap from the cushion side shield.
        - With manual seat track, remove the cushion side shield.
    9. With power seat track, remove the seat control switch knob and separate the seat control switch from the cushion side shield.
        - Remove the cushion side shield.

3. Release the cushion trim cover rear J-clips.
    1. Release the cushion trim cover rear inboard J-clip from the inboard recliner.
    2. For a driver seat or passenger seat equipped with heat, release the cushion trim cover rear J-clips.



4. Release the cushion trim cover inboard J-clip.



5. Remove the safety belt buckle and pretensioner electrical connector cover.

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6. Remove the 2 safety belt buckle and pretensioner nuts.
    - To install, tighten to 36 Nm (27 lb-ft).

7. Disconnect the safety belt buckle and pretensioner electrical connector and safety belt buckle switch electrical connector.
    - Remove the safety belt buckle and pretensioner.

Seat with manual lumbar

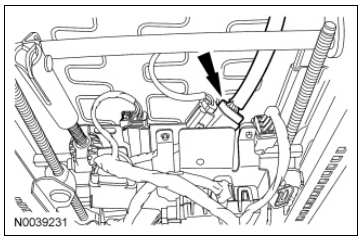
8. Release the cushion trim cover front J-clip. Raise the cushion foam pad and release the lumbar cable pin-type retainer.

9. Remove the 2 screws and separate the manual lumbar control from the cushion frame.

10. Remove the cable from the manual lumbar control.

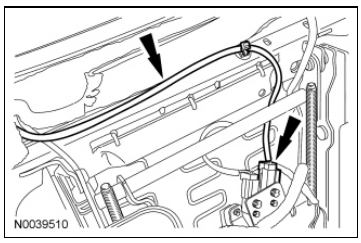
Driver seat with power recline

11. Disconnect the backrest power feed electrical connector and route out the wire harness.
    - Release any wire harness retainers.



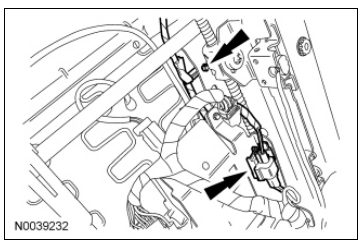
Passenger seat with heat

12. Disconnect the backrest heated seat mat electrical connector and route out the wire harness.
    - Release any wire harness retainers.



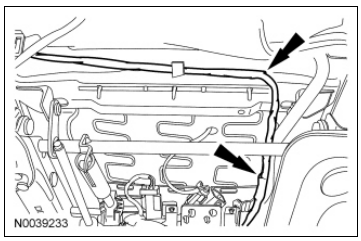
All seats

13. Release the pin-type retainers, disconnect and route out the side air bag module electrical connector and wire harness.



14. **NOTE:** Driver shown, passenger similar.

Release the side air bag wire harness pin-type retainers across the back of the cushion frame.



15. Remove the 4 recliner-to-cushion frame bolts and remove the backrest assembly.
    - Route out the manual lumbar cable and any wire harnesses (if equipped).
    - To install, tighten to 55 Nm (41 lb-ft).

16. To install, reverse the removal procedure.

17. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

18. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat Backrest Cover - Front

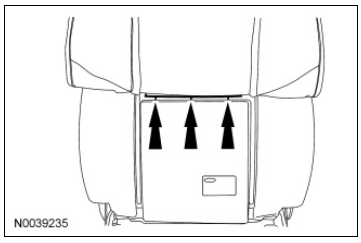
Removal and Installation

⚠ WARNING: Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.

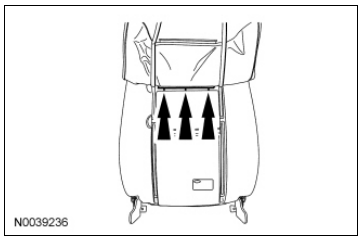
All seats

1. Remove the front seat. For additional information, refer to Seat - Front in this section.
2. Remove the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.
3. Remove the 2 head restraint guide sleeves. For additional information, refer to Head Restraint Guide Sleeve in this section.
4. Remove the plastic rivets attaching the backrest trim cover to the inboard and outboard recliners.
5. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, hook-and-loop strips and invert the trim cover to the first row of hog rings.
6. Remove the first row of hog rings.



7. Release the hook-and-loop strips, invert the trim cover and remove the second row of hog rings.



8. Remove the backrest trim cover.
9. To install, reverse the removal procedure.

10. Install the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

11. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

12. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat Cushion Cover - Front

Removal and Installation

All seats

1. Remove the front seat. For additional information, refer to Seat - Front in this section.

2. Remove the cushion side shield in the following sequence.
    1. Remove the clip and manual recline handle (if equipped).
    2. Pull and remove the manual lumbar control knob (if equipped).
    3. Remove the scrivet.
    4. Remove the retention bracket screw and the retention bracket (if equipped).
    5. Release the cushion side shield front clip.
    6. From under the cushion side shield, release the 3 hook retainers.
    7. Pull out on the cushion side shield at the back and release the pin-type retainer.
    8. Separate the cushion trim cover elastic strap from the cushion side shield.
        - With manual seat track, remove the cushion side shield.
    9. With power seat track, remove the seat control switch knob and separate the seat control switch from the cushion side shield.
        - Remove the cushion side shield.

3. Release all the cushion trim cover-to-cushion frame retainers.

4. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the hook-and-loop strips, remove the hog rings and remove the cushion trim cover from the cushion foam pad.

5. To install, reverse the removal procedure.

6. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

7. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat Track

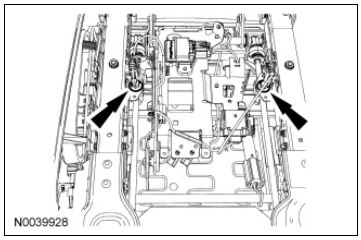
Removal and Installation

All seats

1. Remove the front seat. For additional information, refer to Seat - Front in this section.

Passenger seat with failed horizontal motor

2. To remove the Occupant Classification Sensor (OCS) rails, remove the 2 horizontal screw block bolts. This will allow the power seat tracks to move independently of each other for access to the 8 OCS rail bolts.



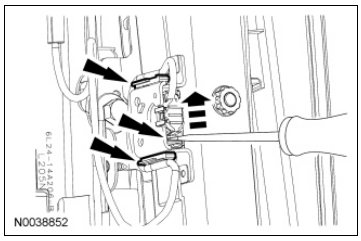
Passenger seat receiving a new seat track

3. Remove the inboard and outboard OCS rails. For additional information, refer to Occupant Classification Sensor (OCS) in the removal and installation portion of Section 501-20B .

Passenger seat not receiving a new seat track

4. **NOTE:** Note the position and the routing of the OCS wiring, connector and wiring retainers for installation.

   Detach the 2 OCS wiring retainers at each OCS rail. Then using a suitable tool, release the tab and disconnect the RH and LH OCS rail electrical connectors.



All seats

5. Remove the cushion side shield in the following sequence.
   1. Remove the clip and manual recline handle (if equipped).
   2. Pull and remove the manual lumbar control knob (if equipped).
   3. Remove the scrivet.
   4. Remove the retention bracket screw and the retention bracket (if equipped).

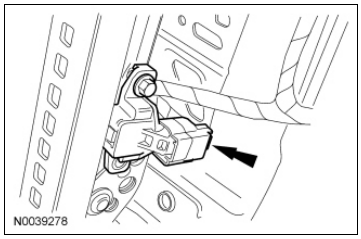
5. Release the cushion side shield front clip.
6. From under the cushion side shield, release the 3 hook retainers.
7. Pull out on the cushion side shield at the back and release the pin-type retainer.
8. Separate the cushion trim cover elastic strap from the cushion side shield.
    - ♦ With manual seat track, remove the cushion side shield.
9. With power seat track, remove the seat control switch knob and separate the seat control switch from the cushion side shield.
    - ♦ Remove the cushion side shield.

Power seat

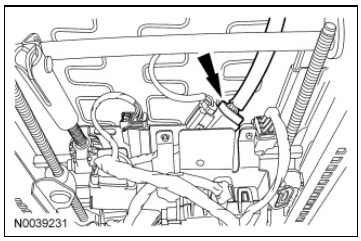
6. Separate the seat control switch wire harness pin-type retainer from the cushion frame.

Driver seat

7. Disconnect the SRS seat position sensor.



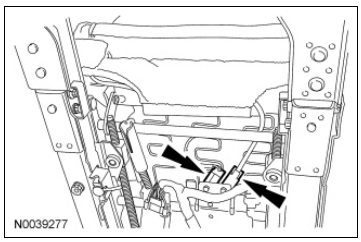
8. Driver seat with 10-way power, disconnect the backrest power feed electrical connector and route out the wire harness.
    - Release any wire harness retainers.



Heated seat

9. **NOTE:** Passenger shown, driver similar.

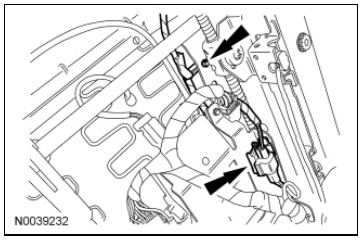
   Disconnect the cushion and backrest heated seat mat electrical connectors.



All seats

10. Release the pin-type retainers, disconnect and route out the side air bag module electrical connector and wire harness.

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11. Remove the safety belt buckle and pretensioner electrical connector cover.

12. Disconnect the safety belt buckle and pretensioner electrical connector and safety belt buckle switch electrical connector.

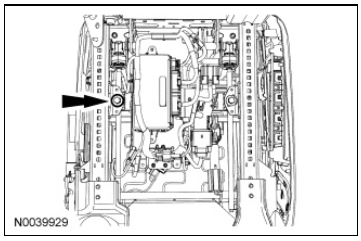
13. Release all the cushion trim cover retainers.

14. Remove the seat cushion foam pad and cushion trim cover.

15. Remove the 4 cushion frame-to-seat track nuts and the seat track.
    - To install, tighten to 36 Nm (27 lb-ft).

Driver seat with failed horizontal motor

16. If necessary, remove the inboard horizontal screw block bolt. This will allow the inboard power seat track to move independently so the safety belt buckle and pretensioner can be removed.



All seats

17. To install, reverse the removal procedure.

18. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

19. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat Recliner Motor

Removal

1. Remove the front seat. For additional information, refer to Seat - Front in this section.

2. Remove the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

3. Remove the plastic rivets attaching the backrest trim cover to the inboard and outboard recliners.

4. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, hook-and-loop strips and invert the trim cover to the first row of hog rings.

5. ***NOTICE:*** **Do not rotate the recliner shaft while not engaged to both recliners. Failure to do so will cause the inboard and outboard recliners to become out of synchronization.**

   Remove the one-way push clip on the side of the inboard power recliner. Slide the recliner shaft out from the outboard side of the seat enough to clear the inboard recliner and power recline motor.

6. Disconnect the electrical connector, remove the screw and the power recline motor.

Installation

All seats

1. ***NOTICE:*** **Do not rotate the recliner shaft while not engaged to both recliners. Failure to do so will cause the inboard and outboard recliners to become out of synchronization.**

   Install the recliner motor in the following sequence.

   1. Position the recliner shaft through the recliner motor and inboard recliner.
      - ♦ Slight turning of the recliner shaft may be necessary.
   2. Install a new one-way push clip onto the recliner shaft at the inboard power recliner.
   3. Turn the recliner motor so the recliner motor mounting hole lines up with the screw hole in the inboard power recliner.
   4. Install the recliner motor bolt.
   5. Connect the recliner motor electrical connector.

2. Roll the backrest trim cover down, attach the hook-and-loop strips and engage the backrest trim cover lower J-clip.

3. Position the backrest trim cover to the inboard and outboard recliners and install the plastic rivets.

4. Install the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

5. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

6. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Lumbar Assembly

Removal and Installation

All seats

1. Remove the front seat. For additional information, refer to Seat - Front in this section.

2. Remove the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

3. Remove the plastic rivets attaching the backrest trim cover to the inboard and outboard recliners.

4. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

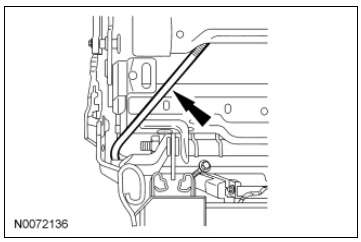
   Release the backrest trim cover lower J-clip, hook-and-loop strips and invert the trim cover to the first row of hog rings.

Seats with manual lumbar

5. **NOTE:** Illustration view from the back of seat.

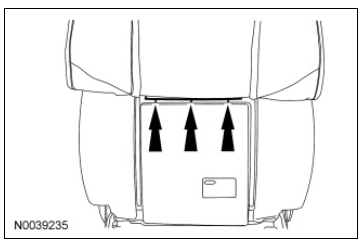
   Release the 2 manual lumbar spring clips from the backrest frame and remove the manual lumbar.

   - Route out the lumbar cable from behind the recliner and from between the inboard side of the backrest foam pad and backrest frame.

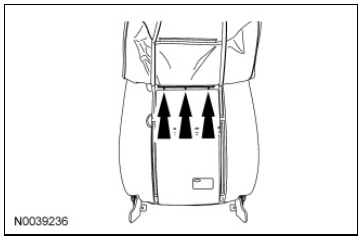


Seats with power lumbar

6. Remove the first row of hog rings.



7. Release the hook-and-loop strips, invert the trim cover and remove the second row of hog rings.



8. Remove the power lumbar adjust assembly in the following sequence.
    1. Disconnect the power lumbar adjust assembly motor electrical connector.
    2. Release the 2 power lumbar adjust assembly lower pin-type retainers to the backrest frame.
    3. Slide the power lumbar adjust assembly rods out of the backrest frame at the top and remove the power lumbar adjust assembly.

All seats

9. To install, reverse the removal procedure.

10. Install the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

11. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

12. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Head Restraint Guide Sleeve

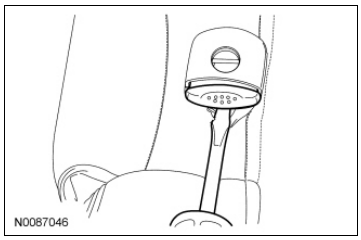
Removal

NOTE: Typical head restraint guide sleeve shown, others similar.

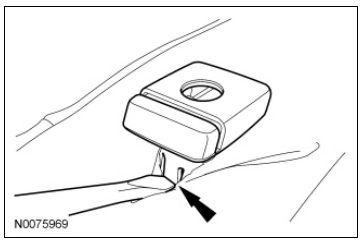
1. Push in on the 2 head restraint guide sleeve release buttons and remove the head restraint.

2. Obtain a flat-head screwdriver with a width of 4 mm (0.157 in) to 7 mm (0.275 in) and a thickness of approximately 1 mm (0.039 in).

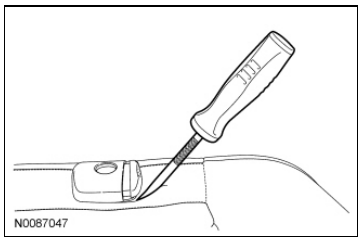
3. Align the screwdriver to the middle of the head restraint guide sleeve release button.



4. Position the screwdriver between the head restraint guide sleeve neck and backrest trim cover and foam pad.

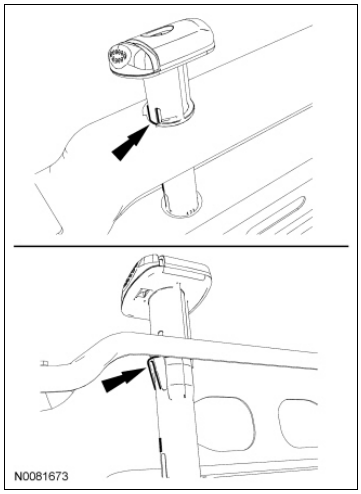


5. Position the screwdriver at a 45-degree angle.

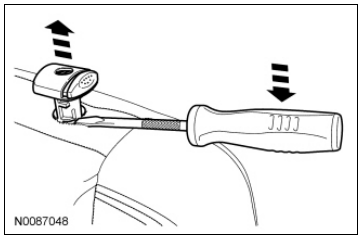


6. **NOTE:** For retainer clarity, backrest trim cover and foam pad are removed.

   Push the screwdriver in, bending the lock feature on the head restraint guide sleeve in.



7. While bending the lock feature in, push down on the screwdriver handle, prying the head restraint guide sleeve up and disengaging it from the backrest frame crossmember.



8. Remove the head restraint guide sleeve.
    - Discard the head restraint guide sleeve.

9. Repeat these steps for the head restraint guide sleeve on the opposite side.

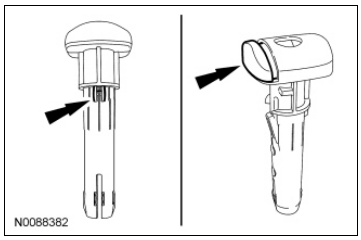
Installation

NOTICE: **Always install new head restraint guide sleeves. Difficult adjustment of the head restraint may occur. Failure to follow these instructions may result in component failure.**

NOTICE: **The head restraint guide sleeves are not interchangeable. Failure to install the correct head restraint guide sleeve at the correct position may result in component failure.**

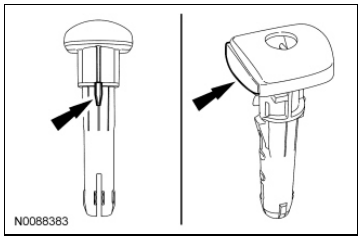
1. Make sure the holes in the backrest foam pad and backrest trim cover are aligned to the holes in the backrest frame.

2. Install the head restraint guide sleeve with the large button and wide key on the LH side of the seat.



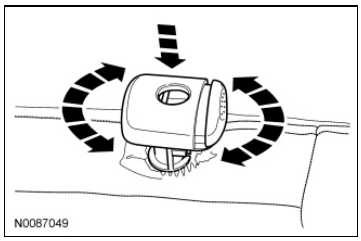
3. Install the head restraint guide sleeve with the small button and thin key on the RH side of the seat.

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4. ***NOTICE:*** **Do not attempt to seat the head restraint guide sleeve by hand. This may result in excessive head restraint adjustment efforts and permanent damage to the head restraint guide sleeve.**

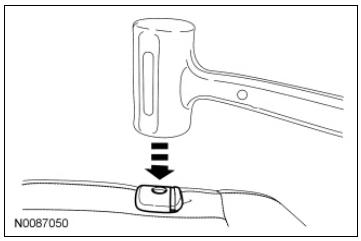
   To allow the head restraint guide sleeve to slide freely through the backrest foam pad and backrest trim cover, twist the head restraint guide sleeve while pushing it into the backrest frame hole as far as it will go with hand pressure.



5. ***NOTICE:*** **Striking effort should not result in any type of damage or distortion to the head restraint guide sleeve. If a head restraint guide sleeve is damaged, install a new one.**

   Using a non-marring mallet, strike the top of the head restraint guide sleeve with moderate force, seating it in the backrest frame.

   - Striking effort must be hard enough to snap the head restraint guide sleeve retainer in place in the backrest frame.



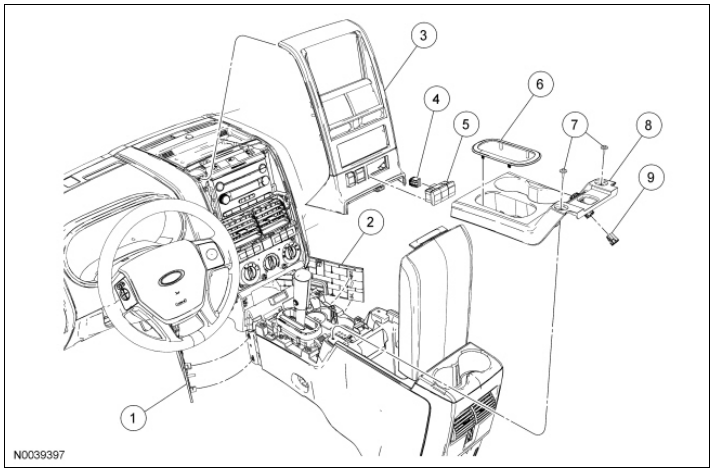
6. Inspect the head restraint guide sleeve.
   - Pull the head restraint guide sleeve out by hand, making sure it is locked in place. If the head restraint guide sleeve can be removed by hand, repeat the installation procedure. If the head restraint guide sleeve can be removed again after installing a second time, install a new head restraint guide sleeve.

7. Repeat these steps for the head restraint guide sleeve on the opposite side.

8. After installation of 2 new head restraint guide sleeves, install the head restraint in the following sequence.
   1. Position the head restraint rods to the head restraint guide sleeve holes.
   2. Push the head restraint down, guiding the rods into the head restraint guide sleeve holes.
   3. Make sure the head restraint adjusts without excessive effort and locks in place.

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Heated Seat Switch



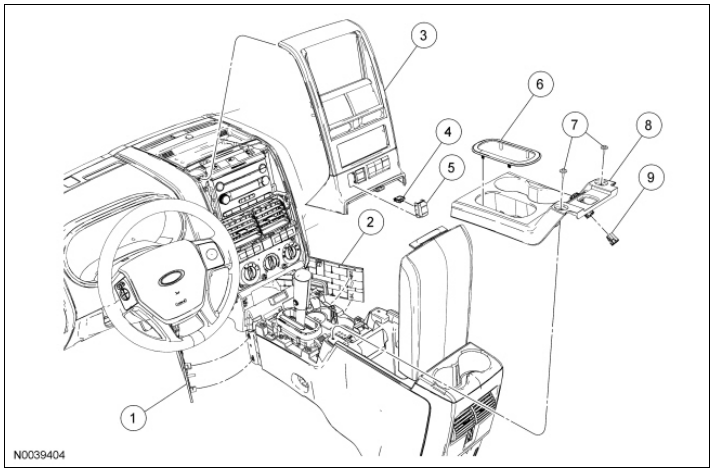
Item	Part Number	Description
1	04609	Instrument panel center lower LH finish panel
2	04608	Instrument panel center lower RH finish panel
3	044D70	Instrument panel center finish panel
4	-	Electrical connector (part of 14401)
5	13350	Heated seat/heated windshield switch pack
6	7E391	Console trim ring
7	W705796	Screws
8	04567	Console finish panel
9	-	Electrical connector (part of 14B079)

Removal and Installation

1. Position the gear selector to NEUTRAL.
2. Remove the console trim ring.
3. Open the center console door, remove the 2 screws and pull up on the console finish panel to release the retainers.
4. Disconnect the power point electrical connector and remove the console finish panel.
5. Pull out to release the retainers and separate the instrument panel center lower RH and LH finish panels.
6. Pull out to release the retainers and separate the instrument panel center finish panel.
7. Disconnect the electrical connector, release the 4 tabs and remove the heated seat/heated windshield switch pack.
8. To install, reverse the removal procedure.

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Memory Set Switch



Item	Part Number	Description
1	04609	Instrument panel center lower LH finish panel
2	04608	Instrument panel center lower RH finish panel
3	044D70	Instrument panel center finish panel
4	-	Electrical connector (part of 14401)
5	044D82	Memory SET switch
6	7E391	Console trim ring
7	W705796	Screws
8	04567	Console finish panel
9	-	Electrical connector (part of 14B079)

Removal and Installation

1. Position the gear selector to NEUTRAL.
2. Remove the console trim ring.
3. Open the center console door, remove the 2 screws and pull up on the console finish panel to release the retainers.
4. Disconnect the power point electrical connector and remove the console finish panel.
5. Pull out to release the retainers and separate the instrument panel center lower RH and LH finish panels.
6. Pull out to release the retainers and separate the instrument panel center finish panel.
7. Disconnect the electrical connector, release the 4 tabs and remove the memory SET switch.
8. To install, reverse the removal procedure.

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Seat Control Switch

Removal and Installation

All seats

1. Remove the front seat. For additional information, refer to Seat - Front in this section.

2. Remove the cushion side shield in the following sequence.
    1. Remove the clip and manual recline handle (if equipped).
    2. Pull and remove the manual lumbar control knob (if equipped).
    3. Remove the scrivet.
    4. Remove the retention bracket screw and the retention bracket (if equipped).
    5. Release the cushion side shield front clip.
    6. From under the cushion side shield, release the 3 hook retainers.
    7. Pull out on the cushion side shield at the back and release the pin-type retainer.
    8. Separate the cushion trim cover elastic strap from the cushion side shield.
    9. Remove the seat control switch knob and separate the seat control switch from the cushion side shield.
        - Remove the cushion side shield.

3. Disconnect and remove the seat control switch.

4. To install, reverse the removal procedure.

5. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

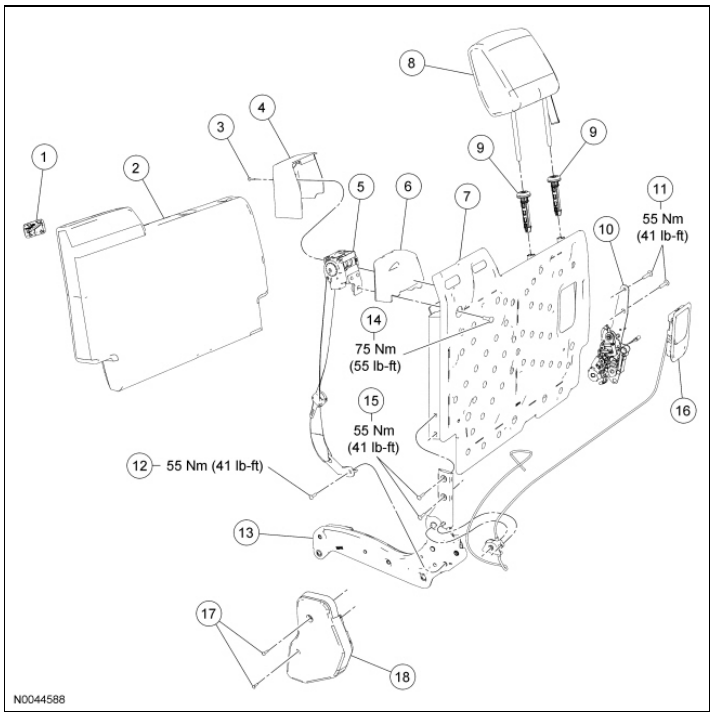
Passenger seat

6. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat - Exploded View, Second Row

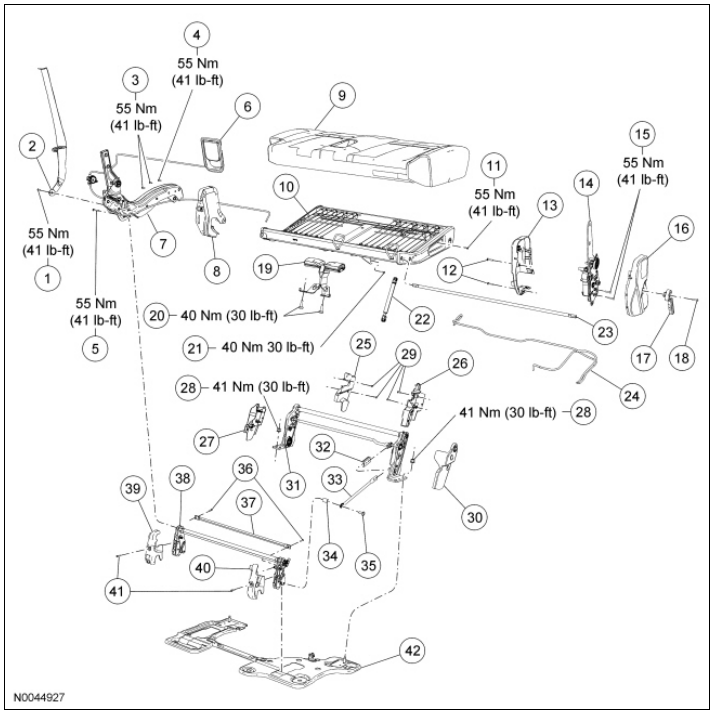
60 Percent E-Z Entry Backrest



Item	Part Number	Description
1	610D72	Safety belt bezel
2	66600/ 66800	Backrest trim cover/ backrest foam pad
3	-	Pin-type retainer (part of 605C10)
4	613C46	Safety belt retractor cover
5	611B64	Safety belt retractor
6	611D52	Safety belt retractor insulator
7	613A38	Backrest frame
8	611A08	Head restraint
9	610A16	Head restraint guides
10	61382	Outboard recliner
11	-	Outboard recliner-to-backrest frame bolts (part of 605C10)
12	-	Safety belt anchor bolt (part of 605C10)
13	61383	Inboard recliner
14	-	Safety belt retractor bolt (part of 605C10)
15	-	Inboard recliner-to-backrest frame bolts (part of 605C10)
16	601L60	Kneeling mechanism release handle and cable

17	-	Screws (part of 605C10)
18	61349	Inboard recliner outer cover

60 Percent, E-Z Entry Cushion

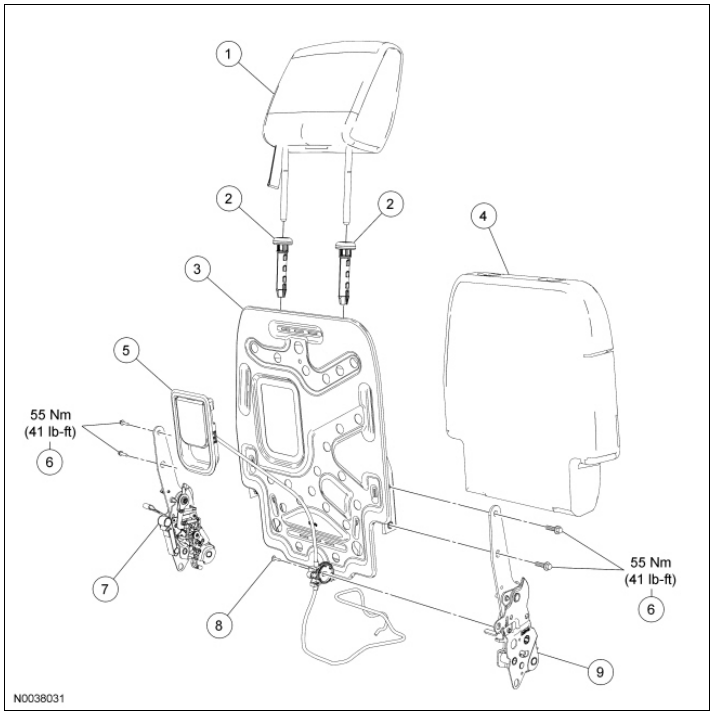


Item	Part Number	Description
1	-	Safety belt anchor bolt (part of 605C10)
2	-	Safety belt anchor (part of 611B64)
3	-	Inboard recliner-to-cushion frame bolts (part of 605C10)
4	-	Inboard recliner-to-kneeling mechanism bolt (part of 605C10)
5	-	Inboard recliner-to-latch foot assembly bolt (part of 605C10)
6	601L60	Kneeling mechanism release handle and cable
7	61383	Inboard recliner
8	61349	Inboard recliner inner cover
9	63804/ 63840	Cushion trim cover/ cushion foam pad
10	63160	Cushion frame
11	-	Cushion frame-to-kneeling mechanism bolt (part of 605C10)
12	-	Screws (2 required) (part of 605C10)
13	61348	Outboard recliner inner cover
14	61382	Outboard recliner
15	-	Outboard recliner-to-cushion frame bolts (part of 605C10)

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16	61348	Outboard recliner outer cover
17	62418	Recliner handle
18	-	Screw (part of 605C10)
19	611C72	Safety belt buckle assembly
20	W700883	Safety belt buckle assembly bolts
21	-	Cushion frame-to-latch foot assembly bolt (part of 605C10)
22	624B74	Shock
23	61382	Recliner release shaft
24	601L60	Cable assembly
25	81349	Kneeling mechanism inboard leg inner cover
26	81348	Kneeling mechanism outboard leg inner cover
27	81349	Kneeling mechanism inboard leg outer cover
28	-	Kneeling mechanism-to-mounting plate nuts (2 required) (part of 605C10)
29	-	Screws (4 required) (part of 605C10)
30	81348	Kneeling mechanism outboard leg outer cover
31	61382	Kneeling mechanism
32	-	Latch feet retracting link retainer
33	61382	Latch feet retracting link
34	-	Spacer
35	-	Bolt (part of 605C10)
36	-	Screws (part of 605C10)
37	61382	Latch feet release bar
38	61382	Latch feet assembly
39	61349	Inboard latch foot cover
40	61348	Outboard latch foot cover
41	-	Screws (part of 605C10)
42	606A50	Mounting plate

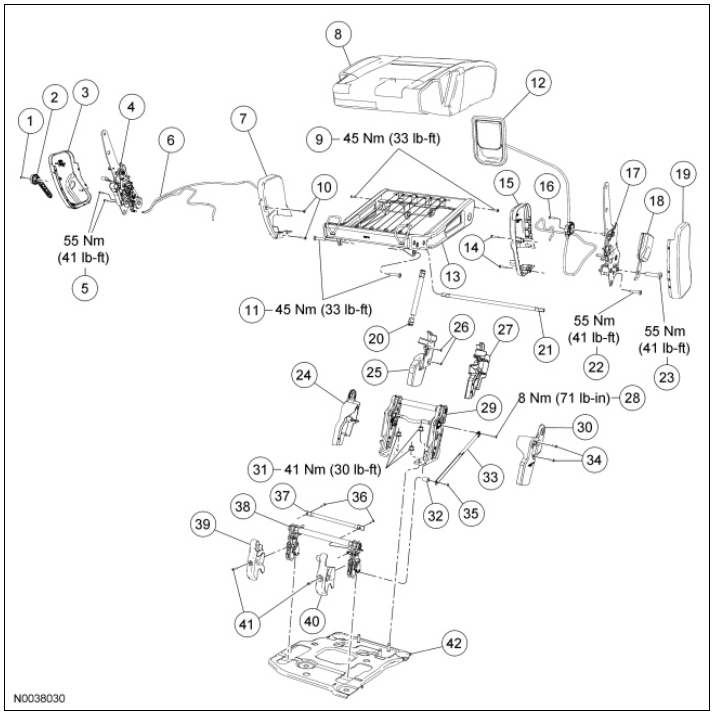
40 Percent E-Z Entry Backrest



Item	Part Number	Description
1	611A09	Head restraint
2	610A16	Head restraint guides
3	613A39	Backrest frame
4	66601/ 66801	Backrest trim cover/ backrest foam pad
5	601L60	Kneeling mechanism release handle and cable
6	-	Recliner-to-backrest frame bolts (part of 605C10)
7	61383	Outboard recliner
8	-	Screw (part of 605C10)
9	61383	Inboard recliner

40 Percent, E-Z Entry Cushion

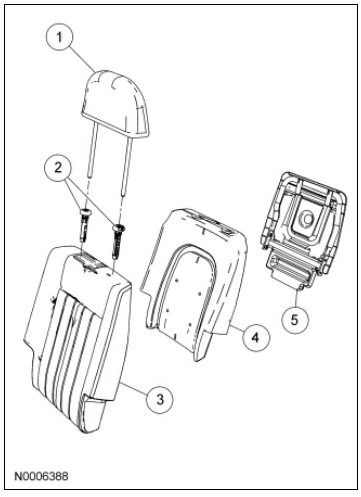
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Item	Part Number	Description
1	-	Screw (part of 605C10)
2	62419	Recliner handle
3	61349	Outboard recliner outer cover
4	61383	Outboard recliner
5	-	Outboard recliner-to-cushion frame bolts (part of 605C10)
6	601L60	Cable assembly
7	61349	Outboard recliner inner cover
8	63805/ 63841	Cushion trim cover/ cushion foam pad
9	-	Cushion frame-to-kneeling mechanism bolts (part of 605C10)
10	-	Screws (2 required) (part of 605C10)
11	-	Cushion frame-to-latch feet assembly bolts (part of 605C10)
12	601L60	Kneeling mechanism release handle and cable
13	63161	Cushion frame
14	-	Screws (part of 605C10)
15	61348	Inboard recliner inner cover
16	-	Screw (part of 605C10)
17	61383	Inboard recliner
18	611C73	Safety belt buckle
19	61348	Inboard recliner outer cover
20	624B75	Shock
21	61383	Recliner release shaft
22	-	Inboard recliner-to-cushion frame bolt (part of 605C10)

23	-	Inboard recliner and safety belt buckle-to-cushion frame bolt (part of 605C10)
24	61349	Kneeling mechanism outboard leg outer cover
25	61349	Kneeling mechanism outboard leg inner cover
26	-	Screws (part of 605C10)
27	81348	Kneeling mechanism inboard leg inner cover
28	-	Latch feet retracting link-to-kneeling mechanism bolt (part of 605C10)
29	61383	Kneeling mechanism
30	81348	Kneeling mechanism inboard leg outer cover
31	-	Kneeling mechanism-to-mounting plate nuts (2 required) (part of 605C10)
32	-	Spacer
33	61383	Latch feet retracting link
34	-	Screws (part of 605C10)
35	-	Latch feet retracting link-to-latch feet assembly bolt (part of 605C10)
36	-	Screws (part of 605C10)
37	-	Latch feet release bar
38	61383	Latch feet assembly
39	61349	Outboard latch foot cover
40	61348	Inboard latch foot cover
41	-	Screws (part of 605C10)
42	606A51	Mounting plate

Bucket, Backrest

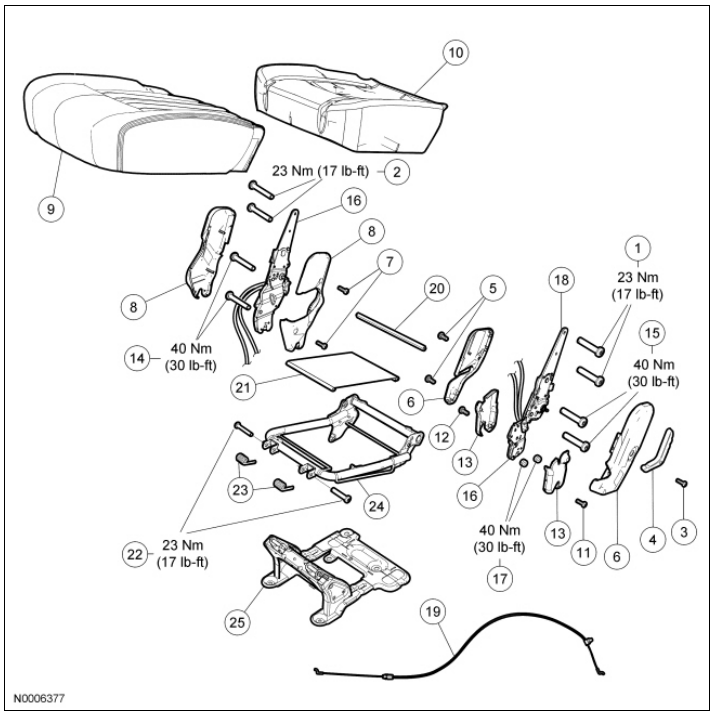


Item	Part Number	Description
1	611A08	Head restraint
2	610A16	Head restraint sleeves
3	66601	Backrest trim cover
4	66801	Backrest foam pad

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5	613A39	Backrest frame

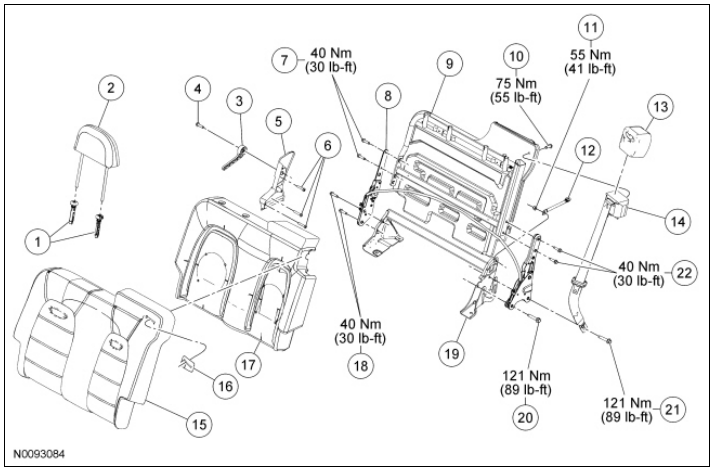
Bucket, Cushion



Item	Part Number	Description
1	-	Upper latch bolts (part of 605C10)
2	-	Upper latch bolts (part of 605C10)
3	-	Release handle screw (part of 605C10)
4	62419	Release handle
5	56906	Latch cover screws
6	61349	Latch covers (2 required)
7	56906	Latch cover screws
8	61349	Latch covers
9	63805	Cushion trim cover
10	63841	Cushion foam pad
11	56906	Lower latch cover screw
12	56906	Lower latch cover screw
13	61349	Lower latch covers
14	-	Lower latch bolts (part of 605C10)
15	-	Lower latch bolts (part of 605C10)
16	61383	Latches
17	-	Outboard lower latch nuts (part of 605C10)
18	61383	Latch pivot
19	7801L60	Riser attachment cable
20	61332	Torsion rod
21	63844	Cushion pad support

22	-	Front spring hinge bolts (part of 605C10)
23	605A76	Pivot springs
24	631B79	Seat cushion frame
25	600A87	Floor riser

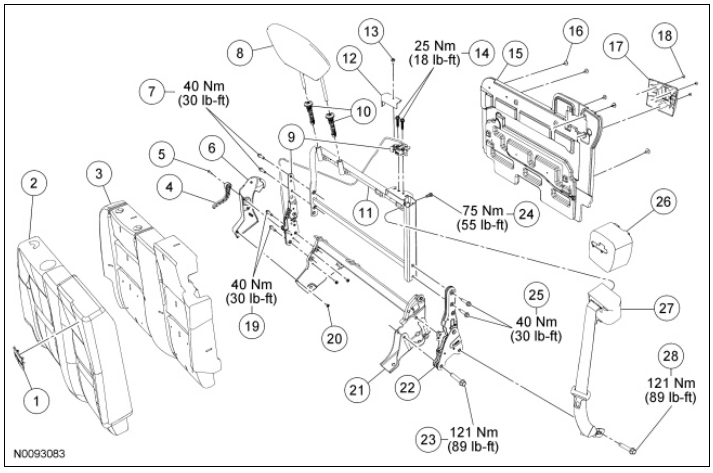
Explorer/Mountaineer, 60 Percent Bench, Backrest



Item	Part Number	Description
1	610A16	Head restraint sleeves
2	611A08	Head restraint
3	851282	Release handle
4	851334	Release handle screw
5	851260	Outboard latch cover
6	851334	Latch cover screws
7	-	Outboard latch-to-backrest frame bolts (part of 605C10)
8	61382	Latch assembly (inboard, outboard and cable)
9	613A38	Backrest frame
10	N807750	Safety belt retractor bolt
11	-	Seat tether-to-riser frame nut
12	600A96	Seat tether
13	613C46	Safety belt retractor cover
14	611B64	Safety belt retractor
15	66601	Backrest trim cover
16	610D72	Safety belt guide cover
17	66800	Backrest foam pad
18	W505237	Outboard latch-to-riser frame bolts
19	606A50	Riser frame
20	-	Inboard latch-to-riser frame front bolt (part of 605C10)
21	-	Safety belt anchor bolt (part of 611B64)
22	-	Inboard latch-to-backrest frame bolts (part of 605C10)

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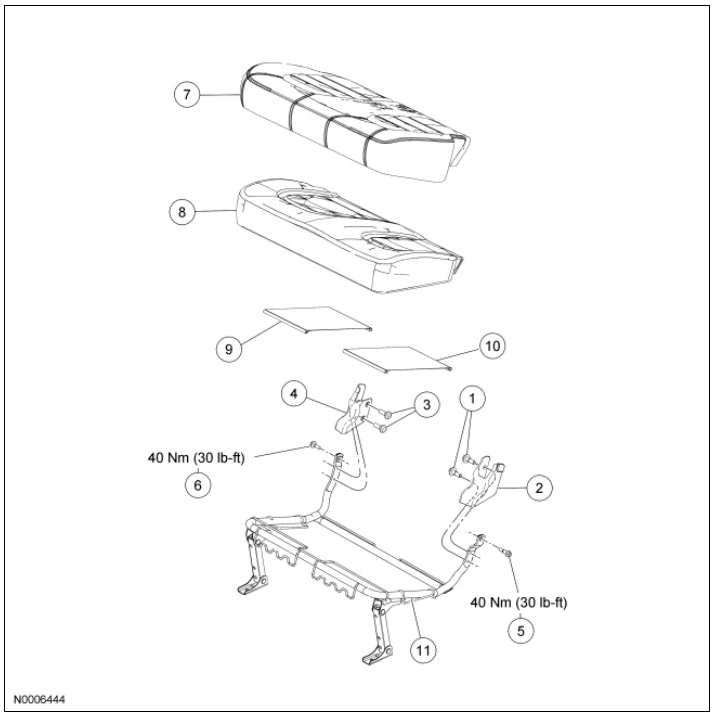
Explorer Sport Trac, 60 Percent Bench, Backrest



Item	Part Number	Description
1	610D72	Safety belt guide cover
2	66601	Backrest trim cover
3	66800	Backrest foam pad
4	851282	Release handle
5	-	Release handle screw (part of 605C10)
6	61348	Outboard latch cover
7	W505273	Outboard latch-to-backrest frame bolts
8	611A08	Head restraint
9	-	Latch assembly (inboard, outboard and cable) (part of 61382)
10	610A16	Head restraint sleeves
11	613A38	Backrest frame
12	638A74	Inner latch cover
13	-	Upper latch cover screw (part of 605C10)
14	-	Upper latch-to-backrest frame bolts (part of 605C10)
15	-	Backrest support panel (part of 613A38)
16	-	Backrest support panel screw (part of 613A38)
17	638A74	Upper latch cover
18	-	Upper latch cover screw (part of 605C10)
19	W505237	Outboard latch-to-riser frame bolts
20	-	Latch cover screw (part of 605C10)
21	606A50	Riser frame
22	-	Inboard latch (inboard, outboard and cable) (part of 61382)
23	-	Inboard latch-to-riser frame front bolt (part of 605C10)

24	N807750	Safety belt retractor bolt
25	W505237	Inboard latch-to-backrest frame bolts
26	613C46	Safety belt retractor cover
27	611B64	Safety belt retractor
28	-	Safety belt anchor bolt (part of 605C10)

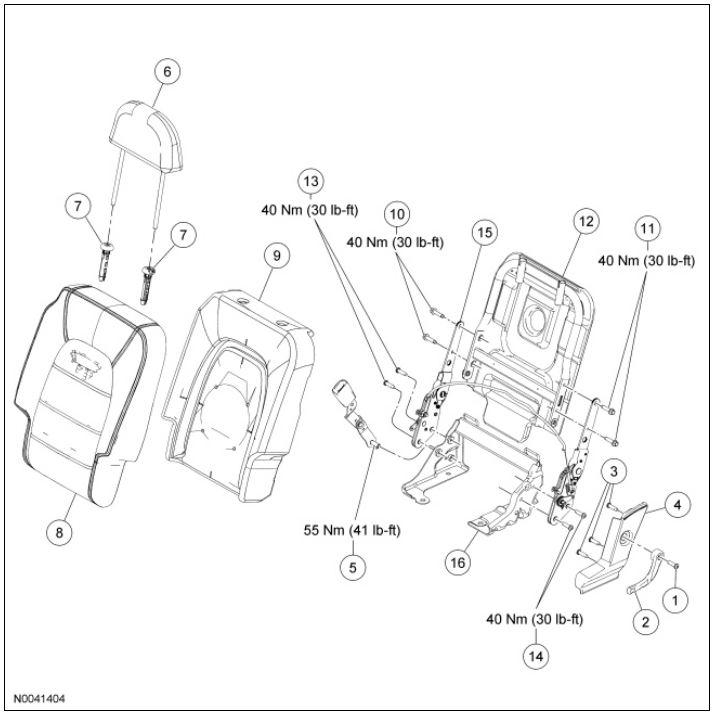
Second Row, 60 Percent Bench, Cushion



Item	Part Number	Description
1	854182	Latch cover screws
2	820007	Latch cover
3	854182	Latch cover screws
4	851262	Latch cover
5	-	Upper pivot latch bolt (part of 605C10)
6	-	Upper pivot latch bolt (part of 605C10)
7	63805	Cushion trim cover
8	63840	Cushion foam pad
9	63844	Cushion pad support
10	63844	Cushion pad support
11	631B79	Seat cushion frame

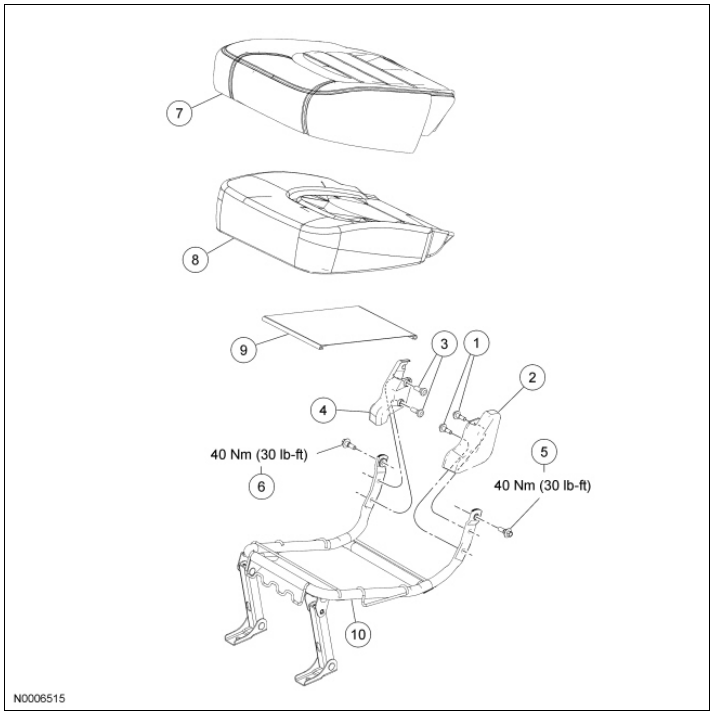
Second Row, 40 Percent Bench, Backrest

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Item	Part Number	Description
1	851334	Release handle screw
2	820015	Release handle
3	851334	Latch cover screws
4	820009	Outboard latch cover
5	611C73	Safety belt buckle and bolt
6	611A08	Head restraint
7	610A16	Head restraint sleeves
8	66601	Backrest trim cover
9	66801	Backrest foam pad
10	W505237	Upper latch bolts
11	W505237	Upper latch bolts
12	613A39	Backrest frame
13	W505237	Lower latch bolts
14	W505237	Lower latch bolts
15	61383	Latch assembly
16	600A87	Riser frame

Second Row, 40 Percent Bench, Cushion



Item	Part Number	Description
1	854182	Latch cover screws
2	820011	Latch cover
3	854182	Latch cover screws
4	851264	Latch cover
5	-	Upper pivot latch bolt (part of 605C10)
6	-	Upper pivot latch bolt (part of 605C10)
7	63805	Cushion trim cover
8	63841	Cushion foam pad
9	63844	Cushion pad support
10	631B79	Seat cushion frame

1. For additional information, refer to the procedures in this section.

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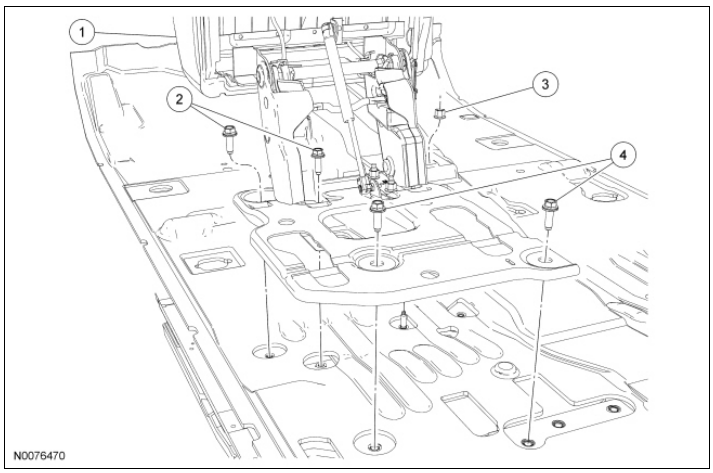
Seat - Second Row, 60/40, E-Z Entry

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

40 Percent E-Z Entry

NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.

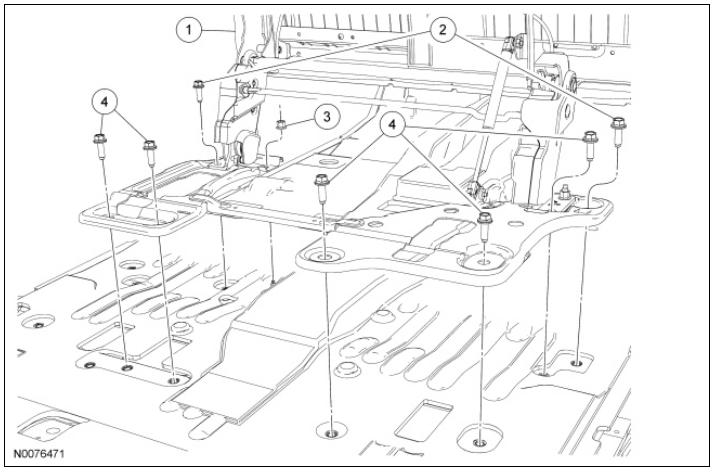


Item	Part Number	Description
1	-	40 percent E-Z entry seat
2	W711175	Mounting plate-to-floor front bolts (M10) (2 required)
3	N620482	Mounting plate-to-floor nut
4	W711952	Mounting plate-to-floor rear bolts (M12) (2 required)

60 Percent E-Z Entry

NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.

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Item	Part Number	Description
1	-	60 percent E-Z entry seat
2	W711175	Mounting plate-to-floor front bolts (M10) (2 required)
3	N620482	Mounting plate-to-floor nut
4	W711952	Mounting plate-to-floor rear bolts (M12) (5 required)

Removal

1. Remove the affected seat retainers and the remove the 40 percent or 60 percent seat.

Installation

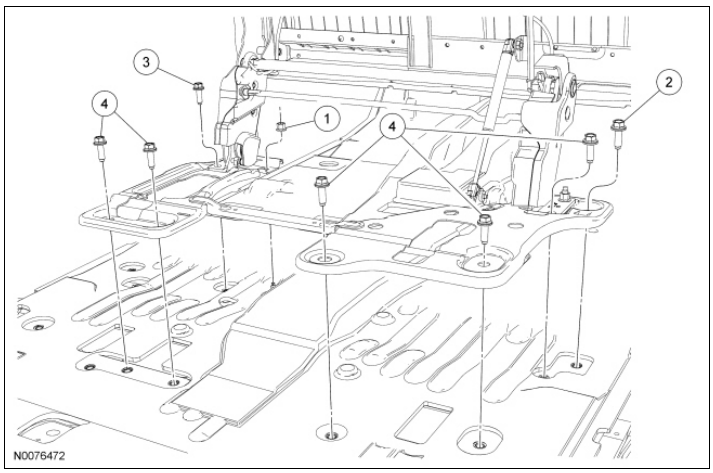
60 percent seat

1. Position the 60 percent seat into the vehicle.

2. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   Tighten the retainers in the following sequence.

   1. Tighten to 40 Nm (30 lb-ft).
   2. Apply threadlock and tighten to 40 Nm (30 lb-ft).
   3. Apply threadlock and tighten to 40 Nm (30 lb-ft).
   4. Apply threadlock and tighten the remaining 5 bolts in any sequence to 55 Nm (41 lb-ft).



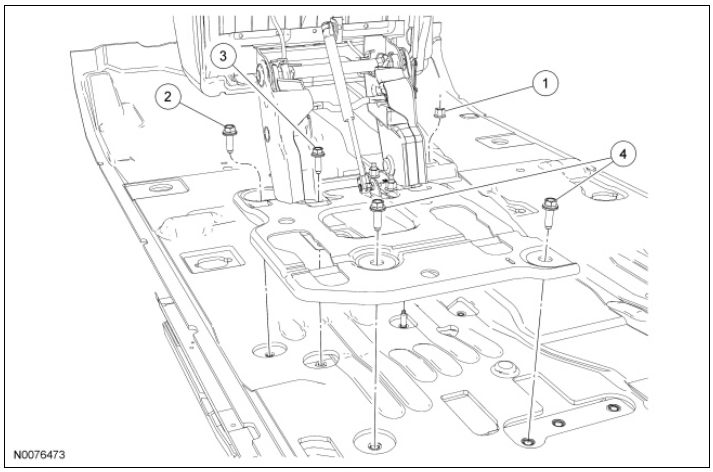
40 percent seat

3. Position the 40 percent seat into the vehicle.

4. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   Tighten the retainers in the following sequence.

   1. Tighten to 40 Nm (30 lb-ft).
   2. Apply threadlock and tighten to 40 Nm (30 lb-ft).
   3. Apply threadlock and tighten to 40 Nm (30 lb-ft).
   4. Apply threadlock and tighten the remaining 2 bolts in any sequence to 55 Nm (41 lb-ft).



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Seat Backrest - Second Row, 40 Percent E-Z Entry

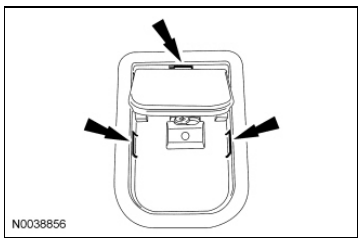
Removal

1. Remove the second row, 40 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, hook-and-loop strips and partially invert the backrest trim cover to expose the 2 inboard and 2 outboard recliner-to-backrest frame bolts.

3. Separate the kneeling mechanism release handle from the backrest frame.
   - Release the 3 kneeling mechanism release handle clips and separate from the backrest frame. Pull the kneeling mechanism release handle and cable back through the backrest frame.
     - Separating the kneeling mechanism release handle from the backrest frame can also be done by going between the backrest foam pad and backrest frame. Release the top and side clips and push out separating the kneeling mechanism release handle from the backrest frame.



4. Release the kneeling mechanism cable from the backrest frame.

5. Remove the 2 inboard and 2 outboard recliner-to-backrest frame bolts and remove the backrest assembly.

Installation

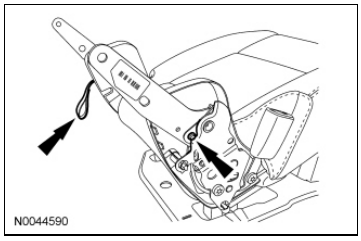
1. Remove 3 screws, recliner handle and outboard recliner outer cover.

2. Remove 2 screws and the inboard recliner outer cover.

3. ⚠ **WARNING: Use care when the seat back frame is removed and when releasing the recliners from a backrest upright position. The recliners are spring-loaded, which may cause the recliner upper arms to fold with significant speed/force. Failure to follow this instruction may result in serious personal injury.**

   Position the inboard recliner pin to the recliner stop.

   - The recliner pin must contact the inboard recliner outer plate (stop).



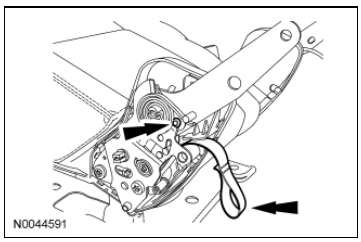
4. ⚠ **WARNING: Use care when the seat back frame is removed and when releasing the recliners from a backrest upright position. The recliners are spring-loaded, which may cause the recliner upper arms to fold with significant speed/force. Failure to follow this instruction may result in serious personal injury.**

   NOTE: If the latch feet are not locked around the strikers on the mounting plate, the recliners will not lock in position.

   NOTE: If the inboard recliner is not positioned to the recliner stop (or any upright position) when the outboard recliner is positioned to the recliner stop and the release strap is let go of, the recliners will not lock in place.

   Pull the release strap at the outboard recliner and position the outboard recliner pin to contact the recliner stop. Let go of the release strap and the inboard and outboard recliners will lock in place.

   - Each recliner pin must contact the recliner outer plate (stop).



5. Position the backrest assembly to the inboard and outboard recliners and hand-start the 2 inboard and 2 outboard recliner-to-backrest frame bolts.

6. ***NOTICE:*** **The recliner-to-backrest frame bolts must be tightened in sequence or recliner latches that do not lock in place or binding may occur.**

   Install the recliner-to-backrest frame bolts in the following sequence:

   1. Install the inboard recliner-to-backrest frame upper bolt.
      - ♦ Tighten to 55 Nm (41 lb-ft).
   2. Install the inboard recliner-to-backrest frame lower bolt.
      - ♦ Tighten to 55 Nm (41 lb-ft).
   3. Install the outboard recliner-to-backrest frame upper bolt.
      - ♦ Tighten to 55 Nm (41 lb-ft).
   4. Install the outboard recliner-to-backrest frame lower bolt.
      - ♦ Tighten to 55 Nm (41 lb-ft).

7. Position the kneeling mechanism release handle and cable back through the backrest frame and backrest trim cover openings.
   - Attach the kneeling mechanism release cable to the backrest frame.

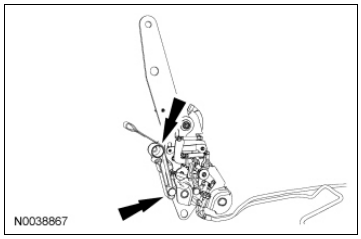
8. Roll the backrest trim cover down, attach the hook-and-loop strips and connect the backrest trim

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cover lower J-clip.

9. Position the kneeling mechanism release handle to the backrest opening and push in, engaging the clips.

10. Route the outboard recliner release strap before installing the outboard recliner outer cover.



11. Install the outboard recliner outer cover.
    - Position the outboard recliner outer cover.
    - Route the release strap through the cover.
    - Install the 2 screws.
    - Install the recliner handle.
    - Install the screw.

12. Position the inboard recliner outer cover and install the 2 screws.

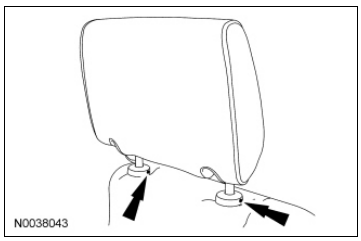
13. Install the second row, 40 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

14. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

Seat Backrest Cover - Second Row, 40 Percent E-Z Entry

Removal and Installation

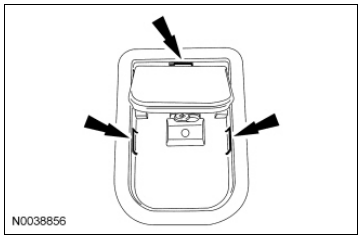
1. Using an appropriate tool, push in the hole of each head restraint guide while lifting up and remove the head restraint.



2. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, hook-and-loop strips and partially invert the trim cover.

3. Separate the kneeling mechanism release handle from the backrest frame.
   - Release the 3 kneeling mechanism release handle clips and separate from the backrest frame.
     - Separating the kneeling mechanism release handle from the backrest frame can also be done by going between the backrest foam pad and backrest frame. Release the top and side clips and push out, separating the kneeling mechanism release handle from the backrest frame.



4. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the hook-and-loop strips and invert the trim cover as high as it will go.

   - Pull the kneeling mechanism release handle and cable through the backrest trim cover opening.

5. From between the backrest foam pad and the backrest frame, reach up, pinch the ends together and remove the head restraint guides.

6. Remove the backrest trim cover.

7. To install, reverse the removal procedure.

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Seat Backrest - Second Row, 60 Percent, E-Z Entry

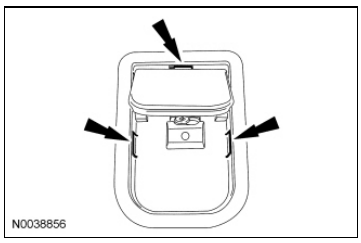
Removal

1. Remove the second row, 60 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, hook-and-loop strips and partially invert the backrest trim cover to expose the 2 inboard and 2 outboard recliner-to-backrest frame bolts.

3. Separate the kneeling mechanism release handle from the backrest frame.
   - Release the 3 kneeling mechanism release handle clips and separate from the backrest frame. Pull the kneeling mechanism release handle and cable back through the backrest frame.
     - Separating the kneeling mechanism release handle from the backrest frame can also be done by going between the backrest foam pad and backrest frame. Release the top and side clips and push out separating the kneeling mechanism release handle from the backrest frame.



4. Release the kneeling mechanism cable from the backrest frame.

5. Remove 2 screws and the inboard recliner outer cover.

6. Remove the safety belt anchor bolt and separate the safety belt anchor from the inboard recliner.

7. Remove the 2 inboard and 2 outboard recliner-to-backrest frame bolts and remove the backrest assembly.

Installation

1. Remove 3 screws, recliner handle and outboard recliner outer cover.

2. ⚠ **WARNING: Use care when the seat back frame is removed and when releasing the recliners from a backrest upright position. The recliners are spring-loaded, which may cause the recliner upper arms to fold with significant speed/force. Failure to follow this instruction may result in serious personal injury.**

   NOTE: An assistant will be necessary for this procedure.

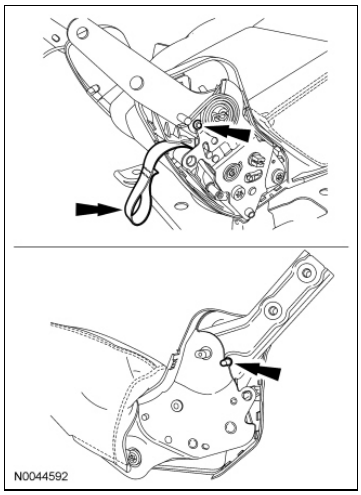
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NOTE: If the latch feet are not locked around the strikers on the mounting plate, the recliners will not lock in position.

NOTE: If both of the recliners are not locked in place simultaneously, the recliners will not lock in position.

Simultaneously pull the release strap at the outboard recliner and position the inboard and outboard recliner pins to the recliner stops. Let go of the release strap and the inboard and outboard recliners will lock in place.

- Each recliner pin must contact the recliner outer plate (stop).



3. Position the backrest assembly to the inboard and outboard recliners and hand-start the 2 inboard and 2 outboard recliner-to-backrest frame bolts.

4. ***NOTICE:*** **The recliner-to-backrest frame bolts must be tightened in sequence or recliner latches that do not lock in place or binding may occur.**

   Install the recliner-to-backrest frame bolts in the following sequence.

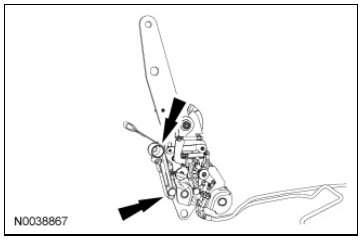
   1. Install the inboard recliner-to-backrest frame upper bolt.
      - Tighten to 55 Nm (41 lb-ft).
   2. Install the inboard recliner-to-backrest frame lower bolt.
      - Tighten to 55 Nm (41 lb-ft).
   3. Install the outboard recliner-to-backrest frame upper bolt.
      - Tighten to 55 Nm (41 lb-ft).
   4. Install the outboard recliner-to-backrest frame lower bolt.
      - Tighten to 55 Nm (41 lb-ft).

5. Position the kneeling mechanism release handle and cable back through the backrest frame and backrest trim cover openings.
   - Attach the kneeling mechanism release cable to the backrest frame.

6. Roll the backrest trim cover down, attach the hook-and-loop strips and connect the backrest trim cover lower J-clip.

7. Position the kneeling mechanism release handle to the backrest opening and push in, engaging the clips.

8. Route the outboard recliner release strap before installing the outboard recliner outer cover.



9. Position the outboard recliner outer cover, recliner handle and install the 3 screws.

10. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

    Position the safety belt anchor to the inboard recliner and install the safety belt anchor bolt.

    - Tighten to 55 Nm (41 lb-ft).

11. Position the inboard recliner outer cover and install the 2 screws.
    - Make sure the kneeling mechanism release cable pivot is still positioned on the inboard recliner and the recliner pin is through the cable pivot before installing the inboard recliner outer cover.

12. Install the second row, 60 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

13. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

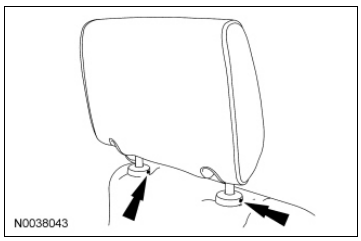
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Seat Backrest Cover - Second Row, 60 Percent, E-Z Entry

Removal

1. Using an appropriate tool, push in the hole of each head restraint guide while lifting up and remove the head restraint.



2. Remove 2 screws and the inboard recliner outer cover.

3. ***NOTICE:*** **Make sure the safety belt webbing is not twisted prior to installation. Failure to follow this instruction may result in incorrect operation of the safety belt retractor.**

   Remove the safety belt anchor bolt and separate safety belt anchor from the inboard recliner.

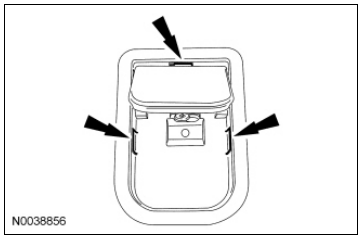
   - To install, tighten to 55 Nm (41 lb-ft).

4. Remove the safety belt bezel.

5. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, hook-and-loop strips and partially invert the backrest trim cover.

6. Separate the kneeling mechanism release handle from the backrest frame.
   - Release the 3 kneeling mechanism release handle clips and separate from the backrest frame.
     - Separating the kneeling mechanism release handle from the backrest frame can also be done by going between the backrest foam pad and backrest frame. Release the top and side clips and push out separating the kneeling mechanism release handle from the backrest frame.



7. Release the hook-and-loop strips and invert the trim cover as high as it will go.
   - Pull the kneeling mechanism release handle and cable through the backrest trim cover opening.

8. From between the backrest foam pad and the backrest frame, reach up, pinch the ends together and remove the 2 head restraint guides.

9. Route out the safety belt and remove the backrest trim cover.

10. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

    To install, reverse the removal procedure.

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Seat Cushion Cover - Second Row, 40 Percent E-Z Entry

Removal and Installation

1. Remove the 2 screws and the latch feet release bar.

2. Release all the cushion trim cover retainers and pin-type retainers.

3. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the hook-and-loop strips and remove the cushion trim cover from the cushion foam pad.

4. To install, reverse the removal procedure.
   - Make sure the lower anchor and tethers for children wires at the rear of the cushion frame are positioned through the cushion trim cover and accessible for use after installation.

Seat Cushion Cover - Second Row, 60 Percent, E-Z Entry

Removal

1. Remove the 2 screws and the latch feet release bar.
2. Release all the cushion trim cover retainers and pin-type retainers.
3. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the hook-and-loop strips and separate the cushion trim cover from the cushion foam pad.
4. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   To install, reverse the removal procedure.

   - Make sure the lower anchor and tethers for children wires at the rear of the cushion frame are positioned through the cushion trim cover and accessible for use after installation.

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Seat Recliner - Second Row, 40 Percent E-Z Entry

Removal and Installation

⚠ WARNING: Use care when the seat back frame is removed and when releasing the recliners from a backrest upright position. The recliners are spring-loaded, which may cause the recliner upper arms to fold with significant speed/force. Failure to follow this instruction may result in serious personal injury.

NOTICE: **The recliner bolts must be tightened in sequence or recliner latches that do not lock in place or binding may occur.**

Inboard and/or outboard recliners

1. Remove the second row, 40 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Remove the second row, 40 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent E-Z Entry in this section.

Outboard recliner

3. Remove 3 screws, recliner handle and outboard recliner outer cover.

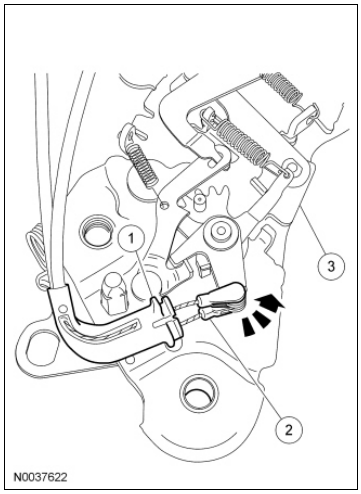
4. Separate the outboard recliner.
   - Remove the 2 outboard recliner-to-cushion frame bolts.
   - **NOTE:** When pulling outboard recliner out, note keyed position of recliner release shaft as it may pull out of inboard recliner.

     Pull out to release the outboard recliner from the recliner release shaft.
   - Separate the outboard recliner.

5. Remove the outboard recliner inner cover.

6. Remove the outboard recliner.
   1. Rotate the cable casing out of the outboard recliner.
   2. **NOTE:** The cable ends are color coded/keyed to the levers.

      Rotate the cable ends out of the outboard recliner levers.
   3. Remove the outboard recliner.



Inboard recliner

7. Remove the 2 screws and inboard recliner outer cover.

8. Separate the inboard recliner.
   - Remove the 2 inboard recliner-to-cushion frame bolts and the safety belt buckle.
   - **NOTE:** When pulling the inboard recliner out, note keyed position of recliner release shaft as it may pull out of outboard recliner.

     Pull out to release the inboard recliner from the recliner release shaft.
   - Separate the inboard recliner.

9. Remove the inboard recliner inner cover.

10. Remove the screw and separate the kneeling mechanism release cable pivot at the inboard recliner.
    - Remove the inboard recliner.

Installation

Inboard and/or outboard recliners

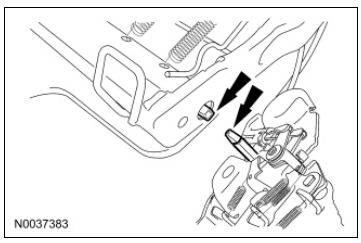
1. If necessary, position the recliner release shaft onto the recliner release pivot stub of the recliner still attached to the seat.

Inboard recliner

2. Install the inboard recliner inner cover.

3. **NOTE:** The inboard recliner inner cover is removed for clarity.

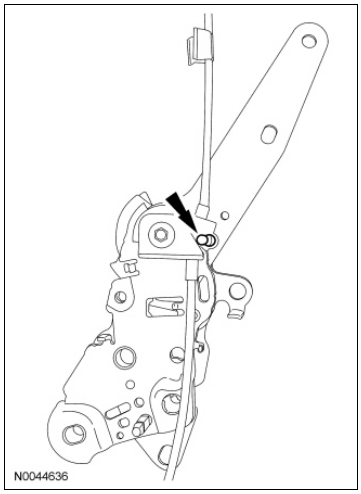
   Position the inboard recliner release pivot stub into the recliner shaft.



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4. Install the 2 inboard recliner-to-cushion frame bolts.
   - Tighten to 55 Nm (41 lb-ft).

5. Position the kneeling mechanism release cable pivot onto the inboard recliner and install the screw.
   - Make sure to put the recliner pin through the cable pivot.

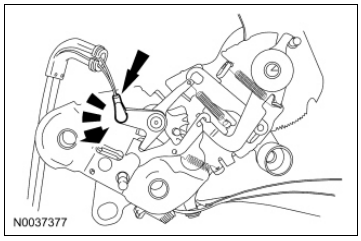


Outboard recliner

6. **NOTE:** The cable ends are color coded/keyed to the levers.

   Position each keyed cable end to the outboard recliner lever and rotate into position.

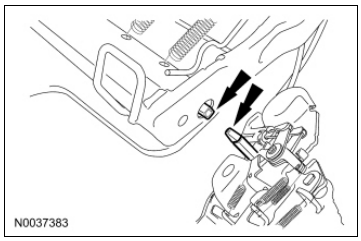
   - Install the cable casing to the outboard recliner.



7. Install the outboard recliner inner cover.

8. **NOTE:** The outboard recliner inner cover is removed for clarity.

   Position the outboard recliner release pivot stub into the recliner shaft.



9. Install the 2 outboard recliner-to-cushion frame bolts.
   - Tighten to 55 Nm (41 lb-ft).

Inboard and/or outboard recliners

10. Install the second row, 40 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent E-Z Entry in this section.

11. Install the second row, 40 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

12. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

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Seat Recliner - Inboard, Second Row, 60 Percent E-Z Entry

Removal

1. Remove the second row, 60 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Remove the second row, 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.

3. Separate the kneeling mechanism release cable pivot at the inboard recliner.

4. Release the cushion trim cover at the inboard side of the cushion frame. Pull the cushion trim cover back to expose 4 inboard recliner bolts.

5. Remove the inboard recliner.
   - Remove the 2 inboard recliner-to-cushion frame bolts.
   - Remove the inboard recliner-to-kneeling mechanism bolt.
   - Remove the inboard recliner-to-latch feet assembly bolt.
   - **NOTE:** When pulling inboard recliner out, note keyed position of recliner release shaft as it may pull out of outboard recliner.

     Pull out and remove the inboard recliner.

     ♦ Remove the inboard recliner inner cover.

Installation

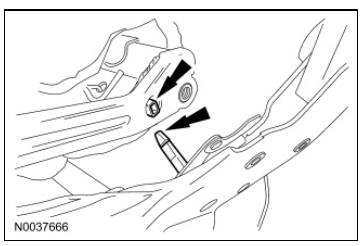
1. If necessary, position the recliner release shaft onto the outboard recliner release pivot stub.

2. Install the inboard recliner inner cover.

3. **NOTE:** The inboard recliner inner cover has been removed for clarity.

   Position the inboard recliner.

   - Position the inboard recliner release pivot stub into the recliner release shaft.
   - Align the inboard recliner to the cushion frame, latch feet assembly and kneeling mechanism.



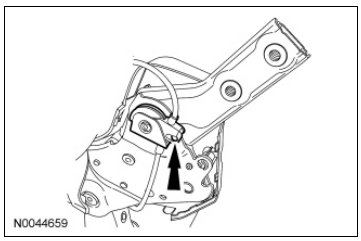
4. Hand-start the 2 inboard recliner-to-cushion frame bolts, inboard recliner-to-latch feet assembly bolt and inboard recliner-to-kneeling mechanism bolt.

5. ***NOTICE:*** **The recliner bolts must be tightened in sequence or recliner latches that do not lock in place or binding may occur.**

   Install the inboard recliner bolts in the following sequence.

   1. Install the inboard recliner-to-latch feet assembly bolt.
      - Tighten to 55 Nm (41 lb-ft).
   2. Install the inboard recliner-to-kneeling mechanism bolt.
      - Tighten to 55 Nm (41 lb-ft).
   3. Install the inboard recliner-to-cushion frame rear bolt.
      - Tighten to 55 Nm (41 lb-ft).
   4. Install the inboard recliner-to-cushion frame front bolt.
      - Tighten to 55 Nm (41 lb-ft).

6. Position the kneeling mechanism release cable pivot at the inboard recliner.
   - Make sure the inboard recliner pin is through the cable pivot.



7. Attach the cushion trim cover retainers at the inboard side of the cushion frame.

8. Install the second row, 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.

9. Install the second row, 60 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

10. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

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Seat Recliner - Outboard, Second Row, 60 Percent E-Z Entry

Removal

1. Remove the second row, 60 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Remove the second row, 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.

3. Remove 3 screws, recliner handle and outboard recliner outer cover.

4. Remove the 2 outboard recliner-to-backrest frame bolts.

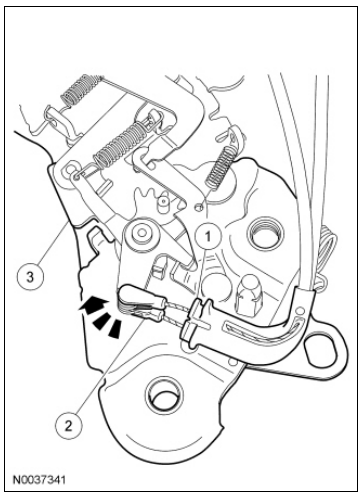
5. **NOTE:** When pulling outboard recliner out, note keyed position of recliner release shaft as it may pull out of inboard recliner.

   Remove 2 outboard recliner-to-cushion frame bolts, pull out and separate the outboard recliner.

6. Remove the outboard recliner inner cover.

7. Remove the outboard recliner.
   1. Rotate the cable casing out of the outboard recliner.
   2. **NOTE:** The cable ends are color coded/keyed to the levers.

      Rotate the cable ends out of the outboard recliner levers.
   3. Remove the outboard recliner.



Installation

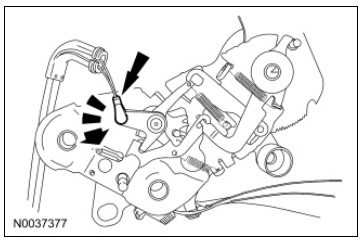
1. If necessary, position the recliner release shaft onto the inboard recliner release pivot stub.

2. **NOTE:** The cable ends are color coded/keyed to the levers.

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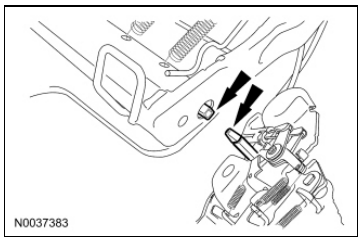
Position each keyed cable end to the outboard recliner lever and rotate into position.

- Install the cable casing to the outboard recliner.



3. Install the outboard recliner inner cover.

4. Position the outboard recliner release pivot stub into the recliner shaft.



5. Install the 2 outboard recliner-to-cushion frame bolts.
   - Tighten to 55 Nm (41 lb-ft).

6. Install the second row, 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.

7. Install the second row, 60 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

8. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

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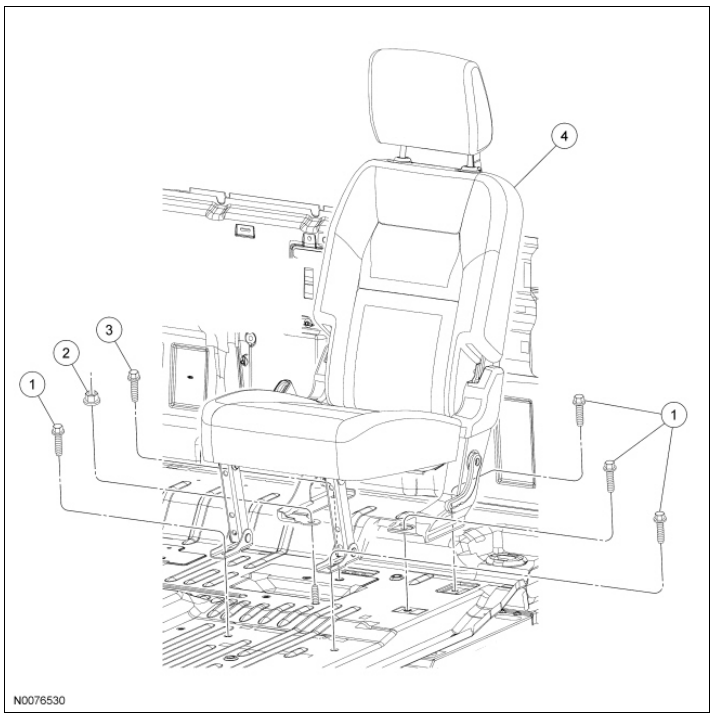
Seat - Second Row, Sport Trac

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

40 Percent Seat

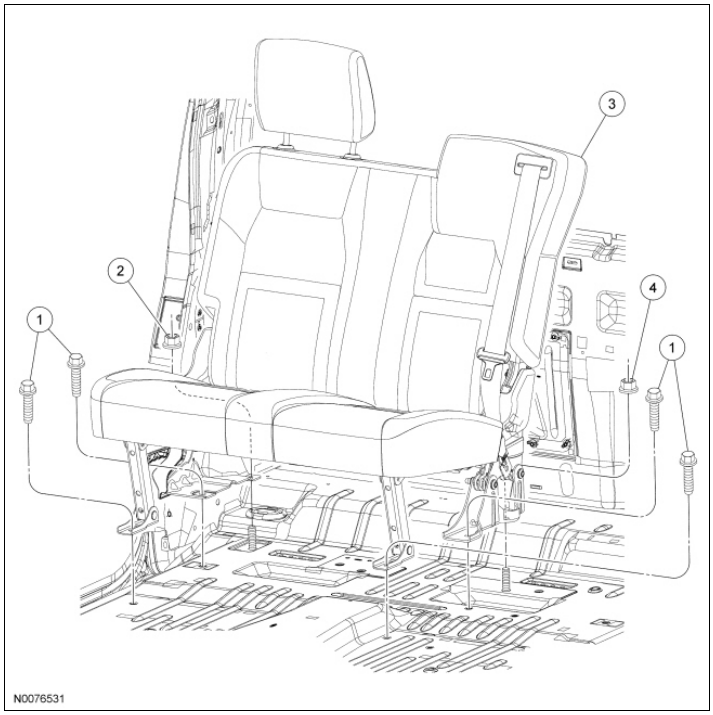
NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.



Item	Part Number	Description
1	W711175	Seat-to-floor bolts (M10) (4 required)
2	N620482	Seat-to-floor nut
3	W711952	Seat-to-floor bolt (M12)
4	-	40 percent seat

60 Percent Seat

NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.



Item	Part Number	Description
1	W711175	Seat-to-floor bolts (M10) (4 required)
2	N620482	Seat-to-floor nut (M10)
3	-	60 percent seat
4	N801995	Seat-to-floor nut (M12)

Removal

NOTE: When removing the 60 percent seat, the 40 percent seat must be removed first to gain access to the 60 percent seat-to-floor fasteners.

40 and 60 percent seats

1. Remove the 40 percent seat front seat-to-floor retainers.

2. With the 40 percent seat in the normal sitting position, lift the seat cushion up for access to the 40 percent seat rear retainers.

3. Remove the rear retainers and 40 percent seat from the vehicle.

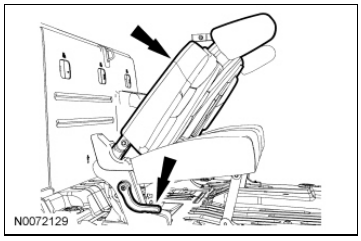
60 percent seat

4. Remove the 60 percent seat front seat-to-floor retainers.

5. With the 60 percent seat in the normal sitting position, lift the seat cushion up for access to the 60 percent seat rear retainers.
    - Pull the safety belt buckles through the 60 percent seat cushion opening.

6. Turn the release handle, releasing the outboard and upper latches and fold the backrest forward.
    - Remove the 60 percent seat from the vehicle.

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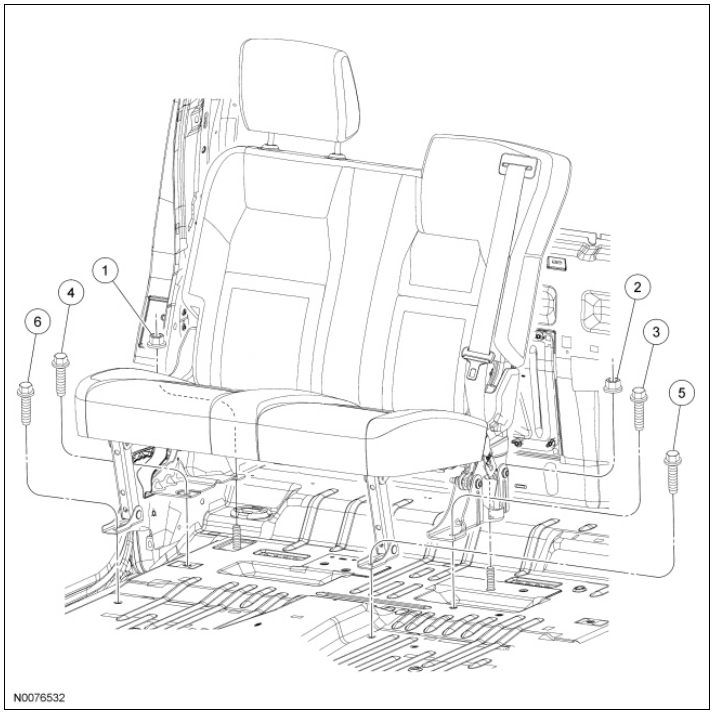


Installation

60 percent seat

1. Position the 60 percent seat in the vehicle.

2. Tighten the retainers in the sequence shown.
    1. Tighten to 40 Nm (30 lb-ft).
    2. Tighten to 55 Nm (41 lb-ft).
    3. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    4. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    5. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    6. Apply threadlock and tighten to 40 Nm (30 lb-ft).



3. **NOTE:** Make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

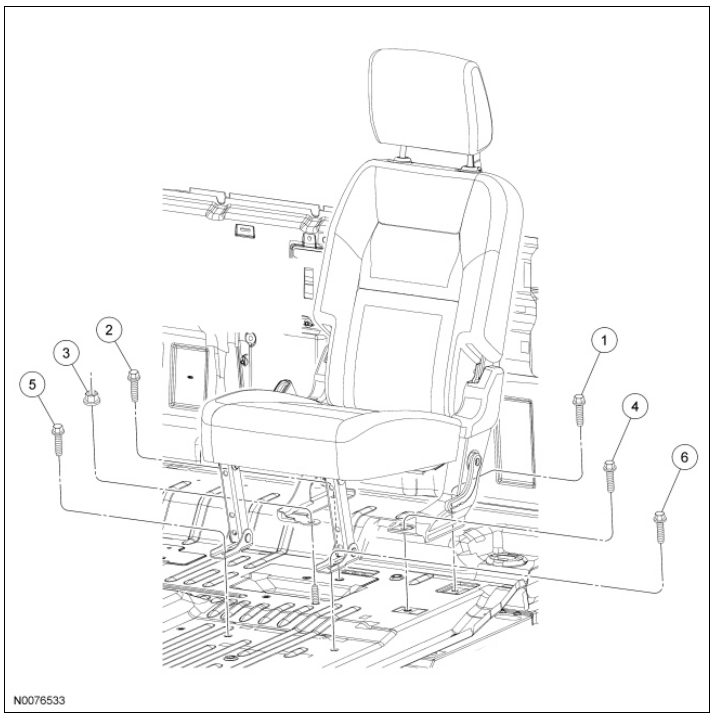
   Position the safety belt buckles through the 60 percent seat cushion opening.

4. Position the backrest upright and make sure the outboard and upper latches lock the backrest in the upright position.

40 and 60 percent seats

5. Position the 40 percent seat in the vehicle.

6. Tighten the retainers in the sequence shown.
    1. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    2. Apply threadlock and tighten to 55 Nm (41 lb-ft).
    3. Tighten to 40 Nm (30 lb-ft).
    4. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    5. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    6. Apply threadlock and tighten to 40 Nm (30 lb-ft).



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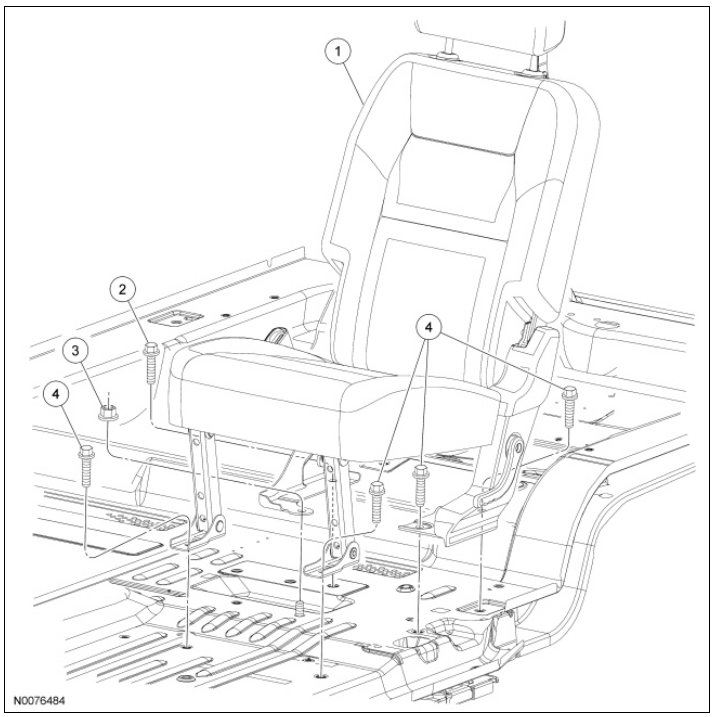
Seat - Second Row, Explorer, 60/40 Bench

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

40 Percent Seat

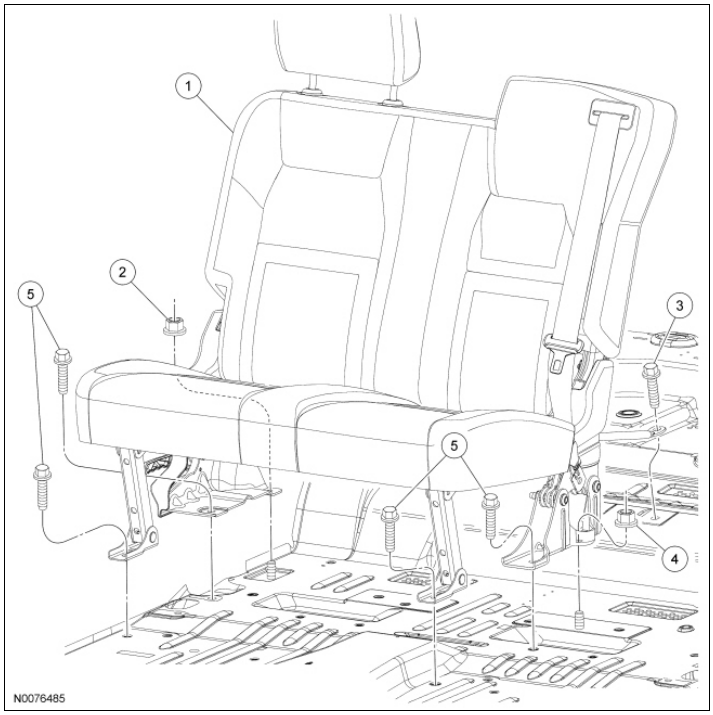
NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.



Item	Part Number	Description
1	-	40 percent seat
2	W711952	Seat-to-floor bolt (M12)
3	N620482	Seat-to-floor nut
4	W711175	Seat-to-floor bolts (M10) (4 required)

60 Percent Seat

NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.



Item	Part Number	Description
1	-	60 percent seat
2	N620482	Seat-to-floor nut (M10)
3	W711952	Tether-to-floor bolt (M12) (late build)
4	N801995	Seat-to-floor nut (M12)
5	W711175	Seat-to-floor bolts (M10) (4 required)

Removal

NOTE: When removing the 60 percent seat, the 40 percent seat must be removed first to gain access to the 60 percent seat-to-floor fasteners.

40 and 60 percent seats

1. Remove the 40 percent seat front seat-to-floor bolts.

2. With the 40 percent seat in the normal sitting position, lift the seat cushion up for access to the 40 percent seat rear retainers.

3. Remove the rear retainers and 40 percent seat from the vehicle.

60 percent seat

4. Remove the tether-to-floor bolt (if equipped).

5. Remove the 60 percent seat front seat-to-floor bolts.

6. With the 60 percent seat in the normal sitting position, lift the seat cushion up for access to the 60 percent seat rear retainers.
    - Pull the safety belt buckles through the 60 percent seat cushion opening.

7. Remove the rear retainers and 60 percent seat from the vehicle.

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Installation

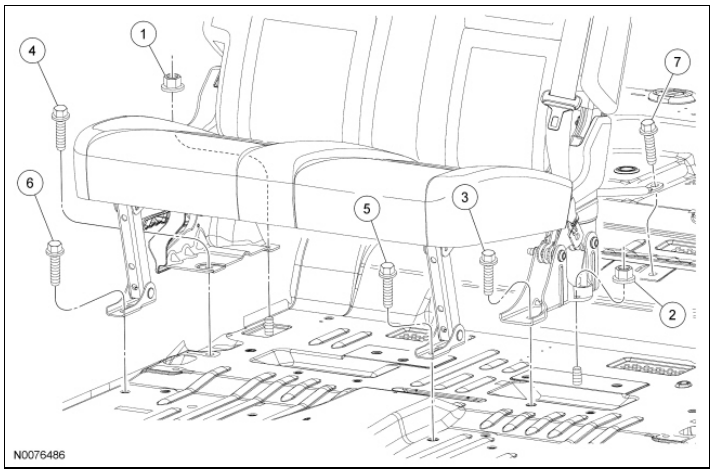
60 percent seat

1. Position the 60 percent seat in the vehicle.
    - Position the safety belt buckles through the 60 percent seat cushion opening.

2. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   Tighten the retainers in the sequence shown.

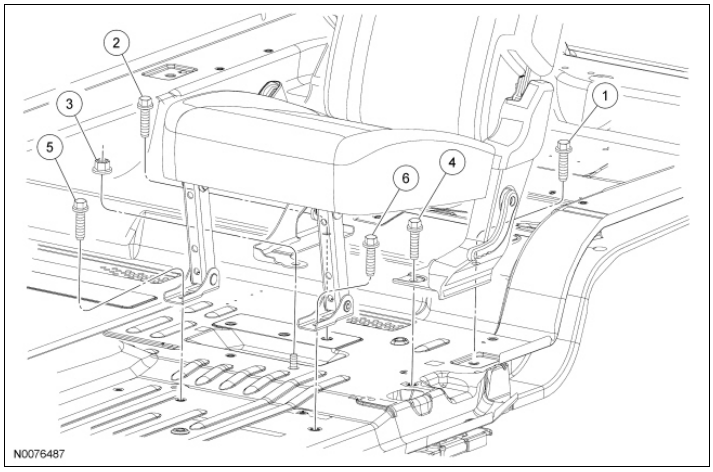
    1. Tighten to 40 Nm (30 lb-ft).
    2. Tighten to 55 Nm (41 lb-ft).
    3. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    4. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    5. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    6. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    7. Apply threadlock and tighten to 55 Nm (41 lb-ft).



40 and 60 percent seats

3. Position the 40 percent seat in the vehicle.

4. Tighten the retainers in the sequence shown.
    1. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    2. Apply threadlock and tighten to 55 Nm (41 lb-ft).
    3. Tighten to 40 Nm (30 lb-ft).
    4. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    5. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    6. Apply threadlock and tighten to 40 Nm (30 lb-ft).



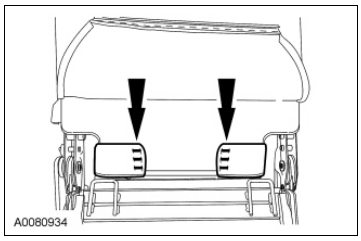
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Seat Backrest - Second Row, 40 Percent, Bench

Removal

1. Release the seat backrest J-clip.

2. Remove all the staples holding the backrest trim cover to the backrest support panel.



3. Invert the seat backrest trim cover and foam pad to access the latch cover screws.

4. Remove the 4 screws and the 2 covers. Detach the seat backrest material attachment from both of the latch covers.

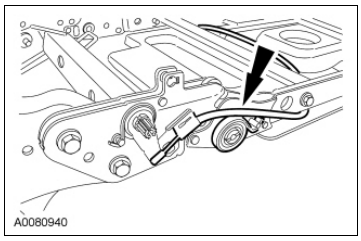
5. Remove the 2 backrest support panel lower screws and detach the latch cable. Position the cable out from between the backrest frame and backrest support panel.

6. Remove the 4 backrest pivot bolts.

7. Remove the 40 percent backrest.

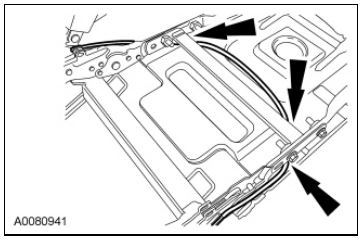
Installation

1. Position the backrest to the latch. The cable is to be routed in front of the spring.



2. **NOTE:** When installing the backrest to the cushion, make sure the latch cover does not come in contact with the latch cable conduit or end fitting. The cable is to move freely after assembly.

   The cable is to pass between the backrest frame and the backrest support at the 2 points shown.



3. Install the 4 backrest pivot bolts.
   - Tighten to 40 Nm (30 lb-ft).

4. Install the 2 backrest support panel lower screws.

5. ***NOTICE:*** **When installing the backrest to the cushion, make sure the latch cover does not come in contact with the latch cable conduit or end fitting.**

   Position the 2 covers and install the 4 screws. Attach the material attachments to both of the latch covers.

6. Roll the seat backrest trim cover and foam pad back down into position.

7. Position the trim cover and install staples in the backrest support panel.

8. Attach the seat backrest J-clip.

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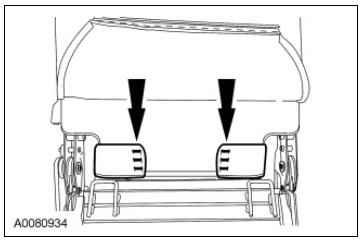
Seat Backrest Cover - Second Row, 40 Percent, Bench

Removal and Installation

1. Remove the head restraint.

2. Release the seat backrest J-clip.

3. Remove all the staples holding the backrest trim cover to the backrest support panel.

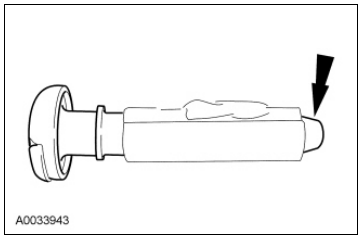


4. Invert the seat backrest trim cover and foam pad to access the head restraint sleeve.

5. **NOTE:** The inboard and outboard head restraint sleeves are not interchangeable.

   NOTE: The head restraint sleeves incorporate an alignment tab that must face forward when installed.

   Squeeze together the tip of the head restraint sleeve and pull the sleeve out of the frame tube.



6. ***NOTICE:*** **Use care when separating the seat backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Separate the hook-and-loop fasteners. Remove the seat backrest trim cover.

7. To install, reverse the removal procedure.

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Seat Backrest - Second Row, 60 Percent, Bench

Removal

All vehicles

1. Remove the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

Sport Trac vehicles

2. Remove the safety belt guide cover in the following sequence.
    1. Pull out at the bottom and release the 2 safety belt guide cover retainers.
    2. Tip the bottom of the safety belt guide cover up to release the top retainer and remove the safety belt guide cover.

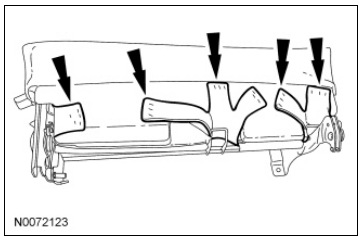
3. Remove the retainers and the upper latch cover.

All vehicles

4. Remove the safety belt anchor bolt.

5. Release the backrest trim cover lower J-clips.

6. Remove all the staples holding the backrest trim cover to the backrest support panel.



7. Position the backrest trim cover and foam pad to access the latch cover screws.

8. Remove the latch covers in the following sequence.
    1. Remove the 4 latch cover screws.
    2. Detach the backrest trim cover from the latch covers.
    3. Remove the latch covers.

Explorer and Mountaineer vehicles

9. Remove the 2 backrest support panel lower screws and detach the latch release cable from the backrest support panel.

Sport Trac vehicles

10. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

Separate the hook-and-loop fasteners and invert the backrest trim cover. Pull the backrest trim cover up over the top of the backrest frame to expose the backrest support panel screws and the upper latch bolts.

11. Remove the backrest support panel in the following sequence.
    1. Remove the backrest support panel screws.
    2. Slide the backrest support panel down and release it from the safety belt retractor cover.
    3. Release the latch release cable from the backrest support panel.
    4. Remove the backrest support panel.

12. Remove the screw and the inner latch cover.

13. Remove the 2 upper latch bolts.

14. Separate the latch release cable pin-type retainer from the backrest frame.

All vehicles

15. Remove the outboard upper pivot latch bolt.

16. Remove the 2 inboard and 2 outboard latch-to-backrest frame bolts.

17. Remove the 60 percent backrest.
    - For Explorer and Mountaineer, position the latch release cable out from between the backrest frame and backrest support panel.

Installation

Sport Trac vehicles

1. Install the backrest frame to the inboard and outboard latches in the following sequence.
    1. Position the backrest frame to the inboard and outboard latches and hand-start the 2 inboard and 2 outboard latch-to-backrest frame bolts.
    2. Hand-start the outboard upper pivot latch bolt.
    3. Install the 2 inboard latch-to-backrest frame bolts.
        - Tighten to 40 Nm (30 lb-ft).
    4. Install the 2 outboard latch-to-backrest frame bolts.
        - Tighten to 40 Nm (30 lb-ft).
    5. Install the outboard upper pivot latch bolt.
        - Tighten to 40 Nm (30 lb-ft).

2. Position the upper latch and install the bolts.
    - Tighten to 25 Nm (18 lb-ft).

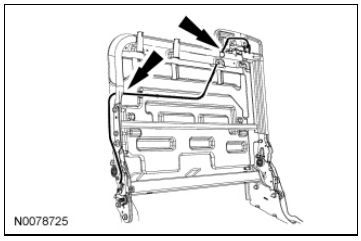
3. Position the inner latch cover and install the screw.

4. **NOTE:** The safety belt retractor has been removed for clarity.

   Position the backrest support panel to the backrest frame and route the latch release cable.

   - The latch release cable is to pass between the backrest frame and the backrest support at the 2 points shown.

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5. **NOTE:** The cable is to move freely after assembly.

   Install the backrest support panel screws to the backrest frame.

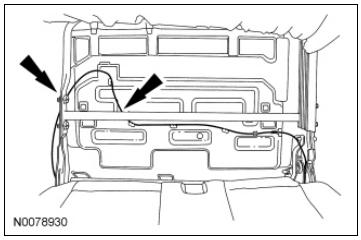
   - Attach the latch release cable to the backrest support panel.

Explorer and Mountaineer vehicles

6. **NOTE:** The cable is to move freely after assembly.

   Position the backrest to the inboard and outboard latches and route the cable between the backrest frame and support panel.

   - The cable is to pass between the backrest frame and the backrest support at the 2 points shown.



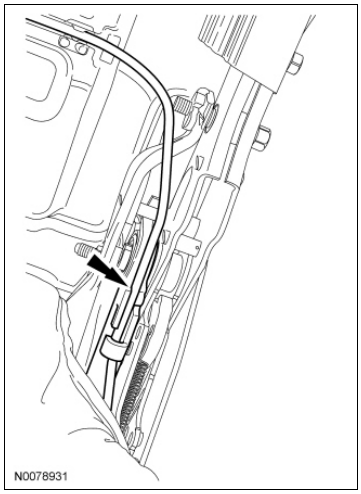
7. Install the backrest frame to the inboard and outboard latches in the following sequence.
   1. Position the backrest frame to the inboard and outboard latches and hand-start the 2 inboard and 2 outboard latch-to-backrest frame bolts.
   2. Hand-start the outboard upper pivot latch bolt.
   3. Install the 2 inboard latch-to-backrest frame bolts.
      - Tighten to 40 Nm (30 lb-ft).
   4. Install the 2 outboard latch-to-backrest frame bolts.
      - Tighten to 40 Nm (30 lb-ft).
   5. Install the outboard upper pivot latch bolt.
      - Tighten to 40 Nm (30 lb-ft).

8. **NOTE:** The cable is to move freely after assembly.

   Install the backrest support panel screws to the backrest frame.

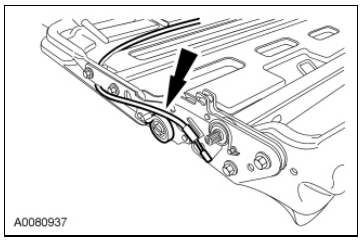
   - Attach the latch release cable to the backrest support panel.

9. Route the latch release cable through the inboard latch holder.



All vehicles

10. Position the latch release cable in front of the spring.



11. Roll the backrest trim cover down.
    - For Sport Trac, route the safety belt through the backrest trim cover.
    - Attach the backrest trim cover to backrest foam pad hook-and-loop strips.

12. Attach the backrest trim cover to both of the latch covers. Position the 2 latch covers and install the 4 screws.

13. Position the trim cover and install staples in the backrest support panel.

14. Attach the backrest trim cover J-clip.

15. Position the safety belt anchor and install the bolt.
    - To install, tighten to 121 Nm (89 lb-ft).

Sport Trac vehicles

16. Position the upper latch cover and install the retainers.

17. Install the safety belt guide cover.

All vehicles

18. Install the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

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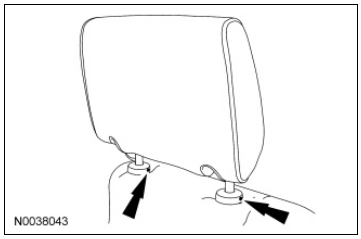
Seat Backrest Cover - Second Row, 60 Percent, Bench

Removal and Installation

All vehicles

1. Remove the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

2. Using an appropriate tool, push in the hole of each head restraint guide while lifting up and remove the head restraint.



3. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   Remove the safety belt anchor bolt.

   - To install, tighten to 121 Nm (89 lb-ft).

4. Remove the safety belt guide cover in the following sequence.
   1. Pull out at the bottom and release the 2 safety belt guide cover retainers.
   2. Tip the bottom of the safety belt guide cover up to release the top retainer and remove the safety belt guide cover.

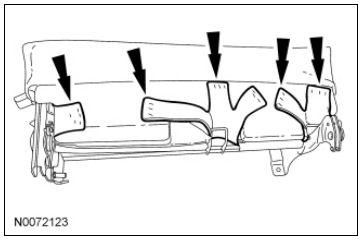
Sport Trac vehicles

5. Remove the retainers and the upper latch cover.

All vehicles

6. Release the backrest trim cover J-clip.

7. Remove all the staples in the backrest support panel.



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8. Reposition the backrest trim cover and foam pad to access the latch cover screws.

9. Remove the latch covers in the following sequence.
    1. Remove the 4 latch cover screws.
    2. Detach the backrest trim cover from the latch covers.
    3. Remove the latch covers.

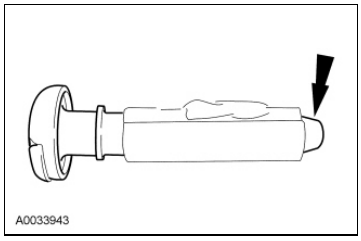
10. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

    Separate the hook-and-loop fasteners and invert the backrest trim cover.

11. **NOTE:** The inboard and outboard head restraint sleeves are not interchangeable.

    NOTE: The head restraint sleeves incorporate an alignment tab that must face forward when installed.

    Squeeze together the tip of the head restraint sleeve and pull the sleeve out of the frame tube.



12. Remove the backrest trim cover.
    - Feed the safety belt out through the opening in the backrest trim cover.

13. To install, reverse the removal procedure.

Seat Cushion Cover - Second Row, 40 Percent, Bench

Removal and Installation

1. Remove the second row 40 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

2. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the J-clips, separate the hook-and-loop fasteners, remove the hog rings and the cushion trim cover.

3. To install, reverse the removal procedure.

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Seat Cushion Cover - Second Row, 60 Percent, Bench

Removal and Installation

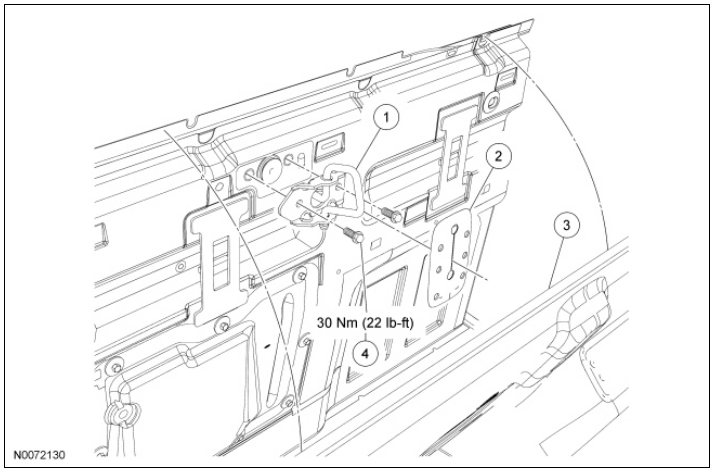
1. Remove the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

2. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the J-clips, separate the hook-and-loop fasteners, remove the hog rings and the cushion trim cover.

3. To install, reverse the removal procedure.

Seat Latch Striker - Second Row, Sport Trac, 60 Percent Bench

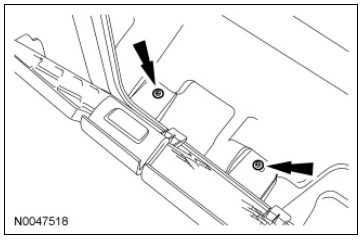


Item	Part Number	Description
1	62452	Seat latch striker
2	-	Seat latch striker cover
3	40374	Cab rear trim panel
4	W505264	Seat latch striker bolt (2 required)

Removal and Installation

1. Fold the rear 60 percent and 40 percent seat backrests forward.

2. Remove the 2 screws from the storage compartment.



3. **NOTE:** When separating the cab rear trim panel, start in the upper left corner, moving clockwise and separate the panel from the retaining clips.

   Pull to release the clips and position the cab rear trim panel forward to access the seat latch striker.

4. Remove the 2 bolts and remove the striker.
   - To install, tighten to 30 Nm (22 lb-ft).

5. To install, reverse the removal procedure.

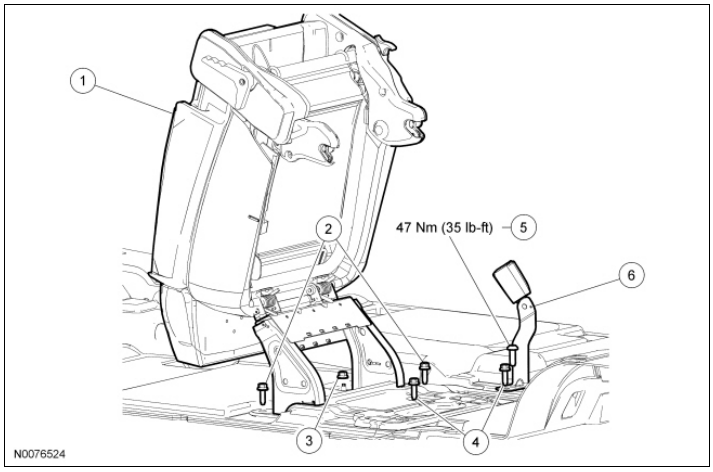
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Seat - Second Row, Bucket

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

NOTE: When installing any seat-to-floor bolts or floor studs, apply threadlock.



Item	Part Number	Description
1	-	Bucket seat
2	W711175	Seat-to-floor bolts (M10) (2 required)
3	N620482	Seat-to-floor nut
4	W711952	Seat-to-floor bolts (M12) (2 required)
5	-	Safety belt buckle bolt (part of 60045)
6	60045	Safety belt buckle

Removal and Installation

NOTE: LH seat shown, RH seat similar.

1. Remove the front seat-to-floor nut and bolt.
2. Fold the affected bucket seat up to the E-Z entry position.
3. Pull up to release and remove the floor riser trim cover.
4. Remove the safety belt buckle bolt and the safety belt buckle.
5. Remove the 3 seat-to-floor bolts.

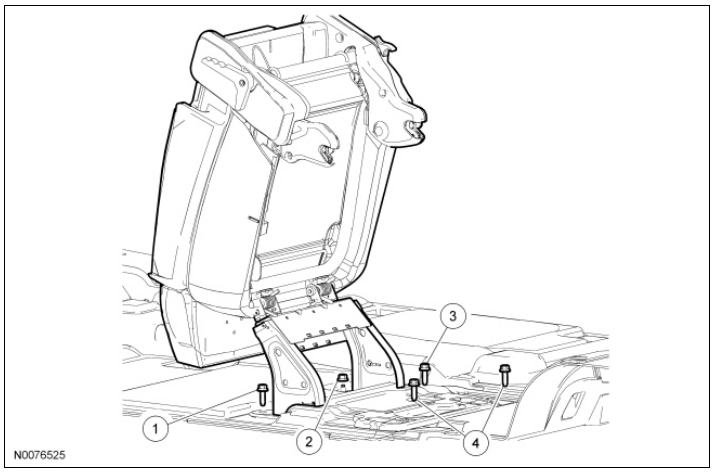
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6. Remove the bucket seat.

Installation

1. Position the seat in the vehicle.

2. Tighten the retainers in the following sequence.
    1. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    2. Tighten to 40 Nm (30 lb-ft).
    3. Apply threadlock and tighten to 40 Nm (30 lb-ft).
    4. Apply threadlock and tighten the remaining 2 bolts in any sequence to 55 Nm (41 lb-ft).



3. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   Position the safety belt buckle and install the bolt.

   - Apply threadlock and tighten to 47 Nm (35 lb-ft).

Seat Backrest - Second Row, Bucket

Removal and Installation

1. Release all of the seat backrest J-clips. Slightly raise the backrest trim cover.

2. Remove all of the staples in the backrest trim cover.

3. Pull the seat backrest material up and remove the 4 backrest bolts. Remove the backrest assembly.
   - To install, tighten to 23 Nm (17 lb-ft).

4. To install, reverse the removal procedure.

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Seat Backrest Cover - Second Row, Bucket

Removal and Installation

1. Remove the head restraint.

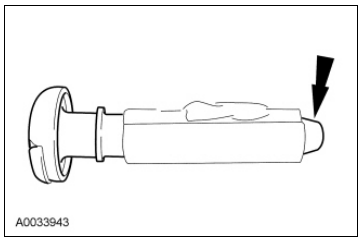
2. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover lower J-clip, separate the hook-and-loop fasteners, remove 2 rows of hog rings and invert the backrest trim cover as high as it will go.

3. **NOTE:** The inboard and outboard head restraint sleeves are not interchangeable.

   NOTE: The head restraint sleeves incorporate an alignment tab that must face forward when installed.

   Squeeze together the tip of the head restraint sleeve and pull the sleeve out of the frame tube.



4. Remove the seat backrest trim cover.

5. To install, reverse the removal procedure.

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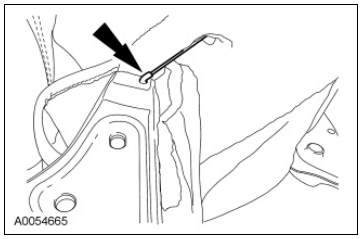
Seat Cushion Cover - Second Row, Bucket

Removal and Installation

1. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the cushion trim cover J-clips, separate the hook-and-loop fasteners and remove one row of hog rings.

2. Release the cable from the seat riser and remove the cushion trim cover.



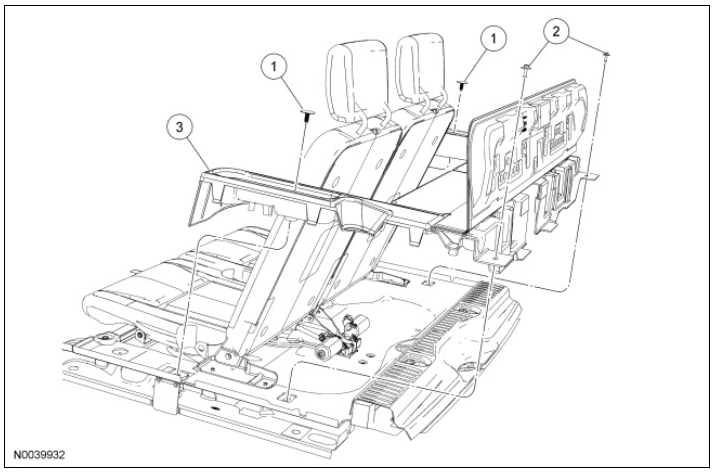
3. To install, reverse the removal procedure.

Seat - Third Row

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

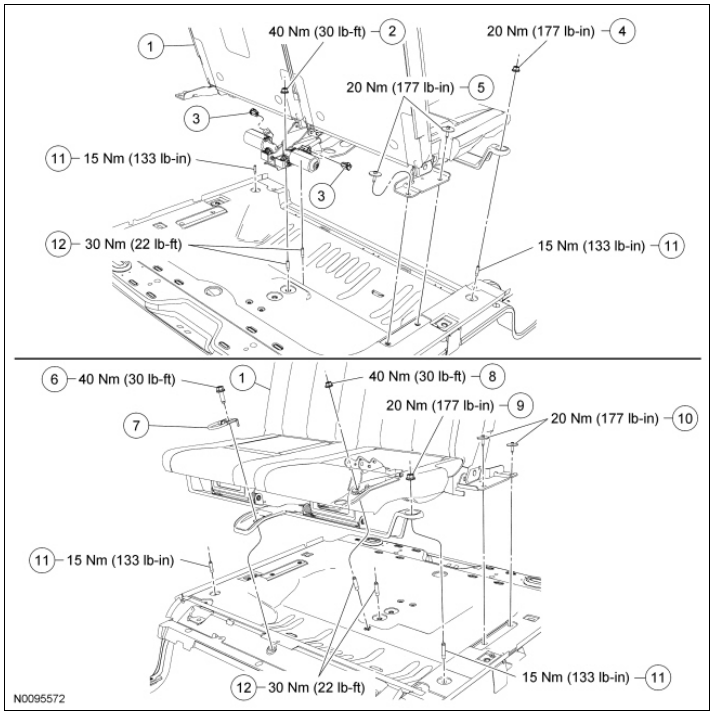
Cargo Management System



Item	Part Number	Description
1	W709343	Pin-type retainers (2 required)
2	W704734	Bolts (2 required)
3	310A67	Cargo management system

Third Row Seat

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Item	Part Number	Description
1	-	Third row seat
2	W707654	Floor mounting bracket center rear nut
3	-	Power fold seat motor electrical connectors (part of 14B509)
4	W710869	Floor mounting bracket RH nut
5	W710851	Floor mounting bracket RH bolts (2 required)
6	-	Floor mounting bracket front bolt (part of 613D74)
7	613D74	Child safety seat tether anchor
8	W707654	Floor mounting bracket center front nut
9	W710869	Floor mounting bracket LH nut
10	W710851	Floor mounting bracket LH bolts (2 required)
11	W710867	Floor mounting bracket LH/RH studs (2 required)
12	W711375	Floor mounting bracket center studs (2 required)

Removal and Installation

All seats

1. Remove the 2 pin-type retainers.

2. Remove the 2 bolts and the cargo management system.

Power fold seats

3. Separate any power fold seat wire harness pin-type retainers and disconnect the power fold seat motor electrical connectors.

All seats

4. Remove the 2 LH and 2 RH floor mounting bracket bolts.
    - To install, apply threadlock and tighten to 20 Nm (177 lb-in).

5. Remove the floor mounting bracket center front and rear nuts.
    - To install, tighten to 40 Nm (30 lb-ft).

6. Remove the floor mounting bracket front bolt and child safety seat tether anchor.
    - To install, apply threadlock and tighten to 40 Nm (30 lb-ft).

7. Remove the floor mounting bracket LH and RH nuts.
    - To install, tighten to 20 Nm (177 lb-in).

8. Remove the third row seat.

9. To install, reverse the removal procedure.
    - When installing any seat-to-floor bolts or studs, apply threadlock.

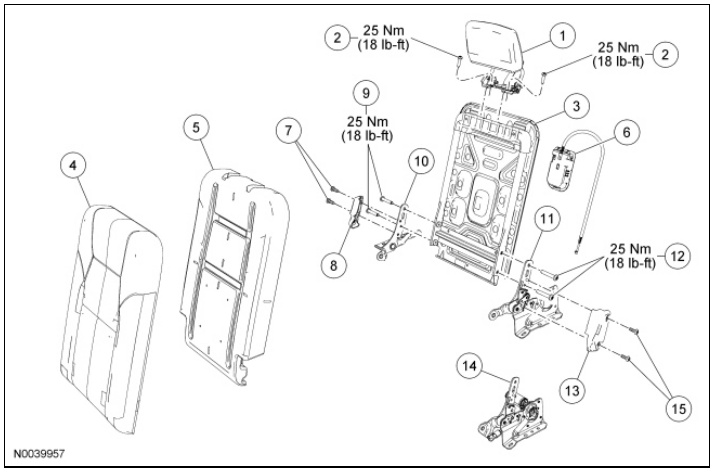
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Seat - Exploded View, Third Row

Third Row Seat Backrest

NOTE: RH backrest shown, LH similar.

NOTE: Power latch shown, manual latch similar.

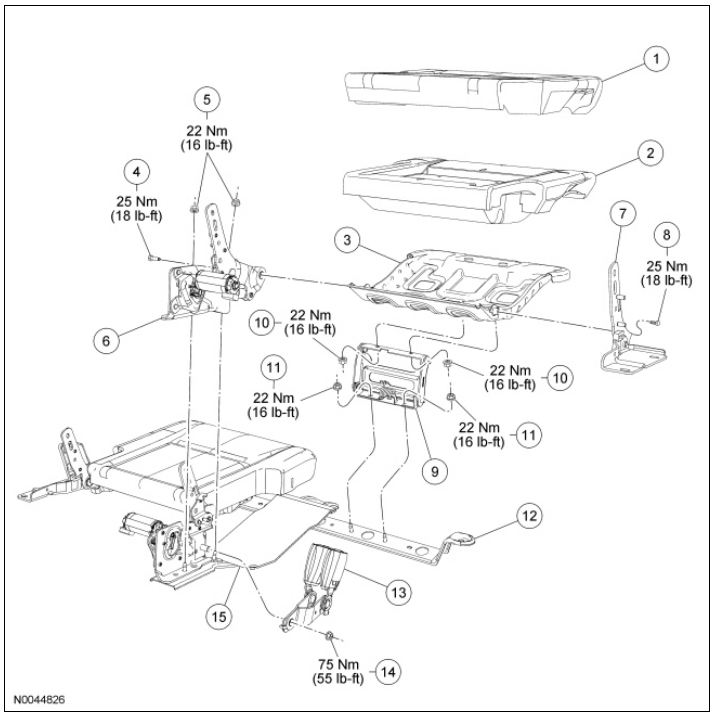


Item	Part Number	Description
1	611A08	Head restraint
2	-	Head restraint-to-backrest frame bolts (2 required) (part of 605C10)
3	613A38	Backrest frame
4	66600	Backrest trim cover
5	66800	Backrest foam pad
6	62418	Backrest release handle (if equipped)
7	-	Hinge cover screws (2 required) (part of 605C10)
8	61348	Hinge cover
9	-	Hinge-to-backrest frame bolts (2 required) (part of 605C10)
10	61382	Hinge
11	61382	Manual latch
12	-	Latch-to-backrest frame bolts (manual and power) (2 required) (part of 605C10)
13	61349	Latch cover
14	61382	Power latch
15	-	Latch cover screws (2 required) (part of 605C10)

Third Row Seat Cushion

NOTE: RH cushion shown, LH similar.

NOTE: Power latch shown, manual latch similar.



Item	Part Number	Description
1	63804	Cushion trim cover
2	63840	Cushion foam pad
3	63160	Cushion frame
4	-	Latch-to-cushion frame bolt (manual and power) (part of 605C10)
5	-	Latch-to-floor mounting bracket nuts (manual and power) (2 required) (part of 605C10)
6	61382	Power latch
7	61382	Hinge
8	-	Hinge-to-cushion frame bolt (part of 605C10)
9	613E52	Cushion pivot link assembly
10	-	Cushion pivot link assembly-to-cushion frame nuts (2 required) (part of 605C10)
11	-	Cushion pivot link assembly-to-floor mounting bracket nuts (2 required) (part of 605C10)
12	606A51	Floor mounting bracket
13	611B60	Safety belt buckle assembly
14	-	Safety belt buckle assembly-to-latch nut (power and manual)
15	617C42	Cover

1. For additional information, refer to the procedures in this section.

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Seat Backrest - Third Row

Removal and Installation

All seats

1. Fold the backrest not being serviced down.

2. Remove 2 bolts and the hinge cover on the backrest being serviced.

3. Remove 2 bolts and the latch cover on the backrest being serviced.

4. Release the backrest trim cover lower J-clip on the backrest being serviced.

5. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover side J-clips, hook-and-loop strips and invert the trim cover to expose the 2 hinge-to-backrest frame bolts and the 2 latch-to-backrest frame bolts on the backrest being serviced.

Manual fold seats

6. Separate the cable casing from the latch and remove the cable from the latch lever on the backrest being serviced.

All seats

7. Remove the 2 hinge-to-backrest frame bolts and the 2 latch-to-backrest frame bolts and remove the backrest.
   - To install, tighten to 25 Nm (18 lb-ft).

8. To install, reverse the removal procedure.

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Seat Backrest Cover - Third Row

Removal and Installation

1. Fold the backrest not being serviced down.

2. Release the backrest trim cover J-clip at the top of the trim cover by the head restraint.
   - Pull the head restraint release strap through the backrest trim cover.

3. Remove the 2 head restraint-to-backrest frame bolts and remove the head restraint.
   - To install, tighten to 25 Nm (18 lb-ft).

4. Remove 2 bolts and the hinge cover.

5. Remove 2 bolts and the latch cover.

6. Release the backrest trim cover lower J-clip.

7. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the backrest trim cover side J-clips, hook-and-loop strips, invert and remove the backrest trim cover.

8. To install, reverse the removal procedure.

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Seat Cushion - Third Row

Removal and Installation

1. Position the backrest to the upright position.

2. Remove the third row seat from the vehicle. For additional information, refer to Seat - Third Row in this section.

3. **NOTE:** The backrest must be up to access the bolts.

   Remove the latch-to-cushion frame bolt and the hinge-to-cushion frame bolt.

   - To install, tighten to 25 Nm (18 lb-ft).

4. From under the front of the cushion frame, release the cushion trim cover from the studs to access the 2 cushion pivot link assembly-to-cushion frame nuts.

5. Remove the 2 cushion pivot link assembly-to-cushion frame nuts. Remove the cushion assembly.
   - To install, tighten to 22 Nm (16 lb-ft).

6. To install, reverse the removal procedure.

Seat Cushion Cover - Third Row

Removal and Installation

1. Remove the third row seat from the vehicle. For additional information, refer to Seat - Third Row in this section.

2. Release the cushion trim cover retainers attached to the bottom of the cushion frame.

3. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Invert the cushion trim cover, release the hook-and-loop strips and separate the cushion trim cover from the cushion foam pad.

4. To install, reverse the removal procedure.

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Power-Fold Seat Motor - Third Row

Removal and Installation

NOTE: The power-fold seat motor is serviced with the latch bracket.

LH or RH motors

1. Position the backrest with the working motor in the opposite position of the backrest with the motor that is not working.

2. Remove the third row seat from the vehicle. For additional information, refer to Seat - Third Row in this section.

3. From under the RH seat, remove the 2 cushion pivot link assembly-to-cushion frame nuts.
   - To install, tighten to 22 Nm (16 lb-ft).

4. Remove the 2 latch-to-floor mounting bracket nuts and separate the RH seat and power latch from the floor mounting bracket.
   - To install, tighten to 22 Nm (16 lb-ft).

Motor being serviced

5. Remove the latch-to-cushion frame bolt. If unable to position the seat to access the bolt, use a suitable tool to remove the bolt.
   - To install, tighten to 25 Nm (18 lb-ft).

6. Remove the 2 bolts and latch cover.

7. On the side with the motor being serviced, release the backrest trim cover lower J-clip, side retainer and invert the cover up to access to 2 latch-to-backrest frame bolts.

8. Remove the 2 latch-to-backrest frame bolts and remove the latch with motor.
   - To install, tighten to 25 Nm (18 lb-ft).

LH motor

9. Remove the safety belt buckle assembly-to-latch nut and remove the safety belt buckle assembly.
   - To install, tighten to 75 Nm (55 lb-ft).

LH or RH motors

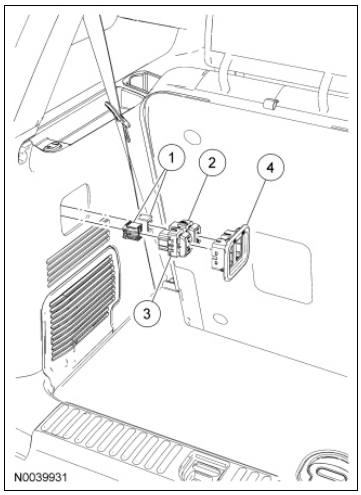
10. To install, reverse the removal procedure.

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Seat Control Switch - Third Row

Removal and Installation

NOTE: The third row seat control switches are located in the LH quarter trim panel.



Item	Part Number	Description
1	-	Third row seat control switch electrical connectors (part of 14A698)
2	14C715	Third row LH seat control switch
3	14C715	Third row RH seat control switch
4	14D721	Third row seat control switch bezel

1. Pull out on the third row seat control switch bezel and separate from the LH quarter trim panel.

2. Disconnect the third row seat control switch(es), release the retainers and remove the third row seat control switch(es).

3. To install, reverse the removal procedure.

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Seat Latch - Third Row, Manual

Removal and Installation

LH or RH latch

1. Position both of the third row seat backrests up.

2. Remove the RH latch-to-cushion frame bolt.
   - To install, tighten to 25 Nm (18 lb-ft).

LH latch

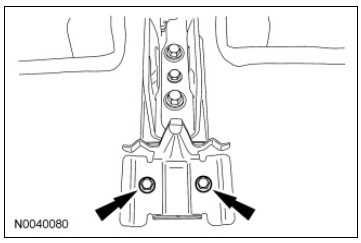
3. Remove the LH latch-to-cushion frame bolt.
   - To install, tighten to 25 Nm (18 lb-ft).

LH or RH latch

4. Position the third row seat LH backrest down.

5. Remove the vehicle jack.

6. Remove the 2 bolts and the vehicle jack mounting bracket.



7. Remove the 2 screws and the RH latch cover.

8. Separate the cable and casing from the RH latch.

9. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the RH seat backrest trim cover lower and inboard J-clips and roll the backrest trim cover up to access the 2 RH latch-to-backrest frame bolts.

10. Remove the 2 RH latch-to-backrest frame bolts.
    - To install, tighten to 25 Nm (18 lb-ft).

11. Remove the floor mounting bracket center front and rear nuts.
    - To install, tighten to 40 Nm (30 lb-ft).

12. Remove the 2 latch-to-floor mounting bracket nuts.
    - To install, tighten to 22 Nm (16 lb-ft).

13. Remove the RH latch.

LH latch

14. Position the third row seat LH backrest up and the RH backrest down.

15. Remove the 2 screws and the LH latch cover.

16. Separate the cable and casing from the LH latch.

17. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

    Release the LH seat backrest trim cover lower and inboard J-clips and roll the backrest trim cover up to access the 2 LH latch-to-backrest frame bolts.

18. Remove the 2 LH latch-to-backrest frame bolts.
    - To install, tighten to 25 Nm (18 lb-ft).

19. Remove the LH latch.

20. Remove the safety belt buckle assembly-to-latch nut and remove the safety belt buckle assembly.
    - To install, tighten to 75 Nm (55 lb-ft).

Both latches

21. To install, reverse the removal procedure.
    - The latch(es) must be in the backrest fold down position to install.

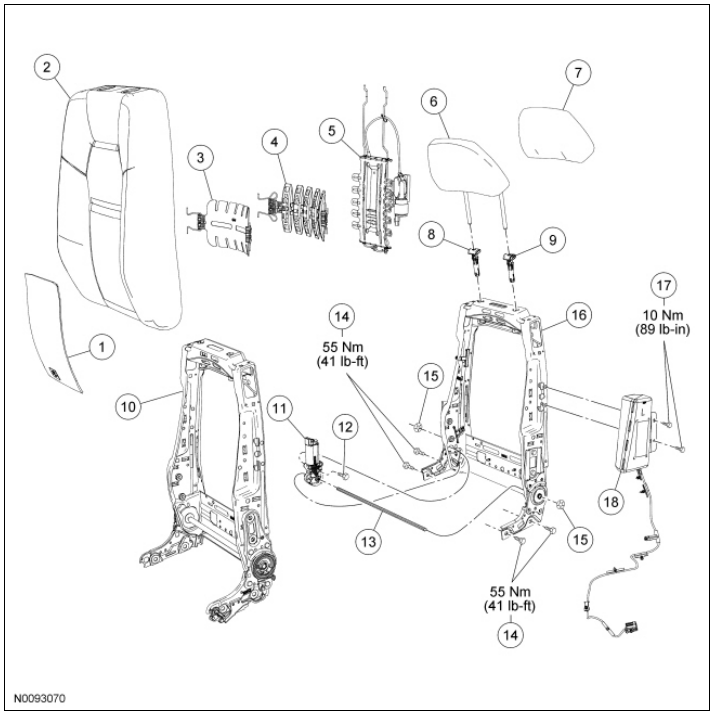
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Seat Backrest - Front

Front Seat Backrest

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	14D696	Backrest heated seat mat (if equipped)
2	64417/ 64811	Backrest trim cover/ backrest foam pad
3	65500	Static lumbar (if equipped)
4	65500	Manual lumbar adjust assembly (if equipped)
5	65500	Power lumbar adjust assembly (if equipped)
6	611A08	Head restraint assembly
7	-	Head restraint cover
8	610A18	Inboard head restraint guide sleeve
9	610A16	Outboard head restraint guide sleeve
10	61018	Backrest frame (serviced with manual recliners) (if equipped)
11	14547	Power recline motor (if equipped)
12	-	Screw (if equipped) (part of 600A58)
13	62714	Recliner shaft (if equipped)
14	-	Recliner-to-cushion frame bolts (4 required) (part of 600A58)

15	-	One-way push clips (2 required) (if equipped) (part of 14547)
16	61018	Backrest frame (serviced with power recliners) (if equipped)
17	-	Side air bag module bolts (2 required)
18	611D11	Side air bag module

Disassembly

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.

NOTE: If a side air bag deployment took place a new backrest foam pad, backrest trim cover and side air bag module must be installed. A new backrest frame should be installed if necessary.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The manual recliners and power recliners are serviced as part of the backrest frame.

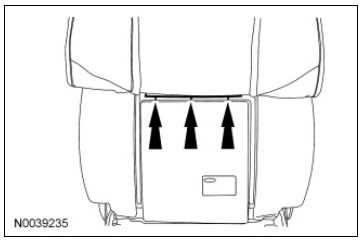
All seats

1. Remove the front seat. For additional information, refer to Seat - Front in this section.
2. Remove the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.
3. Remove the 2 head restraint guide sleeves. For additional information, refer to Head Restraint Guide Sleeve in this section.
4. Remove the plastic rivets attaching the backrest trim cover to the inboard and outboard recliners.
5. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

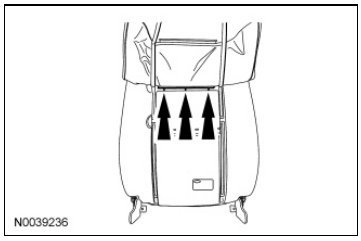
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Release the backrest trim cover lower J-clip, hook-and-loop strips and invert the trim cover to the first row of hog rings.

6. Remove the first row of hog rings.



7. Release the hook-and-loop strips, invert the trim cover and remove the second row of hog rings.



8. Remove the backrest trim cover.

Heated seat

9. For power driver seat, disconnect the backrest heated seat mat electrical connector.
   - If necessary, remove the backrest heated seat mat from the backrest foam pad.

All seats

10. Separate the backrest foam pad from the backrest frame.

11. **NOTE:** Note the side air bag module wire harness routing for assembly.

    Release the side air bag module wire harness pin-type retainers, remove the bolts and the side air bag module with wire harness.

Seat with manual lumbar

12. Release the 2 manual lumbar spring clips from the backrest frame and remove the manual lumbar.

Seat with power lumbar

13. Remove the power lumbar adjust assembly in the following sequence.
    1. Disconnect the power lumbar adjust assembly motor electrical connector.
    2. Release the 2 power lumbar adjust assembly lower pin-type retainers to the backrest frame.
    3. Slide the power lumbar adjust assembly rods out of the backrest frame at the top and remove the power lumbar adjust assembly.

Seat with power recline

14. ***NOTICE:*** **Do not rotate the recliner shaft while not engaged to both recliners. Failure to do so will cause the inboard and outboard recliners to become out of synchronization.**

Remove a one-way push clip from the recliner shaft and remove the recliner shaft.

15. Disconnect the electrical connector, remove the screw and the power recline motor.

Assembly

Seat with power recline

1. ***NOTICE:*** **Do not rotate the recliner shaft while not engaged to both recliners. Failure to do so will cause the inboard and outboard recliners to become out of synchronization.**

   Install the recliner motor.

   - Position the recliner shaft through the inboard power recliner, power recline motor and outboard recliner.
     - ♦ Slight turning of the recliner shaft may be necessary.
   - Install a new one-way push clip at each end of the recliner shaft.
   - Turn the power recline motor so the mounting hole lines up with the bolt hole in the inboard power recliner.
   - Install the power recline motor bolt.
   - Connect the power recline motor electrical connector.

Seat with power lumbar

2. Install the power lumbar adjust assembly.
   - Slide the power lumbar adjust assembly rods into the backrest frame holes at the top.
   - Attach the 2 power lumbar adjust assembly lower pin-type retainers to the backrest frame.
   - Connect the power lumbar adjust assembly motor electrical connector.

Seat with manual lumbar

3. Attach the 2 manual lumbar spring clips to the backrest frame.

All seats

4. ⚠ **WARNING: Before installing the seat side air bag module/deployment chute assembly:**

   - ♦ Inspect the side air bag module and mounting surfaces for any damage or foreign material.
   - ♦ Remove any foreign material from the mounting surfaces of the deployment chute, the seat backrest frame mounting bracket and the air bag module cavity in the seat backrest foam pad.
   - ♦ Install new parts if damaged.

   Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

   ⚠ **WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

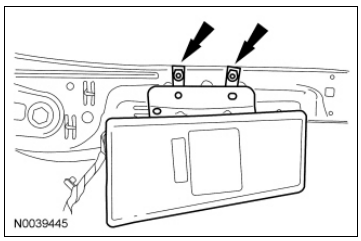
   ⚠ **WARNING: Inspect the seat side air bag module cavity in the seat backrest foam pad for any foreign material. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

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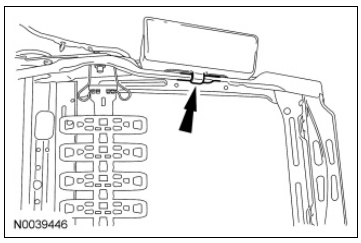
NOTICE: **Make sure the side air bag module wiring harness is not pinched between the side air bag module and the mounting bracket. Failure to follow this instruction may result in wiring harness damage.**

Align the holes of the side air bag module bracket to the U-nuts on the backrest frame.

- Install new U-nuts if installing a new side air bag module.



5. Slide the side air bag module onto the backrest frame so the bracket hook wraps around the backrest frame.



6. Install the side air bag module bolts, route the wire harness as noted during disassembly and install the side air bag module wire harness pin-type retainers.
   - Tighten to 10 Nm (89 lb-in).

Heated seat

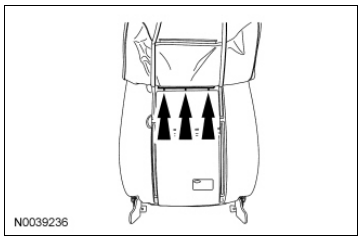
7. If necessary, install the backrest heated seat mat.
   - For driver seats with power recline, connect the backrest heated seat mat electrical connector.

All seats

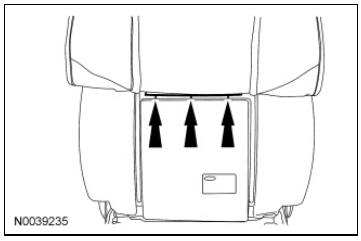
8. Position the backrest foam pad around the backrest frame.

9. Position the backrest trim cover to the backrest frame and foam pad.

10. Roll the backrest trim cover down, attach the hook-and-loop strips and install the second row of hog rings.



11. Roll the backrest trim cover down, attach the hook-and-loop strips and install the first row of hog rings.



12. Roll the backrest trim cover down, attach the hook-and-loop strips and connect the backrest trim cover lower J-clip.

13. Position the backrest trim cover to the inboard and outboard recliners and install the plastic rivets.

14. Install the 2 head restraint guide sleeves. For additional information, refer to Head Restraint Guide Sleeve in this section.

15. Install the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

16. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

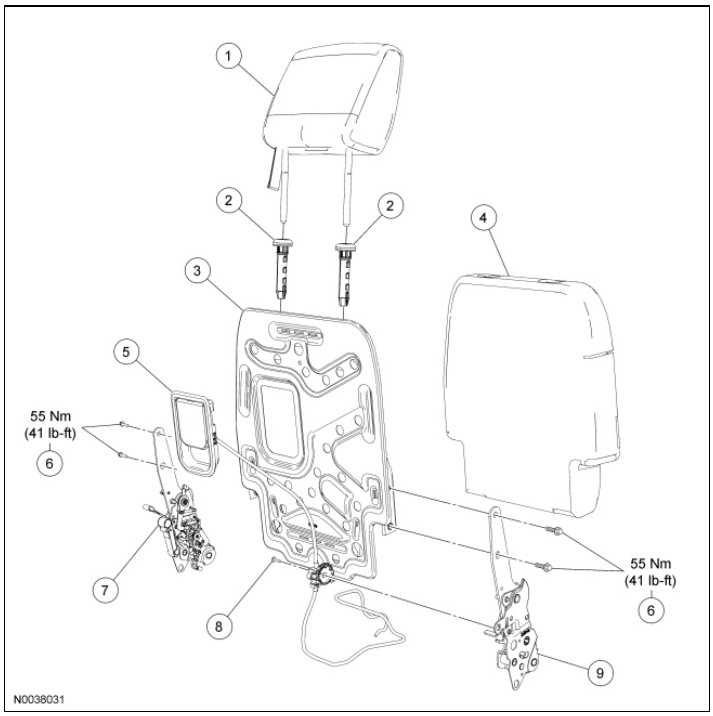
Passenger seat

17. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat Backrest - Second Row, 40 Percent E-Z Entry

Second Row, 40 Percent E-Z Entry Backrest



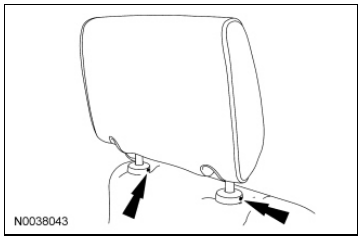
Item	Part Number	Description
1	611A09	Head restraint
2	610A16	Head restraint guides (2 required)
3	613A39	Backrest frame
4	66601/66801	Backrest trim cover/backrest foam pad
5	601L60	Kneeling mechanism release handle and cable
6	-	Recliner-to-backrest frame bolts (4 required) (part of 605C10)
7	61383	Outboard recliner
8	-	Screw (part of 605C10)
9	61383	Inboard recliner

Disassembly and Assembly

1. Remove the second row, 40 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Remove the second row, 40 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent E-Z Entry in this section.

3. Using an appropriate tool, push in the hole of each head restraint guide while lifting up and remove the head restraint.



4. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the hook-and-loop strips, invert the trim cover as high as it will go.

5. From between the backrest foam pad and the backrest frame, reach up, pinch the ends together and remove the 2 head restraint guides.

6. Remove the backrest trim cover.

7. Separate the backrest foam pad from the backrest frame.

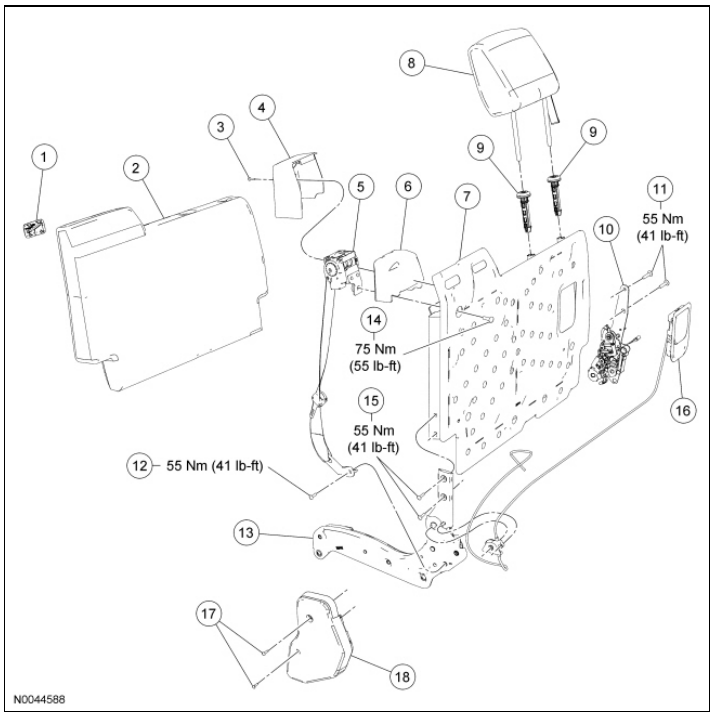
8. To assemble, reverse the disassembly procedure.

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Seat Backrest - Second Row, 60 Percent, E-Z Entry

Second Row, 60 Percent E-Z Entry Backrest



Item	Part Number	Description
1	610D72	Safety belt bezel
2	66600/ 66800	Backrest trim cover/ backrest foam pad
3	-	Pin-type retainer (part of 605C10)
4	613C46	Safety belt retractor cover
5	611B64	Safety belt retractor
6	611D52	Safety belt retractor insulator
7	613A38	Backrest frame
8	611A08	Head restraint
9	610A16	Head restraint guides
10	61382	Outboard recliner
11	-	Outboard recliner-to-backrest frame bolts (part of 605C10)
12	-	Safety belt anchor bolt (part of 605C10)
13	61383	Inboard recliner
14	-	Safety belt retractor bolt (part of 605C10)
15	-	Inboard recliner-to-backrest frame bolts (part of 605C10)
16	601L60	Kneeling mechanism release handle and cable

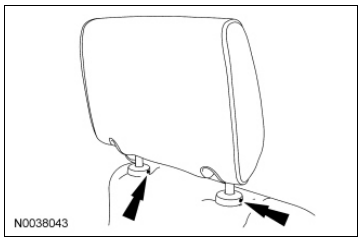
17	-	Screws (part of 605C10)
18	61349	Inboard recliner outer cover

Disassembly

1. Remove the second row, 60 percent E-Z entry seat. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Remove the second row, 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.

3. Using an appropriate tool, push in the hole of each head restraint guide while lifting up and remove the head restraint.



4. Remove the safety belt bezel.

5. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the hook-and-loop strips and invert the trim cover as high as it will go.

6. From between the backrest foam pad and the backrest frame, reach up pinch the ends together and remove the 2 head restraint guides.

7. Route out the safety belt and remove the backrest trim cover.

8. Remove the backrest foam pad from the backrest frame.

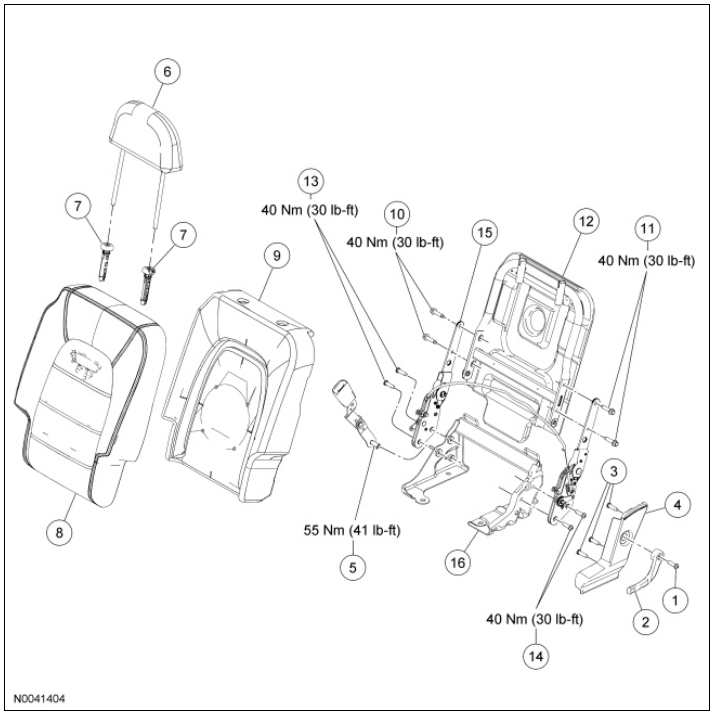
9. Remove the safety belt retractor cover.
   - Remove the pin-type retainer.
   - Release the rear of the safety belt retractor cover from the backrest frame.
   - Route out the safety belt and remove the safety belt retractor cover.

10. Remove the bolt, safety belt retractor and insulator.
    - To install, tighten to 75 Nm (55 lb-ft).
    - If necessary, remove the safety belt retractor insulator.

11. To assemble, reverse the disassembly procedure.

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Seat Backrest - Second Row, 40 Percent, Bench



Item	Part Number	Description
1	851334	Release handle screw
2	820015	Release handle
3	851334	Latch cover screws
4	820009	Outboard latch cover
5	611C73	Safety belt buckle and bolt
6	611A08	Head restraint
7	610A16	Head restraint sleeves
8	66601	Backrest trim cover
9	66801	Backrest foam pad
10	W505237	Upper latch bolts
11	W505237	Upper latch bolts
12	613A39	Backrest frame
13	W505237	Lower latch bolts
14	W505237	Lower latch bolts
15	61383	Latch assembly
16	600A87	Riser frame

Disassembly and Assembly

1. Remove the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

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2. Remove the second row, 40 percent seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent, Bench in this section.

3. Remove the screw and the release handle.

4. Remove the 3 screws and the latch cover.

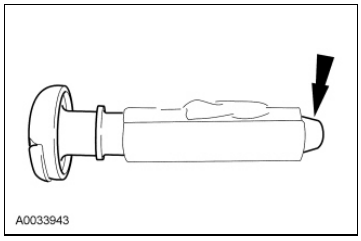
5. Remove the bolt and the safety belt buckle.
    - To install, tighten to 55 Nm (41 lb-ft).

6. Remove the head restraint.

7. **NOTE:** The inboard and outboard head restraint sleeves are not interchangeable.

   NOTE: The head restraint sleeves incorporate an alignment tab that must face forward when installed.

   Squeeze together the tip of the head restraint sleeve and pull the sleeve out of the frame tube.



8. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Separate the hook-and-loop fasteners. Remove the seat backrest trim cover.

9. Remove the backrest foam pad.

10. Remove the 2 outboard lower latch bolts.
    - To install, tighten to 40 Nm (30 lb-ft).

11. Remove the 2 inboard lower latch bolts.
    - To install, tighten to 40 Nm (30 lb-ft).

12. ***NOTICE:*** **Do not detach the latch cable from the seat latches. The latch assembly is synchronized; if disassembled, the latch assembly may not operate correctly.**

    Remove the latch assembly.

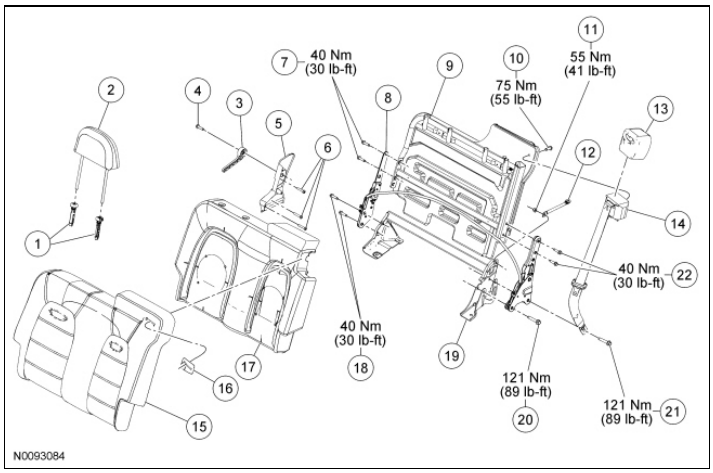
    - Do not separate or disassemble the latch assembly components.

13. To assemble, reverse the disassembly procedure.

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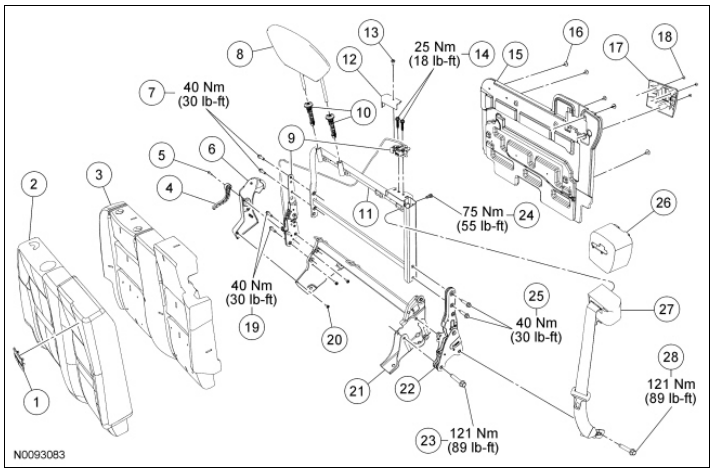
Seat Backrest - Second Row, 60 Percent, Bench

Explorer/Mountaineer, 60 Percent Bench, Backrest



Item	Part Number	Description
1	610A16	Head restraint sleeves
2	611A08	Head restraint
3	851282	Release handle
4	851334	Release handle screw
5	851260	Outboard latch cover
6	851334	Latch cover screws
7	-	Outboard latch-to-backrest frame bolts (part of 605C10)
8	61382	Latch assembly (inboard, outboard and cable)
9	613A38	Backrest frame
10	N807750	Safety belt retractor bolt
11	-	Seat tether-to-riser frame nut
12	600A96	Seat tether
13	613C46	Safety belt retractor cover
14	611B64	Safety belt retractor
15	66601	Backrest trim cover
16	610D72	Safety belt guide cover
17	66800	Backrest foam pad
18	W505237	Outboard latch-to-riser frame bolts
19	606A50	Riser frame
20	-	Inboard latch-to-riser frame front bolt (part of 605C10)
21	-	Safety belt anchor bolt (part of 611B64)
22	-	Inboard latch-to-backrest frame bolts (part of 605C10)

Explorer Sport Trac, 60 Percent Bench, Backrest



Item	Part Number	Description
1	610D72	Safety belt guide cover
2	66601	Backrest trim cover
3	66800	Backrest foam pad
4	851282	Release handle
5	-	Release handle screw (part of 605C10)
6	61348	Outboard latch cover
7	W505273	Outboard latch-to-backrest frame bolts
8	611A08	Head restraint
9	-	Latch assembly (inboard, outboard and cable) (part of 61382)
10	610A16	Head restraint sleeves
11	613A38	Backrest frame
12	638A74	Inner latch cover
13	-	Upper latch cover screw (part of 605C10)
14	-	Upper latch-to-backrest frame bolts (part of 605C10)
15	-	Backrest support panel (part of 613A38)
16	-	Backrest support panel screw (part of 613A38)
17	638A74	Upper latch cover
18	-	Upper latch cover screw (part of 605C10)
19	W505237	Outboard latch-to-riser frame bolts
20	-	Latch cover screw (part of 605C10)
21	606A50	Riser frame
22	-	Inboard latch (inboard, outboard and cable) (part of 61382)
23	-	Inboard latch-to-riser frame front bolt (part of 605C10)
24	N807750	Safety belt retractor bolt

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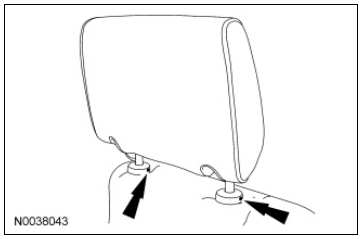
25	W505237	Inboard latch-to-backrest frame bolts
26	613C46	Safety belt retractor cover
27	611B64	Safety belt retractor
28	-	Safety belt anchor bolt (part of 605C10)

Disassembly and Assembly

1. Remove the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

2. Remove the second row, 60 percent seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, Bench in this section.

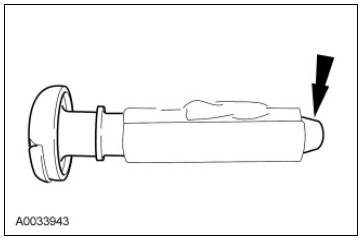
3. Using an appropriate tool, push in the hole of each head restraint guide while lifting up and remove the head restraint.



4. **NOTE:** The inboard and outboard head restraint sleeves are not interchangeable.

   NOTE: The head restraint sleeves incorporate an alignment tab that must face forward when installed.

   Squeeze together the tip of the head restraint sleeve and pull the sleeve out of the frame tube.



5. For Explorer and Mountaineer, pull at the bottom and remove the safety belt guide cover.

6. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Separate the hook-and-loop fasteners, invert and remove the backrest trim cover.

   - Feed the safety belt out through the backrest trim cover.

7. Remove the backrest foam pad.

8. Remove the safety belt retractor cover.

9. Remove the bolt and the safety belt retractor.
   - To install, tighten to 75 Nm (55 lb-ft).

10. Remove the seat tether-to-riser frame nut and the seat tether (if equipped).
    - To install, tighten to 55 Nm (41 lb-ft).

11. Remove the screw and the release handle.

12. Remove the 3 screws and the outboard latch cover.

13. Remove the outboard latch-to-riser frame bolts.
    - To install, tighten to 40 Nm (30 lb-ft).
        - ♦ For Sport Trac, remove the outboard and upper latch assembly.

14. ***NOTICE:*** **For Explorer and Mountaineer, do not detach the latch cable from the seat latches. The latch assembly is synchronized; if disassembled, the latch assembly may not operate correctly.**

    Remove the inboard latch-to-riser frame front bolt. For Explorer and Mountaineer, remove the latch assembly. For Sport Trac, remove the inboard latch.

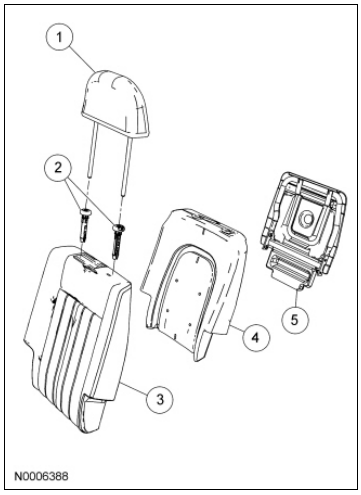
    - To install, tighten to 121 Nm (89 lb-ft).

15. To assemble, reverse the disassembly procedure.

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Seat Backrest - Second Row, Bucket



Item	Part Number	Description
1	611A08	Head restraint
2	610A16	Head restraint sleeves (2 required)
3	66601	Backrest trim cover
4	66801	Backrest foam pad
5	613A39	Backrest frame

Disassembly and Assembly

1. Remove the second row, 40 percent bucket seat backrest. For additional information, refer to Seat Backrest - Second Row, Bucket in this section.

2. Remove the head restraint.

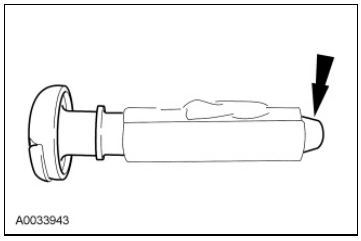
3. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Separate the backrest trim cover hook-and-loop fasteners, remove 2 rows of hog rings and invert the backrest trim cover as high as it will go.

4. **NOTE:** The inboard and outboard head restraint sleeves are not interchangeable.

   NOTE: The head restraint sleeves incorporate an alignment tab that must face forward when installed.

   Squeeze together the tip of the head restraint sleeve and pull the sleeve out of the frame tube.



5. Remove the backrest trim cover.

6. Remove the backrest foam pad from the backrest frame.

7. To assemble, reverse the disassembly procedure.

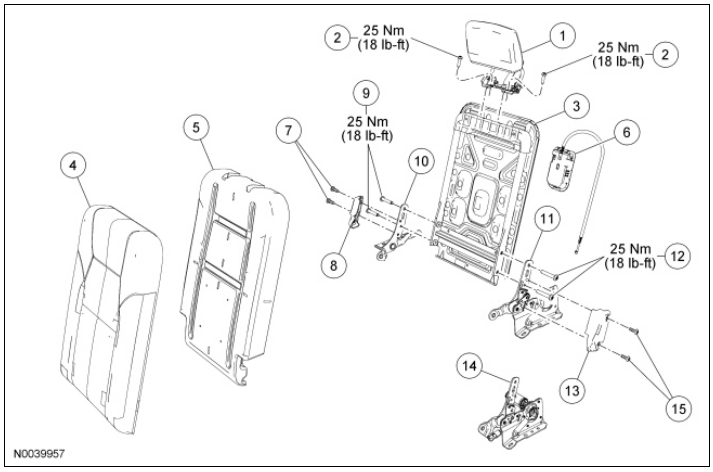
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Seat Backrest - Third Row

Third Row Seat Backrest

NOTE: RH backrest shown, LH similar.



Item	Part Number	Description
1	611A08	Head restraint
2	-	Head restraint-to-backrest frame bolts (2 required) (part of 605C10)
3	613A38	Backrest frame
4	66600	Backrest trim cover
5	66800	Backrest foam pad
6	62418	Backrest release handle (if equipped)
7	-	Hinge cover screws (2 required) (part of 605C10)
8	61348	Hinge cover
9	-	Hinge-to-backrest frame bolts (2 required) (part of 605C10)
10	61382	Hinge
11	61382	Manual latch
12	-	Latch-to-backrest frame bolts (manual and power) (2 required) (part of 605C10)
13	61349	Latch cover
14	61382	Power latch
15	-	Latch cover screws (2 required) (part of 605C10)

Disassembly and Assembly

All seats

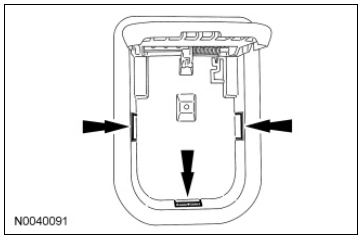
1. Remove the seat backrest. For additional information, refer to Seat Backrest - Third Row in this section.

2. Release the backrest trim cover J-clip at the top of the trim cover by the head restraint.
   - Pull the head restraint release strap through the backrest trim cover.

3. Remove the 2 head restraint-to-backrest frame bolts and remove the head restraint.
   - To install, tighten to 25 Nm (18 lb-ft).

Manual fold seats

4. Release the 3 backrest release handle clips and separate from the backrest.



All seats

5. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Release the hook-and-loop strips, invert and remove the backrest trim cover.

   - If equipped, route the backrest release handle and cable through the backrest trim cover.

Manual fold seats

6. Route the backrest release cable out of the backrest frame and remove the backrest release handle and cable.

All seats

7. Separate the backrest foam pad from the backrest frame.

8. To assemble, reverse the disassembly procedure.

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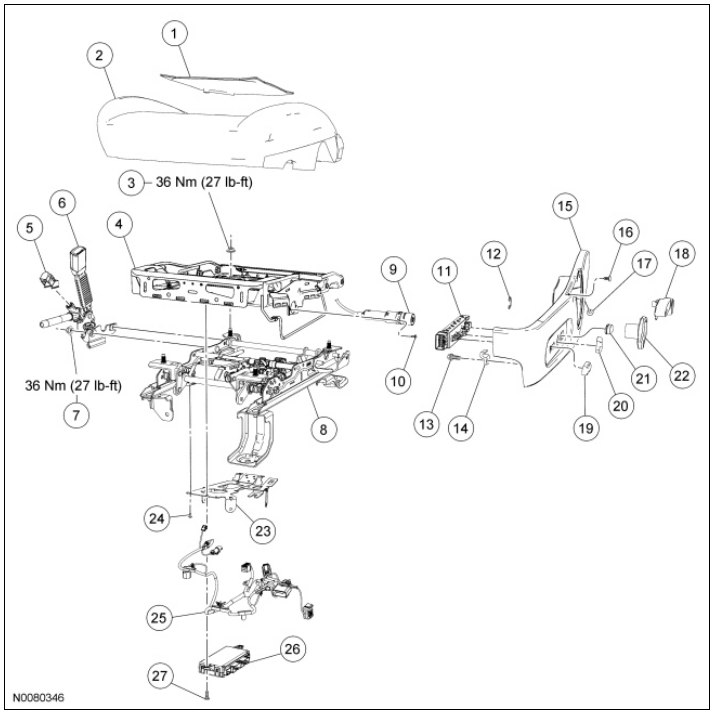
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Seat Cushion - Front

Driver Seat Cushion

NOTE: Power seat track shown, manual seat track similar.

NOTE: The retention bracket and screw can be used to repair cushion side shields that will not retain to the cushion frame wire.



Item	Part Number	Description
1	-	Cushion heated seat mat (if equipped)
2	62901/ 632A23	Cushion trim cover/ cushion foam pad
3	-	Cushion frame-to-seat-track nut (4 required) (part of 600A58)
4	63100	Cushion frame
5	-	Safety belt buckle and pretensioner electrical connector cover
6	61203	Safety belt buckle and pretensioner
7	-	Safety belt buckle and pretensioner nut (2 required) (part of 61203)
8	61711	Power seat track
9	610C00	Manual lumbar control (if equipped)
10	-	Manual lumbar control screw (2 required) (if equipped) (part of 600A58)

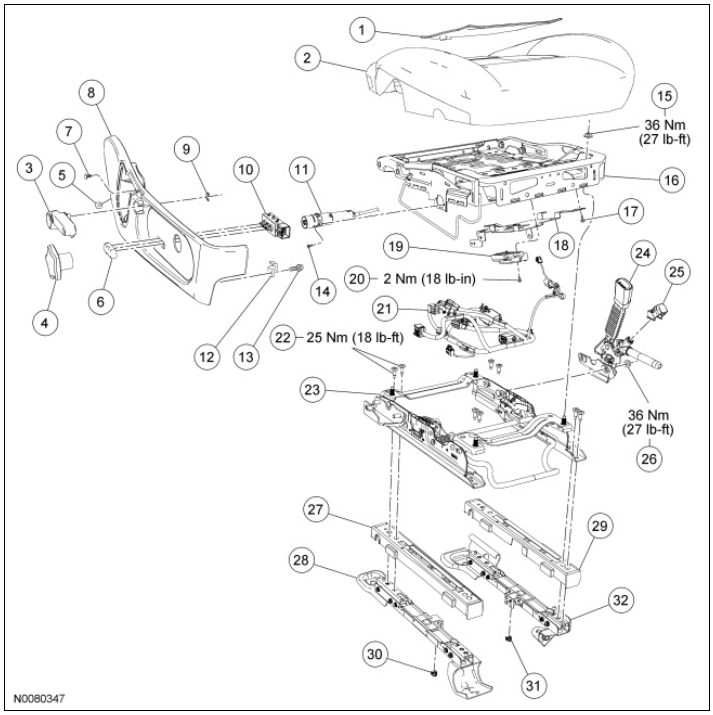
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11	14A701	Seat control switch (if equipped)
12	-	Manual recline handle clip (if equipped) (part of 610A76)
13	W506943	Retention bracket screw (if equipped)
14	62256	Retention bracket (if equipped)
15	62187	Cushion side shield
16	-	Scrivet (part of 600A58)
17	-	Pin-type retainer (part of 600A58)
18	62622	Manual recline handle (if equipped)
19	14C715	Seat control switch knob (if equipped)
20	14711	Power recline switch knob (if equipped)
21	14711	Power lumbar switch knob (if equipped)
22	617B70	Manual lumbar control knob (if equipped)
23	14A163	Bracket
24	-	Screw (4 required) (part of 600A58)
25	14C719	Driver seat wire harness
26	14C708	Driver Seat Module (DSM) (if equipped)
27	-	Screw (2 required) (if equipped) (part of 600A58)

Passenger Seat Cushion

NOTE: Manual seat track shown, power seat track similar.

NOTE: The retention bracket and screw can be used to repair cushion side shields that will not retain to the cushion frame wire.



Item		Description

	Part Number	
1	14D698	Cushion heated seat mat (if equipped)
2	62900/ 632A22	Cushion trim cover/ cushion foam pad
3	62622	Manual recline handle (if equipped)
4	617B70	Manual lumbar control knob (if equipped)
5	-	Pin-type retainer (part of 600A58)
6	14C715	Seat control switch knob (if equipped)
7	-	Scrivet (part of 600A58)
8	62186	Cushion side shield
9	-	Manual recline handle clip (part of 610A76) (if equipped)
10	14A701	Seat control switch (if equipped)
11	610C00	Manual lumbar control (if equipped)
12	62256	Retention bracket (if equipped)
13	W506943	Retention bracket screw (if equipped)
14	-	Manual lumbar control screw (2 required) (if equipped) (part of 600A58)
15	-	Cushion frame-to-seat-track nut (4 required) (part of 600A58)
16	63100	Cushion frame
17	14A163	Bracket
18	-	Screw (4 required) (part of 600A58)
19	14B422	Occupant Classification System Module (OCSM)
20	-	Screw, OCSM (2 required) (part of 600A58)
21	14A699	Passenger seat wire harness
22	-	Seat track-to- OCS rail bolts (8 required) (part of 600A58)
23	61710	Manual seat track
24	61202	Safety belt buckle and pretensioner
25	-	Safety belt buckle and pretensioner electrical connector cover
26	-	Safety belt buckle and pretensioner nut (2 required) (part of 61203)
27	62126	Outboard Occupant Classification Sensor (OCS) rail shield
28	61708	Outboard OCS rail
29	62127	Inboard OCS rail shield
30	-	Outboard OCS rail electrical connector (part of 14A699)
31	-	Inboard OCS rail electrical connector (part of 14A699)
32	61709	Inboard OCS rail

Disassembly and Assembly

All seats

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1. Remove the front seat. For additional information, refer to Seat - Front in this section.

2. Remove the seat track. For additional information, refer to Seat Track in this section.

3. Remove the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

4. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the hook-and-loop strips, remove the hog rings and separate the cushion trim cover from the cushion foam pad.

Seat with heat

5. If necessary, remove the cushion heated seat mat and route out the wire harness through the cushion foam pad opening.

All seats

6. To assemble, reverse the disassembly procedure.

7. Install the front seat backrest. For additional information, refer to Seat Backrest - Front in this section.

8. Install the seat track. For additional information, refer to Seat Track in this section.

9. Install the front seat. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Seat - Front in this section.

Passenger seat

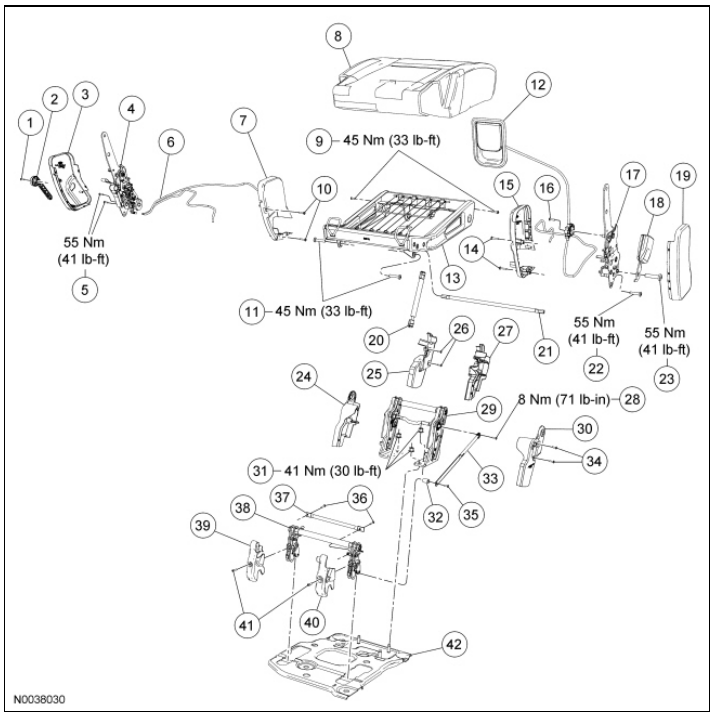
10. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to General Procedures portion of Section 501-20B .

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Seat Cushion - Second Row, 40 Percent E-Z Entry

Second Row, 40 Percent, E-Z Entry Cushion



Item	Part Number	Description
1	-	Screw (part of 605C10)
2	62419	Recliner handle
3	61349	Outboard recliner outer cover
4	61383	Outboard recliner
5	-	Outboard recliner-to-cushion frame bolts (part of 605C10)
6	601L60	Cable assembly
7	61349	Outboard recliner inner cover
8	63805/ 63841	Cushion trim cover/ cushion foam pad
9	-	Cushion frame-to-kneeling mechanism bolts (part of 605C10)
10	-	Screws (2 required) (part of 605C10)
11	-	Cushion frame-to-latch feet assembly bolts (part of 605C10)
12	601L60	Kneeling mechanism release handle and cable
13	63161	Cushion frame
14	-	Screws (part of 605C10)

15	61348	Inboard recliner inner cover
16	-	Screw (part of 605C10)
17	61383	Inboard recliner
18	611C73	Safety belt buckle
19	61348	Inboard recliner outer cover
20	624B75	Shock
21	61383	Recliner release shaft
22	-	Inboard recliner-to-cushion frame bolt (part of 605C10)
23	-	Inboard recliner and safety belt buckle-to-cushion frame bolt (part of 605C10)
24	61349	Kneeling mechanism outboard leg outer cover
25	61349	Kneeling mechanism outboard leg inner cover
26	-	Screws (part of 605C10)
27	81348	Kneeling mechanism inboard leg inner cover
28	-	Latch feet retracting link-to-kneeling mechanism bolt (part of 605C10)
29	61383	Kneeling mechanism
30	81348	Kneeling mechanism inboard leg outer cover
31	-	Kneeling mechanism-to-mounting plate nuts (2 required) (part of 605C10)
32	-	Spacer
33	61383	Latch feet retracting link
34	-	Screws (part of 605C10)
35	-	Latch feet retracting link-to-latch feet assembly bolt (part of 605C10)
36	-	Screws (part of 605C10)
37	-	Latch feet release bar
38	61383	Latch feet assembly
39	61349	Outboard latch foot cover
40	61348	Inboard latch foot cover
41	-	Screws (part of 605C10)
42	606A51	Mounting plate

Disassembly

1. Remove the second row 40 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Lower the backrest and position the seat to the E-Z entry position.
   - The latch feet should be released from the mounting plate and the cushion and backrest must be pivoted up.

3. Using the kneeling mechanism release handle on the backrest, pull the handle and position the kneeling mechanism down in the fold flat load floor position.
   - The cushion and backrest of the seat will be in the E-Z entry position and the kneeling mechanism will be in the fold flat load floor position.

4. **NOTE:** The shock should be fully extended when removing.

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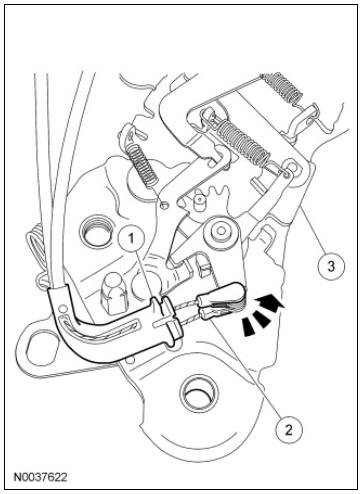
Remove the shock from the seat assembly.

- Pry the retaining clip out and separate the shock at the mounting plate and cushion frame.

5. Remove the second row 40 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent E-Z Entry in this section.
6. Remove 3 screws, recliner handle and outboard recliner outer cover.
7. Remove 2 screws and the inboard recliner outer cover.
8. Remove the 2 screws and the latch feet release bar.
9. Release all the cushion trim cover retainers and pin-type retainers.
10. Remove the cushion trim cover and cushion foam pad from the cushion frame.
11. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

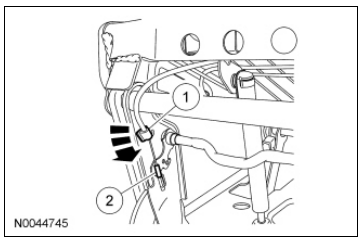
    Release the hook-and-loop strips and separate the cushion trim cover from the cushion foam pad.
12. Remove 2 outboard recliner-to-cushion frame bolts and separate the outboard recliner.
13. Remove the outboard recliner inner cover.
14. Remove the outboard recliner.
    1. Rotate the cable casing out of the outboard recliner.
    2. **NOTE:** The cable ends are color coded/keyed to the levers.

       Rotate the cable ends out of the outboard recliner levers.
    3. Remove the outboard recliner.



15. Remove the 2 screws, pull to separate and remove the kneeling mechanism inboard leg inner and outer covers.
16. Separate the cable to the kneeling mechanism inboard leg.
    1. Turn and separate the cable casing retainer at the inboard side of the kneeling mechanism inboard leg.
    2. Separate the cable from the kneeling mechanism inboard leg release lever.

♦ Remove any cable casing retainers.



17. Remove 2 bolts, the spacer and the latch feet retracting link.

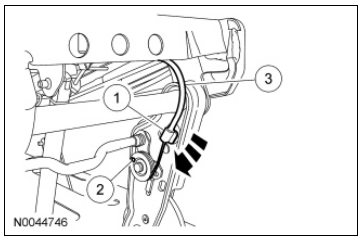
18. Remove the 2 screws and the 2 latch foot covers.

19. Separate the cable and casing from the outboard latch foot. Remove the cable assembly.

20. Remove the screw and separate the kneeling mechanism release cable pivot at the inboard recliner.

21. Remove the 2 screws, pull to separate and remove the kneeling mechanism outboard leg inner and outer covers.

22. Separate the cable to the kneeling mechanism outboard leg and cushion frame.
    1. Turn and separate the cable casing retainer at the inboard side of the outboard kneeling mechanism leg.
    2. Separate the cable from the outboard kneeling mechanism leg release lever.
    3. Separate any cable casing retainers to the cushion frame and remove the cable.

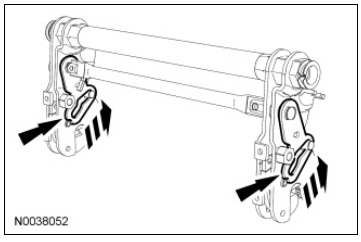


23. Remove the 2 inboard recliner-to-cushion frame bolts, the safety belt buckle and separate the inboard recliner with recliner release shaft.
    - If necessary, separate the recliner release shaft from the inboard recliner.

24. Remove the inboard recliner inner cover.

25. Remove the cushion frame.
    - Remove the 2 kneeling mechanism-to-cushion frame bolts.
    - Remove the 2 latch feet assembly-to-cushion frame bolt.
    - Remove the cushion frame.

26. Using the release lever, manually release the inboard and outboard latch feet and remove the latch feet assembly.



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27. Remove the 2 nuts and remove the kneeling mechanism.

Assembly

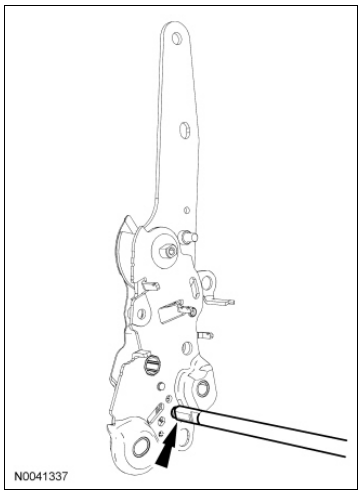
1. Position the kneeling mechanism to the mounting plate and install the nuts.
    - Tighten to 41 Nm (30 lb-ft).

2. **NOTE:** Latch feet will hang down lower than the mounting plate, potentially causing the latch feet to partially latch. Make sure the latch feet are completely latched.

   Position the latching feet assembly to the mounting plate strikers and latch the feet in place.

3. Install the cushion frame.
    - Position the cushion frame to the latch feet assembly and kneeling mechanism.
    - Install the 2 latch feet assembly-to-cushion frame bolts.
        - ♦ Tighten to 45 Nm (33 lb-ft).
    - Install the 2 kneeling mechanism-to-cushion frame bolts.
        - ♦ Tighten to 45 Nm (33 lb-ft).

4. Position the recliner release shaft onto the inboard recliner release pivot stub.

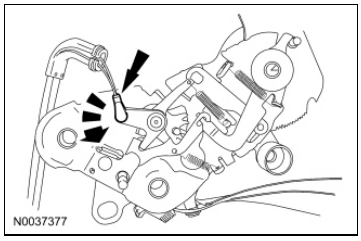


5. Position the inboard recliner and recliner release shaft to the cushion frame.
    - Position the inboard recliner to the cushion frame with the recliner release shaft through the cushion frame opening.
    - Position the safety belt buckle to the inboard recliner forward bolt hole and install the 2 inboard recliner-to-cushion frame bolts.
        - ♦ Tighten to 55 Nm (41 lb-ft).

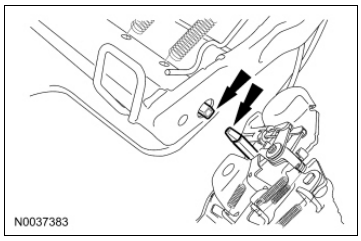
6. **NOTE:** The cable ends are color coded/keyed to the levers.

   Position each keyed cable end to the outboard recliner lever and rotate to the locked position.

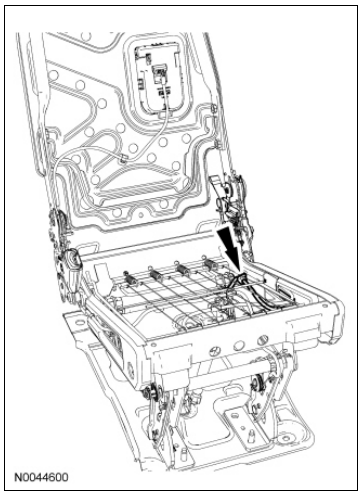
    - Install the cable casing to the outboard recliner.



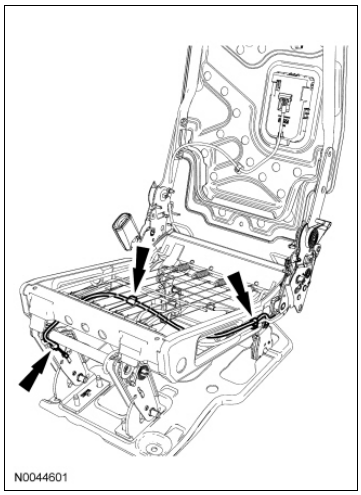
7. Position the outboard recliner release pivot stub into the recliner shaft and install the outboard recliner-to-cushion frame bolts.
    - Tighten to 55 Nm (41 lb-ft).



8. Route the outboard recliner short cable, attach the cable to the latch feet assembly outboard foot and attach the cable casing retainers.

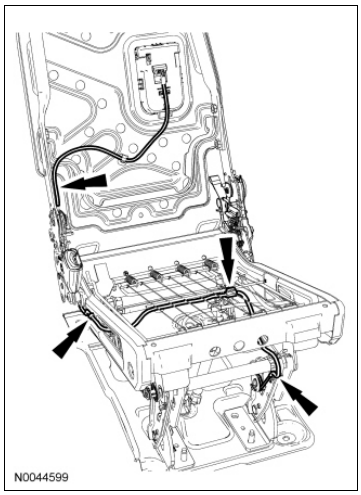


9. Route the outboard recliner long cable, attach it to the kneeling mechanism inboard leg and attach all cable casing retainers.



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10. Route the kneeling mechanism release cable, position the cable pivot at the inboard recliner and install the screw.



11. Install the cable to the kneeling mechanism outboard leg and cushion frame.
    - Attach the cable to the kneeling mechanism outboard leg release lever.
    - Position, turn and install the cable casing retainer at the inboard side of the kneeling mechanism outboard leg.
    - Attach any cable casing retainers.

12. Position the 2 latch foot covers and install the 2 screws.

13. Position the inner and outer covers around the kneeling mechanism outboard leg and install the 2 screws.

14. Position the inner and outer covers around the kneeling mechanism inboard leg and install the 2 screws.

15. Install the latch feet retracting link.
    - Position the spacer between the latch feet retracting link and inboard latch foot.
    - Install the bolt through the latch feet retracting link and spacer and into the inboard latch foot.
    - Install the latch feet retracting link bolt into the kneeling mechanism inboard leg.
        - Tighten to 8 Nm (71 lb-in).

16. Position the inboard and outboard recliner inner covers.

17. Align the cushion trim cover to the cushion foam pad and attach the hook-and-loop strips.

18. Position the cushion foam pad and trim cover to the cushion frame and attach the cushion trim cover retainers and pin-type retainers.
    - Make sure the lower anchor and tethers for children wires at the rear of the cushion frame are positioned through the cushion trim cover and accessible for use after installation.

19. Position the latch feet release bar and install the 2 screws.

20. Install the second row, 40 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent E-Z Entry in this section.

21. Lower the backrest and position the seat to the E-Z entry position.
    - The latch feet should be released from the mounting plate and the cushion and backrest must be pivoted up.

22. Using the kneeling mechanism release handle on the backrest, pull the handle and position the kneeling mechanism down in the fold flat load floor position.
    - The cushion and backrest of the seat will be in the E-Z entry position and the kneeling mechanism will be in the fold flat load floor position.

23. **NOTE:** The shock should be fully extended when installed.

    Position and install the shock onto the seat assembly.

24. Install the second row, 40 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

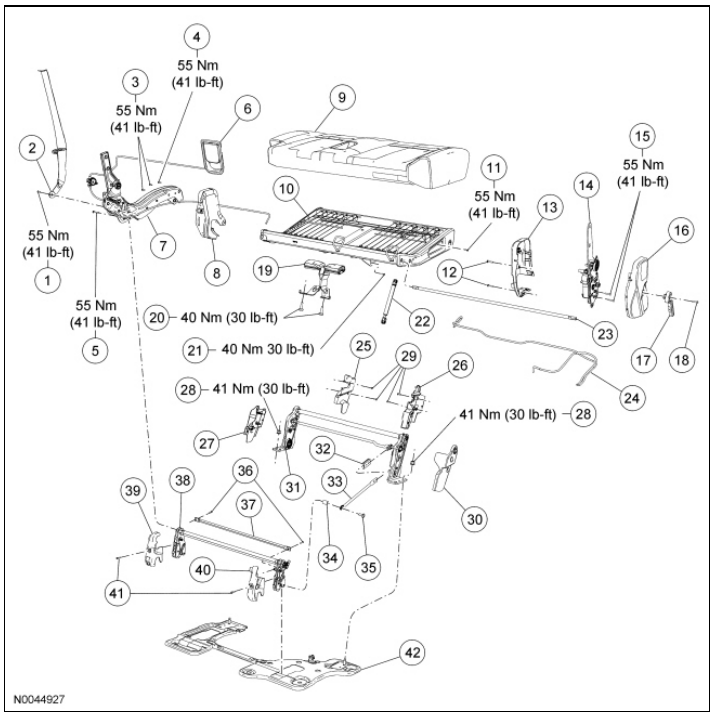
25. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

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Seat Cushion - Second Row, 60 Percent, E-Z Entry

Second Row, 60 Percent, E-Z Entry Cushion



Item	Part Number	Description
1	-	Safety belt anchor bolt (part of 605C10)
2	-	Safety belt anchor (part of 611B64)
3	-	Inboard recliner-to-cushion frame bolts (part of 605C10)
4	-	Inboard recliner-to-kneeling mechanism bolt (part of 605C10)
5	-	Inboard recliner-to-latch foot assembly bolt (part of 605C10)
6	601L60	Kneeling mechanism release handle and cable
7	61383	Inboard recliner
8	61349	Inboard recliner inner cover
9	63804/ 63840	Cushion trim cover/ cushion foam pad
10	63160	Cushion frame
11	-	Cushion frame-to-kneeling mechanism bolt (part of 605C10)
12	-	Screws (2 required) (part of 605C10)
13	61348	Outboard recliner inner cover
14	61382	Outboard recliner

15	-	Outboard recliner-to-cushion frame bolts (part of 605C10)
16	61348	Outboard recliner outer cover
17	62418	Recliner handle
18	-	Screw (part of 605C10)
19	611C72	Safety belt buckle assembly
20	W700883	Safety belt buckle assembly bolts
21	-	Cushion frame-to-latch foot assembly bolt (part of 605C10)
22	624B74	Shock
23	61382	Recliner release shaft
24	601L60	Cable assembly
25	81349	Kneeling mechanism inboard leg inner cover
26	81348	Kneeling mechanism outboard leg inner cover
27	81349	Kneeling mechanism inboard leg outer cover
28	-	Kneeling mechanism-to-mounting plate nuts (2 required) (part of 605C10)
29	-	Screws (4 required) (part of 605C10)
30	81348	Kneeling mechanism outboard leg outer cover
31	61382	Kneeling mechanism
32	-	Latch feet retracting link retainer
33	61382	Latch feet retracting link
34	-	Spacer
35	-	Bolt (part of 605C10)
36	-	Screws (part of 605C10)
37	61382	Latch feet release bar
38	61382	Latch feet assembly
39	61349	Inboard latch foot cover
40	61348	Outboard latch foot cover
41	-	Screws (part of 605C10)
42	606A50	Mounting plate

Disassembly

1. Remove the second row, 60 percent E-Z entry seat from the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

2. Lower the backrest and position the seat to the E-Z entry position.
   - The latch feet should be released from the mounting plate and the cushion and backrest must be pivoted up.

3. Using the kneeling mechanism release handle on the backrest, pull the handle and position the kneeling mechanism down in the fold flat load floor position.
   - The cushion and backrest of the seat will be in the E-Z entry position and the kneeling mechanism will be in the fold flat load floor position.

4. **NOTE:** The shock should be fully extended when removing.

   Remove the shock from the seat assembly.

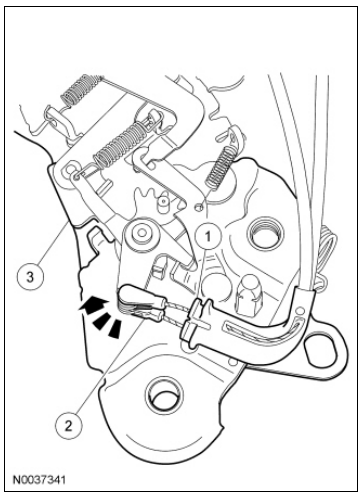
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- Pry the retaining clip out and separate the shock from the seat assembly at each end.

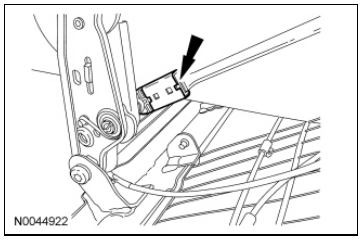
5. Remove the second row 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.
6. Remove 3 screws, recliner handle and outboard recliner outer cover.
7. Remove the 2 screws and the latch feet release bar.
8. Release all the cushion trim cover retainers and pin-type retainers.
9. Remove the cushion trim cover and cushion foam pad from the cushion frame.
10. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

    Release the hook-and-loop strips and separate the cushion trim cover from the cushion foam pad.
11. Remove 2 outboard recliner-to-cushion frame bolts, pull out and separate the outboard recliner.
12. Remove the outboard recliner inner cover.
13. Remove the outboard recliner.
    1. Rotate the cable casing out of the outboard recliner.
    2. **NOTE:** The cable ends are color coded/keyed to the levers.

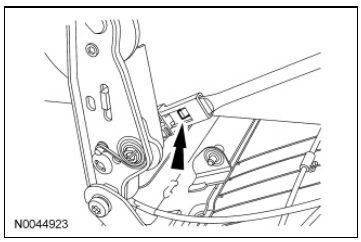
       Rotate the cable ends out of the outboard recliner levers.
    3. Remove the outboard recliner.



14. Remove the 2 screws, pull to separate and remove the kneeling mechanism inboard leg inner and outer covers.
15. Remove the 2 screws, pull to separate and remove the kneeling mechanism outboard leg inner and outer covers.
16. Remove the bolt and spacer and separate the latch feet retracting link from the latch feet assembly.
17. Release the tab and slide the latch feet retracting link retainer back.



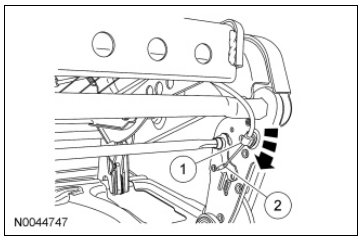
18. Release the tab and remove the latch feet retracting link from the kneeling mechanism.



19. **NOTE:** Note the routing of the cable for installation.

    Separate the cable to the kneeling mechanism inboard leg and cushion frame.

    1. Turn and separate the cable casing retainer at the inboard side of the kneeling mechanism inboard leg.
    2. Separate the cable from the kneeling mechanism inboard leg release lever.
        - Remove the cable casing retainers from the cushion frame.



20. Remove the 2 screws and the 2 latch foot covers.

21. Separate the cable and casing from the outboard latch foot, cushion support springs and remove the cable assembly.

22. Through the opening in the cushion frame, remove the recliner release shaft.

23. **NOTE:** Note the routing of the cable for installation.

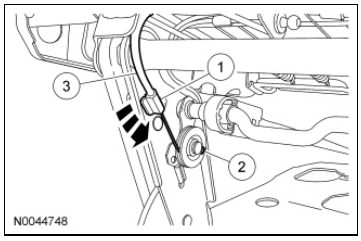
    Separate the kneeling mechanism cable pivot at the inboard recliner.

24. **NOTE:** Note the routing of the cable for installation.

    Remove the kneeling mechanism release handle with cable.

    1. Turn and separate the cable casing retainer at the inboard side of the outboard kneeling mechanism leg.
    2. Separate the cable from the outboard kneeling mechanism leg release lever.
    3. Separate any cable casing retainers to the cushion frame and remove the kneeling mechanism release handle with cable.

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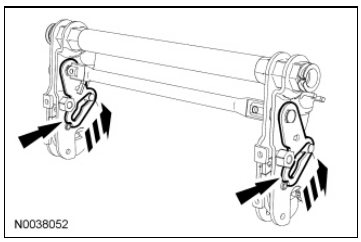


25. Remove the cushion frame.
    - Remove the cushion frame-to-kneeling mechanism bolt.
    - Remove the cushion frame-to-latch foot assembly bolt.
    - Remove the 2 inboard recliner-to-cushion frame bolts.
    - Remove the cushion frame.

26. Remove the 2 bolts and the safety belt buckles.

27. Remove the inboard recliner.
    - Remove the inboard recliner-to-kneeling mechanism bolt.
    - Remove the inboard recliner-to-latch feet assembly bolt.
    - Remove the inboard recliner.
        - ♦ Remove the inboard recliner inner cover.

28. Using the release levers, manually release the inboard and outboard latch feet and remove the latch feet assembly from the mounting plate.



29. Remove the 2 kneeling mechanism-to-mounting plate nuts and remove the kneeling mechanism.

Assembly

1. Position the kneeling mechanism to the mounting plate and install the 2 kneeling mechanism-to-mounting plate nuts.
    - Tighten to 41 Nm (30 lb-ft).

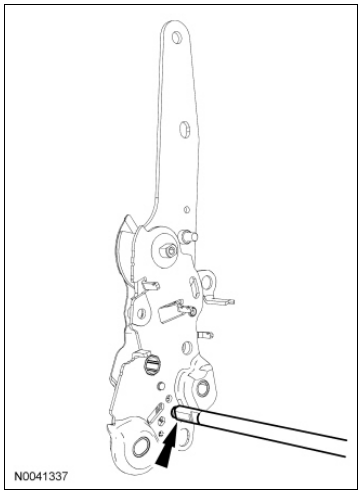
2. **NOTE:** Latch feet will hang down lower than the mounting plate, potentially causing the latch feet to partially latch. Make sure the latch feet are completely latched.

   Position the latch feet assembly to the mounting plate strikers and latch the feet in place.

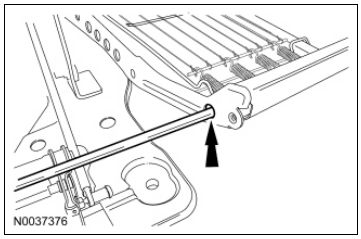
3. Install the inboard recliner inner cover.

4. Position the inboard recliner.
    - Position the inboard recliner to the kneeling mechanism and latch feet assembly.
    - Hand-start the latch feet assembly-to-inboard recliner bolt.
    - Hand-start the kneeling mechanism-to-inboard recliner bolt.

5. Position the recliner release shaft onto the inboard recliner release pivot stub.



6. Position the cushion frame to the inboard recliner with the recliner release shaft through the cushion frame opening.



7. Hand-start the 2 inboard recliner-to-cushion frame bolts.

8. Hand-start the cushion frame-to-latch foot assembly bolt and the cushion frame-to-kneeling mechanism bolt.

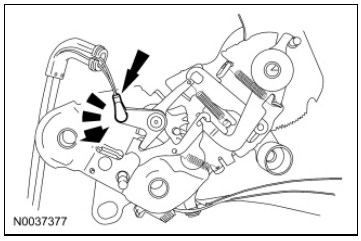
9. Install the bolts.
    - Install the inboard recliner-to-latch feet assembly bolt.
        - ♦ Tighten to 55 Nm (41 lb-ft).
    - Install the inboard recliner-to-kneeling mechanism bolt.
        - ♦ Tighten to 55 Nm (41 lb-ft).
    - Install the cushion frame-to-latch foot assembly bolt.
        - ♦ Tighten to 40 Nm (30 lb-ft).
    - Install the cushion frame-to-kneeling mechanism bolt.
        - ♦ Tighten to 55 Nm (41 lb-ft).
    - Install the inboard recliner-to-cushion frame rear bolt.
        - ♦ Tighten to 55 Nm (41 lb-ft).
    - Install the inboard recliner-to-cushion frame front bolt.
        - ♦ Tighten to 55 Nm (41 lb-ft).

10. **NOTE:** The cable ends are color coded/keyed to the levers.

    Position each keyed cable end to the outboard recliner lever and rotate to the locked position.

    - Install the cable casing to the outboard recliner.

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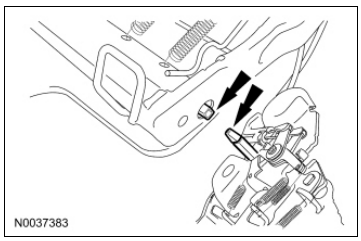


11. Install the outboard recliner inner cover.

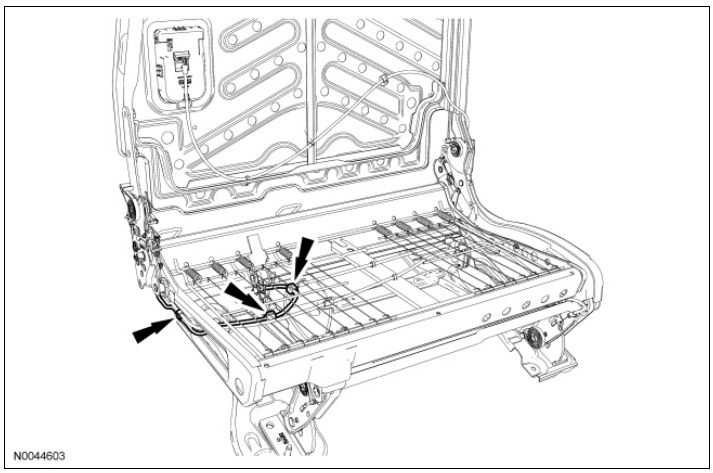
12. **NOTE:** The outboard recliner inner cover has been removed for clarity.

    Position the outboard recliner release pivot stub into the recliner shaft and install the 2 outboard recliner-to-cushion frame bolts.

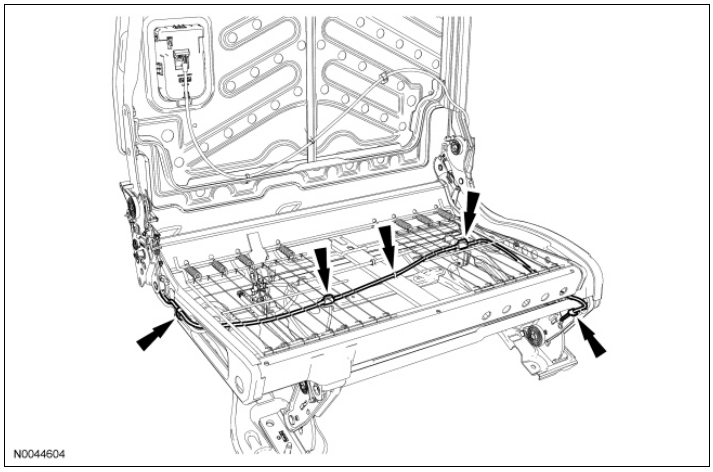
    - Tighten to 55 Nm (41 lb-ft).



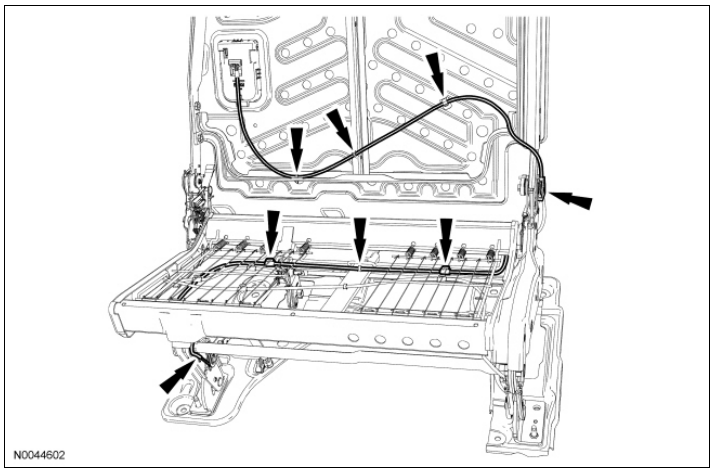
13. Install the outboard recliner short cable to the latch feet assembly outboard foot and attach all cable casing retainers.



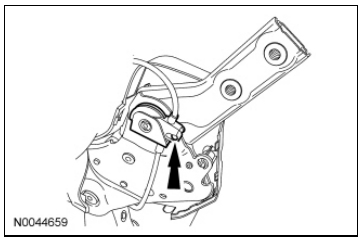
14. Install the outboard recliner long cable to the kneeling mechanism inboard leg and attach all cable casing retainers.



15. Route the kneeling mechanism release cable, position the kneeling mechanism release cable pivot at the inboard recliner and attach all cable casing retainers.



16. Make sure the inboard recliner pin is through the cable pivot.



17. Install the kneeling mechanism release cable to the kneeling mechanism outboard leg.
    - Attach the cable to the kneeling mechanism outboard leg release lever.
    - Position, turn and install the cable casing retainer at the inboard side of the kneeling mechanism outboard leg.
    - Attach any cable casing retainers.

18. Position the inner and outer covers around the kneeling mechanism outboard leg and install the 2 screws.

19. Position the inner and outer covers around the kneeling mechanism inboard leg and install the 2 screws.

20. Position the 2 latch foot covers and install the 2 screws.

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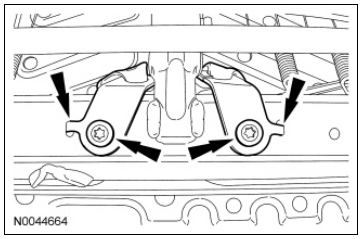
21. Position the latch feet retracting link retainer onto the latch feet retracting link shaft.

22. Position the latch feet retracting link into the kneeling mechanism coupler engaging the retainer.
    - The kneeling mechanism coupler is part of the kneeling mechanism.

23. Slide the latch feet retracting link retainer back to the kneeling mechanism coupler, engaging the retainer.

24. Position the spacer between the latch feet retracting link and outboard latch foot and install the bolt.

25. Align the safety belt buckle anti-rotation tabs to the cushion frame openings and install the 2 bolts.
    - Tighten to 40 Nm (30 lb-ft).



26. Align the cushion trim cover to the cushion foam pad and attach the hook-and-loop strips.

27. Position the cushion foam pad and trim cover to the cushion frame and attach the cushion trim cover retainers and pin-type retainers.
    - Pull the 2 safety belt buckles through the cushion trim cover and foam pad.
    - Make sure the lower anchor and tethers for children wires at the rear of the cushion frame are positioned through the cushion trim cover and accessible for use after installation.

28. Position the latch feet release bar and install the 2 screws.

29. Install the second row, 60 percent E-Z entry seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, E-Z Entry in this section.

30. Lower the backrest and position the seat to the E-Z entry position.
    - The latch feet should be released from the mounting plate and the cushion and backrest must be pivoted up.

31. Using the kneeling mechanism release handle on the backrest, pull the handle and position the kneeling mechanism down in the fold flat load floor position.
    - The cushion and backrest of the seat will be in the E-Z entry position and the kneeling mechanism will be in the fold flat load floor position.

32. **NOTE:** The shock should be fully extended when installed.

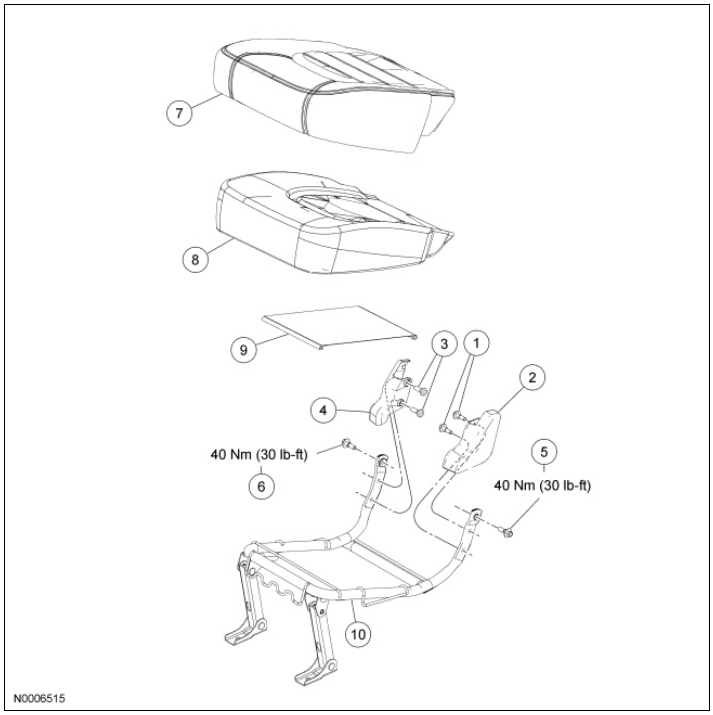
    Position and install the shock onto the seat assembly.

33. Install the second row, 60 percent E-Z entry seat into the vehicle. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry in this section.

34. Cycle the backrest down and then back to the upright position. **Make sure the inboard and outboard recliners simultaneously and securely lock in the upright position.**

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Seat Cushion - Second Row, 40 Percent, Bench



Item	Part Number	Description
1	854182	Latch cover screws
2	820011	Latch cover
3	854182	Latch cover screws
4	851264	Latch cover
5	-	Rear seat 40 percent of 60/40 upper pivot latch bolt (part of 605C10)
6	-	Rear seat 40 percent of 60/40 upper pivot latch bolt (part of 605C10)
7	63805	Cushion trim cover
8	63841	Cushion foam pad
9	63844	Cushion pad support
10	631B79	Seat cushion frame

Disassembly and Assembly

1. Remove the second row 40 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

2. Remove the second row, 40 percent bench seat backrest. For additional information, refer to Seat Backrest - Second Row, 40 Percent, Bench in this section.

3. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the**

hook-and-loop strip can be torn from the seat cushion foam pad.

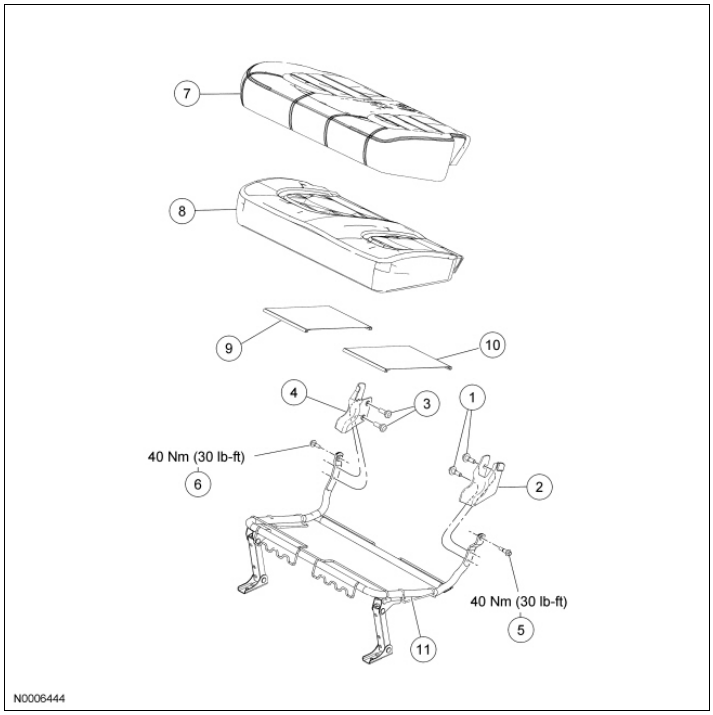
Release the J-clips, separate the hook-and-loop fasteners and remove the seat cushion trim cover.

4. Remove the cushion foam pad.
5. Remove the cushion pad supports.
6. To assemble, reverse the disassembly procedure.

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Seat Cushion - Second Row, 60 Percent, Bench



Item	Part Number	Description
1	854182	Latch cover screws
2	820007	Latch cover
3	854182	Latch cover screws
4	851262	Latch cover
5	-	Rear seat 60 percent of 60/40 upper pivot latch bolt (part of 605C10)
6	-	Rear seat 60 percent of 60/40 upper pivot latch bolt (part of 605C10)
7	63805	Cushion trim cover
8	63840	Cushion foam pad
9	63844	Cushion pad support
10	63844	Cushion pad support
11	631B79	Seat cushion frame

Disassembly and Assembly

1. Remove the second row 60 percent seat of the 60/40 bench seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in this section.

2. Remove the second row 60 percent bench seat backrest. For additional information, refer to Seat Backrest - Second Row, 60 Percent, Bench in this section.

3. Remove the inboard upper pivot latch bolt.
    - To install, tighten to 40 Nm (30 lb-ft).

4. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.**

   Release the J-clips, separate the hook-and-loop fasteners, remove the hog rings and the cushion trim cover.

5. Remove the cushion foam pad.

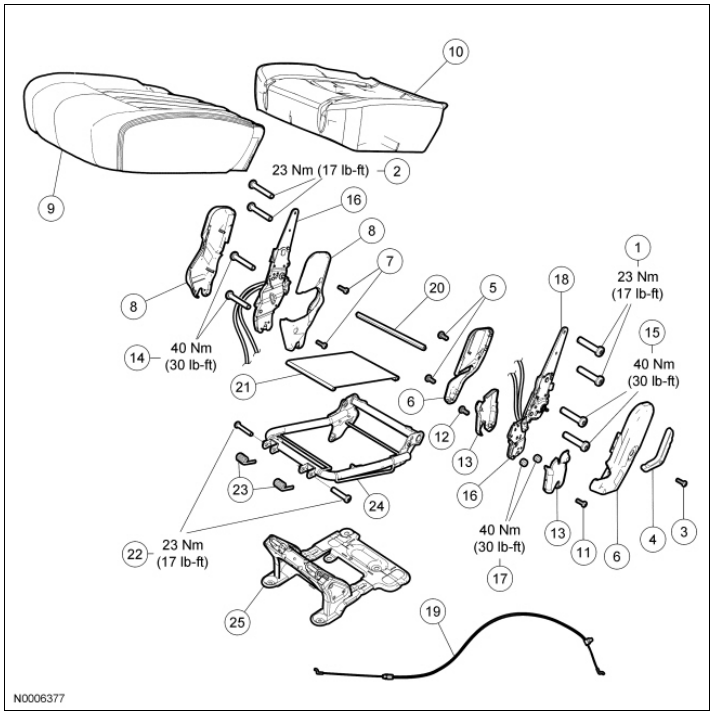
6. Remove 2 cushion pad supports.

7. To assemble, reverse the disassembly procedure.

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Seat Cushion - Second Row, Bucket



Item	Part Number	Description
1	-	Upper latch bolts (part of 605C10)
2	-	Upper latch bolts (part of 605C10)
3	-	Release handle screw (part of 605C10)
4	62419	Release handle
5	56906	Latch cover screws
6	61349	Latch covers (2 required)
7	56906	Latch cover screws
8	61349	Latch covers
9	63805	Cushion trim cover
10	63841	Cushion foam pad
11	56906	Lower latch cover screw
12	56906	Lower latch cover screw
13	61349	Lower latch covers
14	-	Lower latch bolts (part of 605C10)
15	-	Lower latch bolts (part of 605C10)
16	61383	Latches
17	-	Outboard lower latch nuts (part of 605C10)
18	61383	Latch pivot
19	7801L60	Riser attachment cable
20	61332	Torsion rod

21	63844	Cushion pad support
22	-	Front spring hinge bolts (part of 605C10)
23	605A76	Pivot springs
24	631B79	Seat cushion frame
25	600A87	Floor riser

Disassembly and Assembly

NOTE: LH seat shown, RH similar.

1. Remove the second row bucket seat. For additional information, refer to Seat - Second Row, Bucket in this section.

2. Remove the second row bucket seat backrest. For additional information, refer to Seat Backrest - Second Row, Bucket in this section.

3. Remove the screw and the release handle.

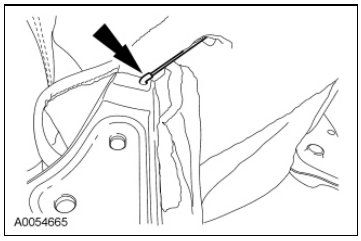
4. Remove the 2 screws and the 2 LH latch covers.

5. Remove the 2 screws and the 2 RH latch covers.

6. ***NOTICE:*** **Use care when separating the cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the seat cushion foam pad.**

   Release the cushion trim cover J-clips, separate the hook-and-loop fasteners and remove one row of hog rings.

7. Release the cable from the seat riser and remove the cushion trim cover.



8. Remove the seat cushion foam pad.

9. Remove the 2 lower latch cover screws and the 2 LH lower latch covers.

10. **NOTE:** The left and right latches with cables are one assembly and should not be separated.

    Remove the 4 latch bolts and the latch pivot.

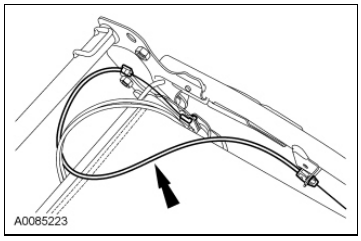
    - To install, tighten to 40 Nm (30 lb-ft).

11. Remove the 2 latch nuts and separate the latch assembly.
    - To install, tighten to 40 Nm (30 lb-ft).

12. **NOTE:** On assembly, route the cable as shown.

    Remove the riser attachment cable and the latch assembly.

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13. Remove the torsion rod and the cushion pad support.

14. Remove the front spring hinge bolts, springs and seat cushion frame assembly.
    - To install, tighten to 23 Nm (17 lb-ft).

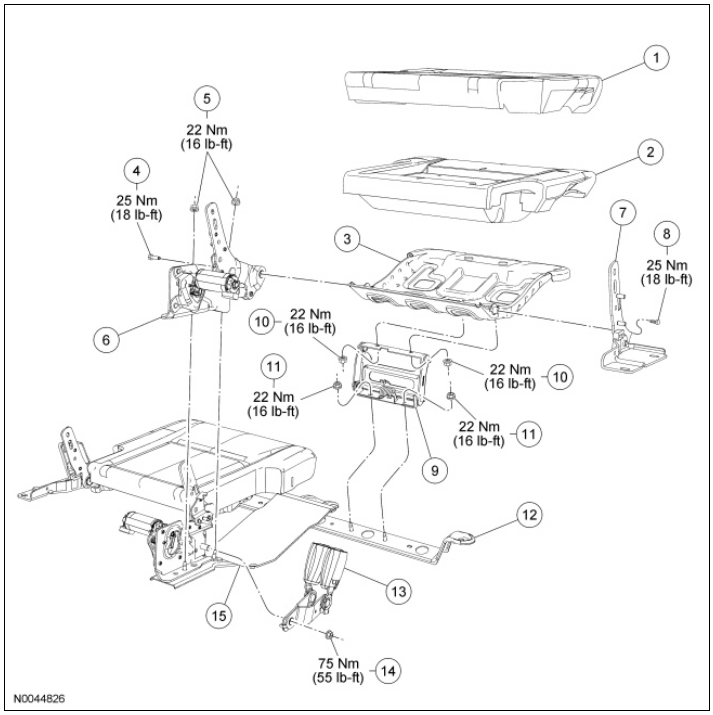
15. To assemble, reverse the disassembly procedure.

Seat Cushion - Third Row

Third Row Seat Cushion

NOTE: RH cushion shown, LH similar.

NOTE: Power latch shown, manual latch similar.



Item	Part Number	Description
1	63804	Cushion trim cover
2	63840	Cushion foam pad
3	63160	Cushion frame
4	-	Latch-to-cushion frame bolt (manual and power) (part of 605C10)
5	-	Latch-to-floor mounting bracket nuts (manual and power) (2 required) (part of 605C10)
6	61382	Power latch
7	61382	Hinge
8	-	Hinge-to-cushion frame bolt (part of 605C10)
9	613E52	Cushion pivot link assembly
10	-	Cushion pivot link assembly-to-cushion frame nuts (2 required) (part of 605C10)
11	-	Cushion pivot link assembly-to-floor mounting bracket nuts (2 required) (part of 605C10)

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12	606A51	Floor mounting bracket
13	611B60	Safety belt buckle assembly
14	-	Safety belt buckle assembly-to-latch nut (power and manual)
15	617C42	Cover

Disassembly and Assembly

1. Remove the third row seat from the vehicle. For additional information, refer to Seat - Third Row in this section.

2. Remove the third row cushion. For additional information, refer to Seat Cushion - Third Row in this section.

3. Release the cushion trim cover J-clips attached to the bottom of the cushion frame.

4. Remove the cushion foam pad and trim cover from the cushion frame.

5. ***NOTICE:*** **Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Invert the cushion trim cover, release the hook-and-loop strips and separate the cushion trim cover from the cushion foam pad.

6. To assemble, reverse the disassembly procedure.

Material

Item	Specification	Fill Capacity
Dow Urethane Adhesive BetasealTM Express	-	-
Dow Urethane One Step Glass Primer BetaprimeTM 5500 / 5500A / 5500SA	-	-
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B1	-
Motorcraft® Lacquer Touch-Up Paint (match color to exterior grid wire) PMP-19500-XXXXX	ESR-M2P100-C	-
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	-	-
Sika Urethane Adhesive Sika Tack ASAP	-	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-	-
Threadlock 262 TA-26	WSK-M2G351-A6	-
Motorcraft® Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A	-

General Specifications

Item	Specification
Polypropylene Film Fine Line Tape (commercially available)	-

Torque Specifications

Description	Nm	lb-in
Front door glass run screws	7	62
Front door glass top run channel bolts	12	106
Liftgate window glass hinge-to-body retaining nut	11	97

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Liftgate window glass hinge-to-glass retaining screws	10	89
Rear door below bolt channel assembly nut	12	106
Rear door glass top run channel bolts	12	106
Rear quarter window nuts	2	18
Rear window glass mounting nuts	3	27
Rear window regulator cover bolts	10	89
Rear window regulator cover-to-motor bolt	10	89
Rear window regulator motor bolts	4	35
Rear window regulator motor bracket nuts	10	89
Rear window regulator mounting nuts	10	89
Rear window regulator-to-window bolts	11	97
Window regulator assembly nuts, front door	10	89
Window regulator motor bolts	7	62
Window regulator nuts, rear door	10	89

Glass, Frames and Mechanisms

The glass, frames and mechanisms consist of the following:

- Accessory delay relay
- Exterior moulding
- Front door glass top run channel assembly
- Front door weather shield
- Front door window glass
- HVAC module
- Interior moulding
- Liftgate window glass
- Rear door glass top run channel assembly
- Rear door weather shield
- Rear door window glass
- Rear quarter window glass
- Rear window control switch
- Rear window defrost relay
- Rear window regulator assembly
- Rear window regulator motor
- Smart Junction Box (SJB)
- Window control switch
- Window regulator assembly
- Window regulator motor
- Windshield glass
- Windshield glass moulding assembly

Power Window Control

The window control switch:

- is located on each door trim panel.
- may be used to raise or lower all windows from the left front window control switch, or the individual side window from the corresponding individual door switch.
- can lock out passenger front and rear window control switches when the lock-out switch on the left front window control switch is turned on.
- can automatically raise or lower the driver door window when the window control switch is momentarily pushed or pulled into the second detent position and released.

Delayed accessory feature

The accessory delay relay, located in the SJB , provides power for the operation of the power windows and the power moon roof (if equipped). The accessory delay feature is active when the ignition switch is in the RUN or the ACC position, or when the ignition switch is changed from RUN or ACC to the OFF/LOCK position and the LF and RF doors are closed.

Rear window defrost

The HVAC module (if equipped) or manual climate control assembly controls the state of the rear window defrost relay. When the rear window defrost switch (integral to the HVAC module or manual climate control

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assembly) is pressed, the HVAC module (if equipped) or manual climate control assembly will activate the rear window defrost relay. When the rear window defrost relay is active, both the rear window defrost grid and heated mirror elements will be energized.

Power Rear Window (if Equipped)

The power rear window is operated by the control switch located in the overhead console. When the rear window is in the fully CLOSED position, pressing and releasing the control switch will lower the rear window to the VENT position. Pressing and releasing the control switch again will lower the rear window to the fully OPEN position. When the rear window is in the fully OPEN or VENT position, pulling and releasing the control switch will return the rear window to the fully CLOSED position.

Glass, Frames and Mechanisms

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

LH Front Power Window Operation

The LH front window motor contains integral electronics which must be initialized whenever a new window motor has been installed. Initialization is required to learn both the full UP and full DOWN positions and the profile of the glass as it travels through the glass channel. Once initialized, obstacle detection is enabled. When mechanical repairs have been carried out on either front window regulator or glass run, the LH front window motor must be de-initialized, and then initialized. The LH front window control switch sends 3 separate signals to the front window motor: up, down and auto. The front window control switch provides a 12-volt signal to the front window motor to request an up or down operation. When one-touch up or one-touch down is requested, the front window control switch provides a 12-volt signal on the up or down line and a ground signal on the auto line simultaneously. The up, down and auto feeds to the LH front window motor are all low current.

The LH front window motor operates with the ignition switch in the RUN or ACCESSORY positions, or when the accessory delay relay is active. The high current required to move the LH front window is supplied through a separate battery power circuit. For the motor to operate correctly, both power feeds and the ground feed must be intact at the window motor.

When the LH front window motor is operating in one-touch up or one-touch down mode, movement of the front window can be stopped by activating the switch in either direction. The front window control switch must be released before the window will move again.

Bounce-Back

The LH front window motor has a bounce-back feature. If an obstacle has been detected in the window opening as the window glass is moving upward, the window motor will automatically reverse direction and move the glass toward the bounce-back position (in both up and one-touch up modes). If an obstruction occurs between 4 mm (0.15 in) and 200 mm (7.87 in) of window opening, the bounce-back position will be 250 mm (9.84 in) of window opening. If an obstruction occurs at a position greater than 200 mm (7.87 in) of window opening, the bounce-back position will be 50 mm (1.96 in) below where the obstruction occurred.

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Security Override

To override a bounce-back condition (to overcome the resistance of ice on the window or seals for example), within 2 seconds after the window reaches the bounce-back position, pull and hold the window control switch. The window will travel up with no bounce-back or pinch protection. If the window control switch is released before the window is fully closed, the window will stop. If the ignition switch is turned to OFF or START (without delayed accessory), the window motor will stop.

A new LH front window motor will not operate in one-touch up mode, and the bounce-back feature will be disabled prior to initialization. If the switch is actuated to the auto UP or auto DOWN position and released, window movement will stop when the up or down contact in the front window control switch is released. If the front window motor is removed from the window regulator drum housing, or if a new front window motor is installed, it must be initialized. Refer to Window Motor Initialization - Front in this section.

The LH front window motor will automatically adjust to system changes throughout its life: changes in seal drag and slight changes in the full OPEN position will occur and will be automatically compensated for. Once initialized, the front window motors will soft stall into the upper and lower positions contributing to extended durability of the system. If the front window does not seal completely in the full UP position (very small gaps/non bounce-back events only), the front window switch can be actuated to the UP position and the front window will be energized for a fraction of a second to fully seal and this new position will be learned.

Passenger Window Operation

Passenger windows may be raised or lowered using the LH front window control switch or the corresponding passenger window control switch. Passenger window control switches receive power when the accessory delay relay is active and the LH front window lock switch is in the UNLOCK position. When the LH front window lock switch is in the LOCK position, the passenger windows will only operate from the LH front window control switch.

Rear Window Defrost

The rear window defrost relay is located in the Smart Junction Box (SJB). The rear window defrost switch is integral to the HVAC module (if equipped) or the manual climate control assembly.

For vehicles equipped with a HVAC module, when the rear window defrost switch is pressed to the ON position, the HVAC module sends a message through the Controller Area Network (CAN) to the SJB . When the SJB receives the rear window defrost ON message, the SJB starts a 10-minute timing function, and grounds the rear window defrost relay coil control circuit, which is hardwired to the SJB . When the rear window defrost relay is active, both the rear window defrost grid and heated mirror elements will be energized.

For vehicles equipped with a manual climate control assembly, when the rear window defrost switch is pressed to the ON position, the manual climate control assembly sends a ground signal to the SJB . When the SJB receives the rear window defrost request, the SJB will activate the rear window defrost relay. When the rear window defrost relay is active, both the rear window defrost grid and heated mirror elements will be energized.

The HVAC module/manual climate control assembly/ SJB will deactivate the rear window defrost relay when one of the following conditions is met

- The rear window defrost switch is pressed when the feature is active
- Ignition switch state is changed from RUN to OFF/LOCK
- The 10 minute timing function is completed

Feature inputs

- Ignition switch RUN position (12V on both RUN and RUN/ACC inputs)

- Rear window defrost switch (momentary contact to ground when switch is pressed)

Feature outputs

- Rear window defrost relay control (grounded when activated, open circuit when deactivated)

Delayed Accessory Power

NOTE: The SJB may also be identified as the Generic Electronic Module (GEM).

The SJB controls power to the power windows and the roof opening panel (if equipped) with the accessory delay relay. Refer to the Wiring Diagrams manual for additional vehicle features powered by the accessory delay relay. The SJB activates the accessory delay relay whenever the ignition switch is in the RUN or the ACCESSORY position, or when the ignition switch is changed from RUN or ACCESSORY to the OFF/LOCK position and the LH and RH front doors are closed.

The SJB will deactivate the accessory delay feature when:

- the LF door is ajar and the ignition switch is in the OFF/LOCK or KEY-OUT position.
- the RF door is ajar and the ignition switch is in the OFF/LOCK or KEY-OUT position.
- ten minutes have elapsed since the ignition switch was changed from ACC or RUN to the OFF/LOCK position.

Feature inputs

- LF door ajar switch (open circuit with door closed, grounded with door ajar)
- RF door ajar switch (open circuit with door closed, grounded with door ajar)
- Ignition switch RUN position (battery potential on both the RUN and RUN/ACC inputs)
- Ignition switch ACC position (battery potential on the RUN/ACC input)
- Ignition switch OFF/LOCK position (absence of battery potential on the RUN, RUN/ACC and START inputs)

Feature outputs

- Accessory delay relay (control circuit grounded when activated, open circuit when deactivated)

Power Rear Window

NOTE: The power rear window motor does not communicate on the Controller Area Network (CAN).

The power rear window motor is an 8-pin motor with integral electronics. The power rear window control switch is located in the overhead console and provides a voltage signal to the motor to signal an open or close request. The integral electronics on the motor allow the power rear window to be moved to 3 positions: fully OPEN, fully CLOSED and VENT (approximately 50.8 mm [2 in] down from fully CLOSED).

When the power rear window is in the fully CLOSED position, pressing and releasing the control switch will lower the rear window to the VENT position. Pressing and releasing the control switch again will lower the rear window to the fully OPEN position. When the rear window is in the fully OPEN or VENT position, pulling and releasing the control switch will return the rear window to the fully CLOSED position.

The power rear window motor plastic pinion gear is mated to the drum housing of a single rail drum and cable window regulator. The motor is attached to the plastic drum housing by 3 screws. The motor uses internal Hall-effect sensor feedback coupled to the microprocessor to determine window position and operate the power rear window. If the microprocessor is not receiving the Hall-effect sensor pulses, the motor will run for approximately half a second, then enter error mode (window will become inoperative). The motor contains a thermal breaker to protect the motor windings from over-current/over-temperature operation. Continued successive operation of the motor will cause the thermal breaker to open, causing a loss of function until the

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power rear window motor cools. If this occurs, when the motor cools it will be in position recovery mode. Simply press the control switch momentarily and the power rear window will stall in the full OPEN position. Full functionality will then be restored.

The power rear window motor operates only with the ignition switch in the RUN/ACC position, or when the accessory delay relay is active. The motor is supplied with battery power and draws a key-off load of approximately 0.5 mA. All of the high current required to move the window is supplied through the battery and motor ground inputs. The loss of both logic and motor ground will cause this system to become inoperative. For correct functionality, both power feeds and one ground feed must be intact at the power rear window motor.

If an open or close command is selected while the ignition switch is in the RUN/ACC position, and the ignition switch is turned to OFF or START without accessory delay relay power enabled, the window will move to the fully OPEN or VENT position and stop.

Bounce-Back

If an obstacle is detected in the power rear window opening as the window is closing, the window will automatically reverse direction and move toward the fully OPEN position. This is known as bounce-back.

Security Override

To override a bounce-back condition (to overcome the resistance of ice on the window or seals for example), within 2 seconds after the window reaches the bounce-back position, pull and hold the window control switch. The window will travel up with no bounce-back or pinch protection. If the ignition switch is turned to OFF or START without accessory delay power enabled, the window will reverse direction with bounce-back re-enabled.

If the high current power circuit is disconnected from the power rear window motor while the window is in motion, the motor will enter position recovery mode when power is restored. Position recovery mode allows upward movement of the window in 15 mm (0.6 in) increments. If the control switch is pulled, the window will move in a one-touch down mode until it stalls in the fully OPEN position. If no internal or external faults exist, the motor will automatically resume normal operation.

The power rear window motor will suspend normal operation if a power rear window control switch error exists. A control switch error is defined as open and close energized at the same time. The window will be inoperative if a control switch error is present.

If the motor is removed from the window regulator drum housing, or if a new motor is installed, the window must be initialized. A new motor will be inoperative until initialized. Refer to Window Motor Initialization - Rear in this section.

The power rear window will automatically adjust to system changes throughout its life. Changes in seal drag and slight changes in the fully CLOSED position will occur and are automatically compensated for. Once initialized, the motor will soft stall into the lower position contributing to the extended durability of the system.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Window regulator assembly • Window motor • Window glass • Window control switch	• Battery Junction Box (BJB) fuse(s): ♦ 1 (50A) ♦ 10 (20A) ♦ 15 (40A) ♦ 37 (30A) • Smart Junction Box (SJB) circuit breaker 1 (25A) • SJB fuse 5 (5A) • Circuitry • Window control switch • Rear window defrost relay • Accessory delay relay

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the SJB or HVAC module (if equipped).

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. Clear the CMDTCs and carry out the self-test diagnostics for the SJB and HVAC module (if equipped).

9. If the DTCs retrieved are related to the concern, GO to Smart Junction Box (SJB) DTC Chart or HVAC Module DTC Chart. For all other DTCs, refer to Section 419-10 .

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10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B1302	Accessory Delay Relay Coil Circuit Failure	GO to Pinpoint Test I .
B1304	Accessory Delay Relay Coil Circuit Short To Battery	GO to Pinpoint Test J .
B1345	Heated Backlite Input Circuit Short To Ground	GO to Pinpoint Test H .
B1347	Heated Backlite Relay Circuit Failure	GO to Pinpoint Test G .
B1349	Heated Backlite Relay Short To Battery	CARRY OUT the rear window defrost relay component test. Refer to Wiring Diagrams Cell 149 for component testing. If the rear window defrost relay is OK, INSTALL a new SJB . REFER to Section 419-10 for removal and installation procedures. TEST the system for normal operation. If the rear window defrost relay is not OK, INSTALL a new rear window defrost relay. TEST the system for normal operation.
U0164	Lost Communication With HVAC Control Module	REFER to Section 418-00 to diagnose no response from the HVAC module.
All Other DTCs	-	REFER to the Master DTC Chart in Section 419-10 .

HVAC Module DTC Chart

DTC	Description	Action
B1342	ECU is Faulted	INSTALL a new HVAC module. REFER to Section 412-01 for removal and installation procedures.
All Other DTCs	-	REFER to the Master DTC Chart in Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: All Power Windows are Inoperative

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

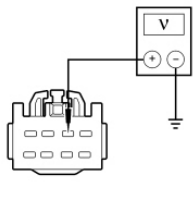
Normal Operation

Under normal operation, the Smart Junction Box (SJB) grounds the accessory delay relay coil circuit to activate the relay. When the accessory delay relay is active, voltage is sent to the LH front window control switch through circuit CBP80 (YE/GN). The LH front window control switch is grounded through circuit GD133 (BK).

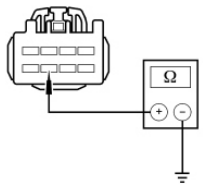
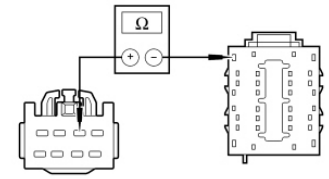
This pinpoint test is intended to diagnose the following:

- Circuit breaker
- Wiring, terminals or connectors
- Accessory delay relay
- SJB
- LH front window control switch

PINPOINT TEST A: ALL POWER WINDOWS ARE INOPERATIVE

Test Step	Result / Action to Take
A1 CHECK THE VOLTAGE TO THE LH FRONT WINDOW CONTROL SWITCH - CIRCUIT CBP80 (YE/GN)	
• Disconnect: LH Front Window Control Switch C504A. • Ignition ON. • Measure the voltage between LH front window control switch C504A-2, circuit CBP80 (YE/GN), harness side and ground.  N0037874 • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** GO to A3 .
A2 CHECK THE GROUND TO THE DRIVER WINDOW CONTROL SWITCH - CIRCUIT GD133 (BK)	

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• Ignition OFF. • Measure the resistance between LH front window control switch C504B-7, circuit GD133 (BK), harness side and ground.  N0037888 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new driver window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK CIRCUIT CBP80 (YE/GN) FOR AN OPEN	
• Disconnect: SJB C2280A. • Ignition OFF. • Measure the resistance between LH front window control switch C504A-2, circuit CBP80 (YE/GN), harness side and SJB C2280A-29, circuit CBP80 (YE/GN), harness side.  N0047263 • **Is the resistance less than 5 ohms?**	**Yes** VERIFY SJB circuit breaker 1 (25A) is OK. If OK, GO to Pinpoint Test I to diagnose the accessory delay relay circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test B: A Single Power Window is Inoperative - LH Front

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

NOTE: A new LH front power window motor will not operate in one-touch up mode until initialized. Refer to Window Motor Initialization - Front in this section.

NOTE: The LH front power window motor must be de-initialized, then initialized whenever the LH front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

Normal Operation

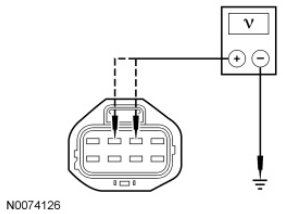
Under normal operation, the LH front power window motor microprocessor receives voltage from the accessory delay relay through circuit CBP05 (YE). The LH window motor receives battery voltage at all times through circuit SBB37 (GY/RD) and ground through circuit GD133 (BK). The LH front window control switch provides a voltage input to the power window motor microprocessor through circuit CPW11 (BU/GY)

to operate the window upward, and voltage input through circuit CPW10 (YE/VT) to operate the driver window upward. When the LH front window control switch is operated to the second detent position (up/down) a ground signal is supplied to the LH front window motor through circuit CPW29 (VT/GY) to enter one-touch up/down mode.

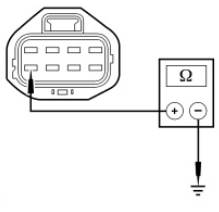
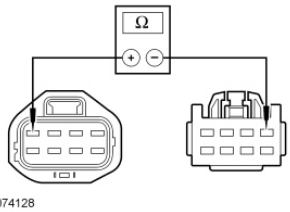
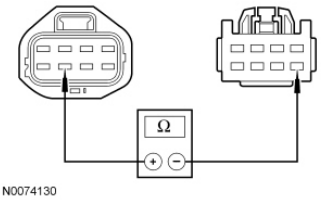
This pinpoint test is intended to diagnose the following:

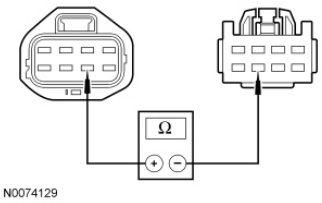
- Fuse(s)
- Wiring, terminals or connectors
- LH front window control switch
- LH front power window motor

PINPOINT TEST B: A SINGLE POWER WINDOW IS INOPERATIVE - LH FRONT

Test Step	Result / Action to Take
B1 CHECK THE POWER TO THE WINDOW MOTOR	
• Ignition OFF. • Disconnect: LH Front Window Motor C540. • Ignition ON. • Measure the voltage between LH front window motor C540-2, circuit CBP05 (YE), harness side and ground; and between LH front window motor C540-3, circuit SBB37 (GY/RD), harness side and ground.  • **Is the voltage greater than 10 volts for both measurements?**	**Yes** GO to B2 . **No** VERIFY Smart Junction Box (SJB) fuse 5 (5A) and Battery Junction Box (BJB) fuse 37 (30A) are OK. If OK, REPAIR the circuit in question. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.
B2 CHECK THE LH FRONT WINDOW MOTOR GROUND	
• Ignition OFF. • Measure the resistance between LH front window motor C540-8, circuit GD133 (BK), harness side and ground.	**Yes** GO to B3 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.

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 N0074127 • **Is the resistance less than 5 ohms?**	
B3 CHECK CIRCUIT CPW10 (YE/VT) FOR AN OPEN	
• Disconnect: LH Front Window Control Switch C504A. • Measure the resistance between LH front window motor C540-4, circuit CPW10 (YE/VT), harness side and LH front window control switch C504A-1, circuit CPW10 (YE/VT), harness side.  N0074128 • **Is the resistance less than 5 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.
B4 CHECK CIRCUIT CPW11 (BU/GY) FOR AN OPEN	
• Measure the resistance between LH front window motor C540-7, circuit CPW11 (BU/GY), harness side and LH front window control switch C504A-5, circuit CPW11 (BU/GY), harness side.  N0074130 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.
B5 CHECK CIRCUIT CPW29 (VT/GY) FOR AN OPEN	
• Measure the resistance between LH front window motor C540-6, circuit CPW29 (VT/GY), harness side and LH front window control switch C504A-7, circuit CPW29 (VT/GY), harness side.	**Yes** GO to B6 . **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor.

 • **Is the resistance less than 5 ohms?**	REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.
B6 CHECK THE LH FRONT WINDOW CONTROL SWITCH	
• Carry out the LH front window control switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the window control switch pass the component test?**	**Yes** INSTALL a new LH front window motor. REFER to Window Regulator Motor - Front Door in this section. INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation. **No** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.

Pinpoint Test C: A Single Power Window is Inoperative - RH Front

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

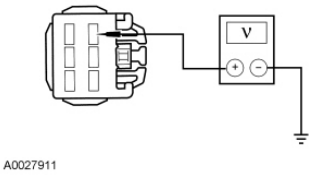
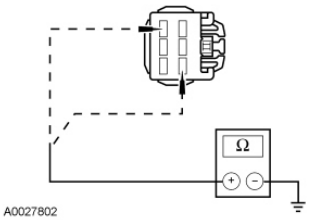
Under normal operation, the RH front window control switch receives voltage from the LH front window control switch through circuit CPW14 (VT/WH) when the LH front window lockout switch is in the UNLOCK position. The RH front window control switch provides voltage to the power window motor through circuit CPW19 (VT) and ground through circuit CPW20 (WH/OG) to operate the window downward; and voltage through circuit CPW20 (WH/OG) and ground through circuit CPW19 (VT) to operate the window upward.

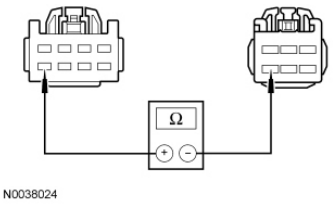
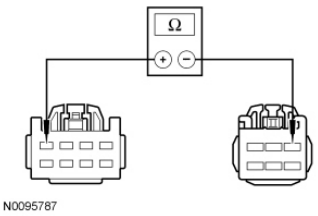
When operating the RH front window using the LH front window control switch, voltage is sent to the RH front window control switch through circuit CPW12 (GN/OG) and ground through circuit CPW13 (BN/YE) to operate the window downward; and voltage through circuit CPW13 (BN/YE) and ground through circuit CPW12 (GN/OG) to operate the window upward.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- LH front window control switch
- RH front window control switch
- RH front window motor

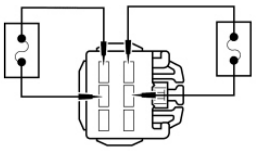
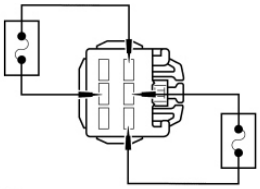
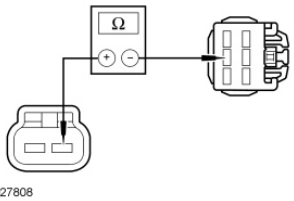
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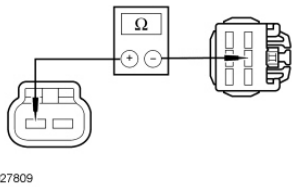
PINPOINT TEST C: A SINGLE POWER WINDOW IS INOPERATIVE - RH FRONT

Test Step	Result / Action to Take
C1 CHECK THE VOLTAGE TO THE RH FRONT WINDOW CONTROL SWITCH - CIRCUIT CPW14 (VT/WH)	
• Disconnect: RH Front Window Control Switch C604. • Ignition ON. • **NOTE:** Make sure the LH front window lock-out switch is in the UNLOCK position. • Measure the voltage between RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side and ground.  A0027911 • **Is the voltage greater than 10 volts?**	**Yes** GO to C2 . **No** REPAIR the circuit. TEST system for normal operation.
C2 CHECK THE GROUNDS TO THE RH FRONT WINDOW CONTROL SWITCH - CIRCUITS CPW13 (BN/YE) AND CPW12 (GN/OG)	
• Ignition OFF. • Measure the resistance between RH front window control switch C604-6, circuit CPW13 (BN/YE), harness side and ground; and between RH front window control switch C604-1, circuit CPW12 (GN/OG), harness side and ground.  A0027802 • **Is the resistance less than 5 ohms?**	**Yes** GO to C4 . **No** GO to C3 .
C3 CHECK CIRCUITS CPW13 (BN/YE) AND CPW12 (GN/OG) FOR AN OPEN	

• Ignition OFF. • Disconnect: LH Front Window Control Switch C504A. • Measure the resistance between LH front window control switch C504A-8, circuit CPW13 (BN/YE), harness side and RH front window control switch C604-6, circuit CPW13 (BN/YE), harness side.  N0038024 • Measure the resistance between LH front window control switch C504A-4, circuit CPW12 (GN/OG), harness side and RH front window control switch C604-1, circuit CPW12 (GN/OG), harness side.  N0095787 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CPW13 (BN/YE) or CPW12 (GN/OG). TEST system for normal operation.
C4 CHECK THE RH FRONT WINDOW CONTROL SWITCH	
• Ignition ON. • **NOTE:** Make sure the LH front window lock-out switch is in the UNLOCK position. • Connect a fused jumper wire between RH front window control switch C604-6, circuit CPW13 (BN/YE), harness side and RH front window control switch C604-5, circuit CPW20 (WH/OG), harness side; and a second fused jumper wire between RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side and RH front window control switch C604-2, circuit CPW19 (VT), harness side. The window should operate in the downward direction.	**Yes** If the RH front window did not operate with the RH front window control switch, INSTALL a new RH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. If the RH front power window did operate with the RH front window control switch, but not with the LH front window control switch, INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** GO to C5 .

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 N0058164 • Connect a fused jumper wire between RH front window control switch C604-1, circuit CPW12 (GN/OG), harness side and RH front window control switch C604-2, circuit CPW19 (VT), harness side; and a second fused jumper wire between RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side and RH front window control switch C604-5, circuit CPW20 (WH/OG), harness side. The window should operate in the upward direction.  N0058163 • **Does the window operate correctly?**	
C5 CHECK CIRCUITS CPW20 (WH/OG) AND CPW19 (VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: RH Front Window Motor C608. • Measure the resistance between RH front window control switch C604-5, circuit CPW20 (WH/OG), harness side and RH front window motor C608-1, circuit CPW20 (WH/OG), harness side.  A0027808 • Measure the resistance between RH front window control switch C604-2, circuit CPW19 (VT), harness side and RH front window motor C608-2, circuit CPW19 (VT), harness side.	**Yes** INSTALL a new RH front window motor. REFER to Window Regulator Motor - Front Door in this section. TEST the system for normal operation. **No** REPAIR circuit CPW20 (WH/OG) or CPW19 (VT). TEST the system for normal operation.

 • **Is the resistance less than 5 ohms for both measurements?**	

Pinpoint Test D: A Single Power Window is Inoperative - LH Rear

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LH rear window control switch receives voltage from the LH front window control switch through circuit CPW14 (VT/WH) when the LH front window lockout switch is in the UNLOCK position. The LH rear window control switch provides voltage to the power window motor through circuit CPW21 (BN) and ground through circuit CPW22 (GN/VT) to operate the window downward; and voltage through circuit CPW22 (GN/VT) and ground through circuit CPW21 (BN) to operate the window upward.

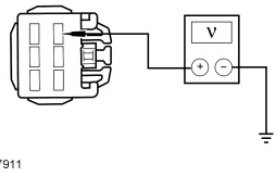
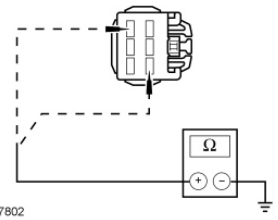
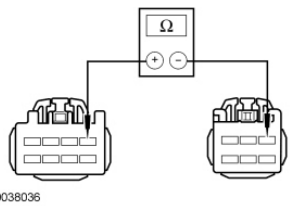
When operating the LH rear window using the LH front window control switch, voltage is sent to the LH rear window control switch through circuit CPW15 (YE) and ground through circuit CPW16 (BU/OG) to operate the LH rear window downward; and voltage through circuit CPW16 (BU/OG) and ground through circuit CPW15 (YE) to operate the window upward.

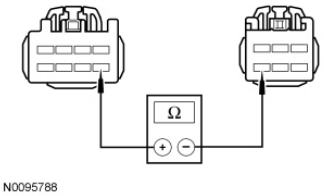
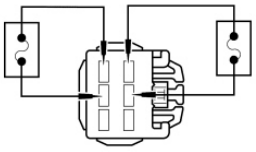
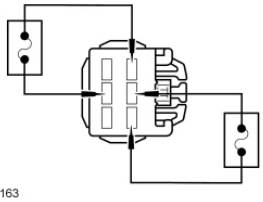
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- LH front window control switch
- LH rear window control switch
- LH rear window motor

PINPOINT TEST D: A SINGLE POWER WINDOW IS INOPERATIVE - LH REAR

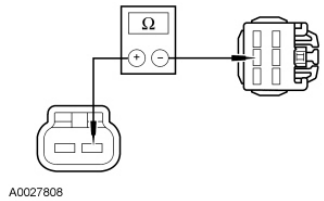
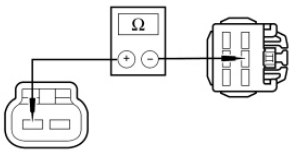
Test Step	Result / Action to Take
D1 CHECK THE VOLTAGE TO THE LH REAR WINDOW CONTROL SWITCH - CIRCUIT CPW14 (VT/WH)	
• Disconnect: LH Rear Window Control Switch C701. • Ignition ON. • **NOTE:** Make sure the LH front window lock-out switch is in the UNLOCK position. • Measure the voltage between LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side and ground.	**Yes** GO to D2 . **No** REPAIR the circuit. TEST system for normal operation.

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 A0027911 • **Is the voltage greater than 10 volts?**	
D2 CHECK THE GROUND TO THE LH REAR WINDOW CONTROL SWITCH - CIRCUITS CPW15 (YE) AND CPW16 (BU/OG)	
• Ignition OFF. • Measure the resistance between LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side and ground; and between LH rear window control switch C701-1, circuit CPW15 (YE), harness side and ground.  A0027802 • **Is the resistance less than 5 ohms?**	**Yes** GO to D4 . **No** GO to D3 .
D3 CHECK CIRCUITS CPW15 (YE) AND CPW16 (BU/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: LH Front Window Control Switch C504B. • Measure the resistance between LH front window control switch C504B-1, circuit CPW15 (YE), harness side and LH rear window control switch C701-1, circuit CPW15 (YE), harness side.  N0038036 • Measure the resistance between LH front window control switch C504B-5, circuit CPW16 (BU/OG), harness side and LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side.	**Yes** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CPW15 (YE) or CPW16 (BU/OG). TEST system for normal operation.

 N0095788 • **Is the resistance less than 5 ohms?**	
D4 CHECK THE LH REAR WINDOW CONTROL SWITCH	
• Disconnect: LH Rear Window Control Switch C701. • Ignition ON. • **NOTE:** Make sure the LH front window lock-out switch is in the UNLOCK position. • Connect a fused jumper wire between LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side and LH rear window control switch C701-5, circuit CPW22 (GN/VT), harness side; and a second fused jumper wire between LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side and LH rear window control switch C701-2, circuit CPW21 (BN), harness side. The window should operate in the downward direction.  N0058164 • Connect a fused jumper wire between LH rear window control switch C701-1, circuit CPW15 (YE), harness side and LH rear window control switch C701-2, circuit CPW21 (BN), harness side; and a second fused jumper wire between LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side and LH rear window control switch C701-5, circuit CPW22 (GN/VT), harness side. The window should operate in the upward direction.  N0058163 • **Does the window operate correctly?**	**Yes** If the LH rear window did not operate with the LH rear window control switch, INSTALL a new LH rear window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. If the LH rear power window did operate with the LH rear window control switch but not with the LH front window control switch, INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** GO to D5 .
D5 CHECK CIRCUITS CPW22 (GN/VT) AND CPW21 (BN) FOR AN OPEN	

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• Ignition OFF. • Disconnect: LH Rear Window Motor C703. • Measure the resistance between LH rear window control switch C701-5, circuit CPW22 (GN/VT), harness side and LH rear window motor C703-1, circuit CPW24 (VT/BK)/CPW22 (GN/VT), harness side.  A0027808 • Measure the resistance between LH rear window control switch C701-2, circuit CPW21 (BN), harness side and LH rear window motor C703-2, circuit CPW23 (GY)/CPW21 (BN), harness side.  A0027809 • **Is the resistance less than 5 ohms for both measurements?**	**Yes** INSTALL a new LH rear window motor. REFER to Window Regulator Motor - Rear Door in this section. TEST the system for normal operation. **No** REPAIR circuit CPW21 (BN) or CPW22 (GN/VT). TEST the system for normal operation.

Pinpoint Test E: A Single Power Window is Inoperative - RH Rear

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the RH rear window control switch receives voltage from the LH front window control switch through circuit CPW14 (VT/WH) when the LH front window lockout switch is in the UNLOCK position. The RH rear window control switch provides voltage to the power window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT) to operate the window downward; and voltage through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY) to operate the window upward.

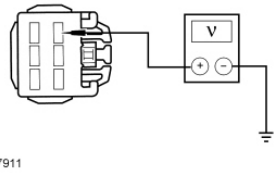
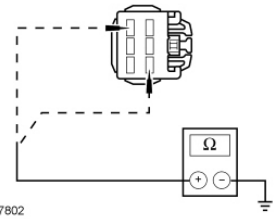
When operating the RH rear window using the LH front window control switch, voltage is sent to the RH rear window control switch through circuit CPW17 (BN/GN) and ground through circuit CPW18 (GY/VT) to operate the window downward; and voltage through circuit CPW18 (GY/VT) and ground through circuit CPW17 (BN/GN) to operate the window upward.

This pinpoint test is intended to diagnose the following:

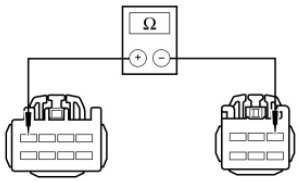
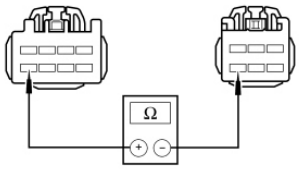
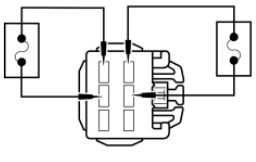
- Wiring, terminals or connectors
- LH front window control switch

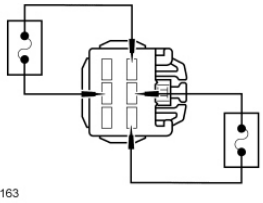
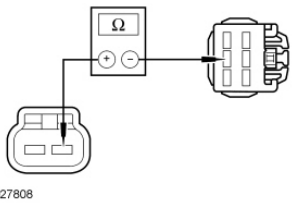
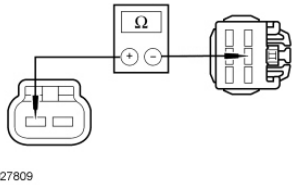
- RH rear window control switch
- RH rear window motor

PINPOINT TEST E: SINGLE POWER WINDOW IS INOPERATIVE - RH REAR

Test Step	Result / Action to Take
E1 CHECK THE VOLTAGE TO THE RH REAR WINDOW CONTROL SWITCH - CIRCUIT CPW14 (VT/WH)	
• Disconnect: RH Rear Window Control Switch C801. • Ignition ON. • **NOTE:** Make sure the LH front window lock-out switch is in the UNLOCK position. • Measure the voltage between RH rear window control switch C801-3, circuit CPW14 (VT/WH), harness side and ground.  A0027911 • **Is the voltage greater than 10 volts?**	**Yes** GO to E2 . **No** REPAIR the circuit. TEST system for normal operation.
E2 CHECK THE GROUNDS TO THE RH REAR WINDOW CONTROL SWITCH - CIRCUITS CPW17 (BN/GN) AND CPW18 (GY/VT)	
• Ignition OFF. • Measure the resistance between RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side and ground; and between RH rear window control switch and C801-6, circuit CPW18 (GY/VT), harness side and ground.  A0027802 • **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** GO to E3 .
E3 CHECK CIRCUITS CPW17 (BN/GN) AND CPW18 (GY/VT) FOR AN OPEN	

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• Ignition OFF. • Disconnect: LH Front Window Control Switch C504B. • Measure the resistance between LH front window control switch C504B-4, circuit CPW17 (BN/GN), harness side and RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side.  N0038045 • Measure the resistance between LH front window control switch C504B-8, circuit CPW18 (GY/VT), harness side and RH rear window control switch C801-6, circuit CPW18 (GY/VT), harness side.  N0038044 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CPW17 (BN/GN) or CPW18 (GY/VT). TEST system for normal operation.
E4 CHECK THE RH REAR WINDOW CONTROL SWITCH	
• Disconnect: RH Rear Window Control Switch C801. • Ignition ON. • **NOTE:** Make sure the LH front window lock-out switch is in the UNLOCK position. • Connect a fused jumper wire between RH rear window control switch C801-6, circuit CPW18 (GY/VT), harness side and C801-5, circuit CPW24 (WH/VT), harness side; and a second fused jumper wire between C801-3, circuit CPW14 (VT/WH), harness side and C801-2, circuit CPW23 (GY), harness side. The window should operate in the downward direction.  N0058164	**Yes** If the RH rear window did not operate with the RH rear window control switch, INSTALL a new RH rear window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. If the RH rear power window did operate with the RH rear window control switch, but not with the LH front window control switch, INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation. **No** GO to E5 .

• Connect a fused jumper wire between RH rear window control switch C801-1, circuit CPW17 (BN/GN), harness side and C801-2, circuit CPW23 (GY), harness side; and a second fused jumper wire between C801-3, circuit CPW14 (VT/WH), harness side and C801-5, circuit CPW24 (WH/VT), harness side. The window should operate in the upward direction.  N0058163 • **Does the window operate correctly?**	
E5 CHECK CIRCUITS CPW23 (GY) AND CPW24 (WH/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: RH Rear Window Motor C803. • Measure the resistance between RH rear window control switch C801-5, circuit CPW24 (WH/VT), harness side and RH rear window motor C803-1, circuit CPW24 (WH/VT), harness side.  A0027808 • Measure the resistance between RH rear window control switch C801-2, circuit CPW23 (GY), harness side and RH rear window motor C803-2, circuit CPW23 (GY), harness side.  A0027809 • **Is the resistance less than 5 ohms for both measurements?**	**Yes** INSTALL a new RH rear window motor. REFER to Window Regulator Motor - Rear Door in this section. TEST the system for normal operation. **No** REPAIR circuit CPW24 (WH/VT) or CPW23 (GY). TEST the system for normal operation.

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Pinpoint Test F: The One-Touch Up/Down Feature is Inoperative - LH Front

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

NOTE: A new LH front power window motor will not operate in one-touch up mode until initialized. Refer to Window Motor Initialization - Front in this section.

NOTE: The LH front power window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

Normal Operation

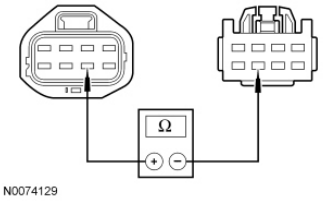
Under normal operation, the LH front power window motor microprocessor receives voltage from the accessory delay relay through circuit CBP05 (YE). The LH window motor receives battery voltage at all times through circuit SBB37 (GY/RD) and ground through circuit GD133 (BK). The LH front window control switch provides a voltage input to the power window motor microprocessor through circuit CPW11 (BU/GY) to operate the window upward, and voltage input through circuit CPW10 (YE/VT) to operate the driver window upward. When the LH front window control switch is operated to the second detent position (up/down) a ground signal is supplied to the LH front window motor through circuit CPW29 (VT/GY) to enter one-touch up/down mode.

This pinpoint test is intended to diagnose the following:

- LH front motor not initialized
- Wiring, terminals or connectors
- LH front window control switch
- LH front window motor

PINPOINT TEST F: THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE - LH FRONT

Test Step	Result / Action to Take
F1 DE-INITIALIZE, THEN INITIALIZE THE LH FRONT MOTOR	
• De-initialize the LH front window motor, then carry out the front window motor initialization procedure. Refer to Window Motor Initialization - Front in this section. • **Is the one-touch down feature operating correctly?**	**Yes** The system is operating normally at this time. The front window motor lost initialization. **No** GO to F2 .
F2 CHECK THE LH FRONT WINDOW CONTROL SWITCH	
• Ignition OFF. • Disconnect: LH Front Window Control Switch C504A and C504B. • Carry out the LH front window control switch component test. Refer to Wiring Diagrams Cell 149 for component testing.	**Yes** GO to F3 . **No** INSTALL a new LH front window control switch. REFER to Window Control Switch in this section. TEST the system for normal operation.

• **Did the LH front window control switch pass the component test?**	
F3 CHECK CIRCUIT CPW29 (VT/GY) FOR AN OPEN	
• Disconnect: LH Front Window Motor C540. • Measure the resistance between LH front window motor C540-6, circuit CPW29 (VT/GY), harness side and LH front window control switch C504A-7, circuit CPW29 (VT/GY), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new LH front window motor. REFER to Window Regulator Motor - Front Door in this section. TEST the system for normal operation. **No** REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to Window Motor Initialization - Front in this section. TEST the system for normal operation.

Pinpoint Test G: The Defrost System is Inoperative

Refer to Wiring Diagrams Cell 56 , Heated Window for schematic and connector information.

Normal Operation

Under normal operation, the rear window defrost relay receives power from the Battery Junction Box (BJB) through circuit SBB15 (WH/RD).

For vehicles equipped with HVAC module, when the rear window defrost switch is depressed, a message is sent to the Smart Junction Box (SJB) through the Controller Area Network (CAN). When the SJB receives a rear window defrost ON message through the CAN , the SJB starts an internal 10 minute timer and grounds the rear window defrost relay coil, which activates the rear window defrost relay. When the rear window defrost relay is active, power is sent to the rear window defrost grid through circuit CRD06 (BN/YE). The rear window defrost grid is grounded to the chassis through circuit GD150 (BK/WH).

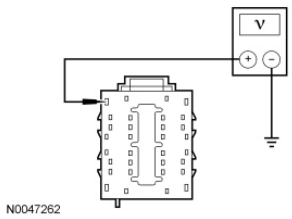
For vehicles equipped with manual climate control assembly, when the rear window defrost switch is depressed, a ground signal is sent to the SJB through circuit CRD09 (BU/GY). When the SJB receives ground through circuit CRD09 (BU/GY), the SJB starts an internal 10 minute timer and grounds the rear window defrost relay coil, which activates the rear window defrost relay. When the rear window defrost relay is active, power is sent to the rear window defrost grid through circuit CRD06 (BN/YE). The rear window defrost grid is grounded to the chassis through circuit GD150 (BK/WH).

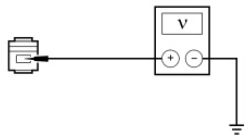
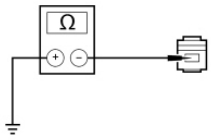
- DTC B1347 Heated Backlite Relay Circuit Failure - Open or short to ground in rear window defrost relay coil circuit.

This pinpoint test is intended to diagnose the following:
- Fuse
- Inoperative rear window defrost relay
- Wiring, terminals or connectors
- Inoperative SJB
- Inoperative HVAC module or manual climate control assembly

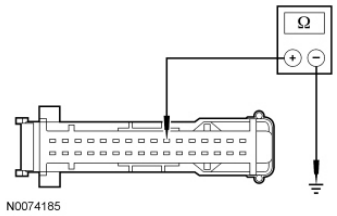
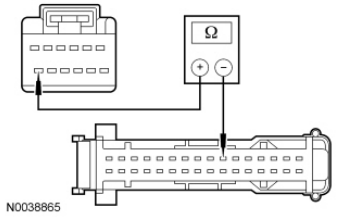
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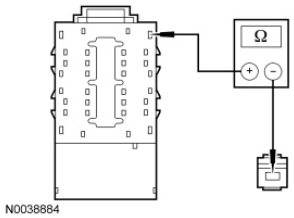
PINPOINT TEST G: THE DEFROST SYSTEM IS INOPERATIVE

Test Step	Result / Action to Take
G1 RETRIEVE THE DTCs	
• Carry out the SJB continuous and on-demand self tests. • **Are any DTCs present?**	**Yes** If DTC U0164 is present, REFER to Section 418-00 to diagnose no response from the HVAC module. If DTC B1347 is present, CARRY OUT the rear window defrost relay component test. Refer to Wiring Diagrams Cell 149 for component testing. If the rear window defrost relay is OK, GO to G2 . If the rear window defrost relay is not OK, INSTALL a new rear window defrost relay. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. For all other DTCs, REFER to the Smart Junction Box (SJB) DTC Chart. **No** If no DTCs are present, GO to G3 .
G2 CHECK CIRCUIT SBB15 (WH/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280E. • Ignition ON. • Measure the voltage between SJB C2280E-29, circuit SBB15 (WH/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 for removal and installation procedures. TEST the system for normal operation. **No** VERIFY SJB fuse 15 (40A) is OK, If OK, REPAIR circuit SBB15 (WH/RD) for an open. CLEAR the DTCs. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
G3 CHECK THE REAR WINDOW DEFROST GRID VOLTAGE	

• Disconnect: Rear Window Defrost Grid C402A. • Start the engine. • Turn the rear window defrost ON. • Measure the voltage between rear window defrost grid C402A-1, circuit CRD06 (BN/YE), harness side and ground.  A0010207 • **Is the voltage greater than 10 volts?**	**Yes** GO to G4 . **No** GO to G5 .
G4 CHECK THE REAR WINDOW DEFROST GRID GROUND	
• Ignition OFF. • Disconnect: Rear Window Defrost Grid C402B. • Measure the resistance between rear window defrost grid C402B-1, circuit GD150 (BK/WH), harness side and ground.  A0010216 • **Is the resistance less than 5 ohms?**	**Yes** CARRY OUT the Grid Wire Component Test in this section. REPAIR the rear window defrost grid or INSTALL a new liftgate glass as necessary. REFER to Window Grid Wire Repair or Window Glass - Liftgate in this section. CLEAR the DTCs. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
G5 CHECK THE REAR WINDOW DEFROST RELAY	
• Ignition OFF. • Disconnect: Rear Window Defrost Relay. • Carry out the rear window defrost relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the rear window defrost relay pass the component test?**	**Yes** For vehicles equipped with HVAC module, GO to G7 . For vehicles equipped with manual climate control assembly, GO to G6 . **No** INSTALL a new rear window defrost relay. CLEAR the DTCs. TEST the system for normal operation.
G6 CHECK CIRCUIT CRD09 (BU/GY) INPUT TO SJB MODULE	

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• Disconnect: SJB C2280D. • Ignition ON. • Monitor the resistance between SJB C2280D-7, circuit CRD09 (BU/GY), harness side and ground while activating and deactivating the rear window defrost switch.  N0074185 • **Is the resistance less than 30 ohms when the rear defrost switch is activated; and greater than 10,000 ohms when the rear window defrost switch is deactivated?**	**Yes** GO to G9 . **No** GO to G8 .
G7 CHECK THE REAR WINDOW DEFROST SWITCH PID CC_RDEF	
• Connect: Rear Window Defrost Relay. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - HVAC Module. • Monitor the HVAC module PID CC_RDEF while activating the rear window defrost ON and OFF. • **Does the PID agree with the rear window defrost switch status?**	**Yes** GO to G9 . **No** INSTALL a new HVAC module. REFER to Section 412-01 . CLEAR the DTCs. TEST the system for normal operation.
G8 CHECK CIRCUIT CRD09 (BU/GY) FOR AN OPEN	
• Ignition OFF. • Disconnect: C294C. • Measure the resistance between C294C-12, circuit CRD09 (BU/GY), harness side and SJB C2280D-7, circuit CRD09 (BU/GY), harness side.  N0038865 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new manual climate control assembly. CLEAR the DTCs. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

G9 CHECK CIRCUIT CRD06 (BN/YE) FOR AN OPEN	
• Disconnect: SJB C2280A. • Measure the resistance between SJB C2280A-32, circuit CRD06 (BN/YE), harness side rear window defrost grid C402A, circuit CRD06 (BN/YE), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to G10 . **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
G10 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all SJB connectors and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 for removal and installation procedures. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test H: The Defrost System Does Not Shut Off Automatically

Refer to Wiring Diagrams Cell 56 , Heated Window for schematic and connector information.

Normal Operation

Under normal operation, the rear window defrost relay receives power from the Battery Junction Box (BJB) through circuit SBB15 (WH/RD).

For vehicles equipped with HVAC module, when the rear window defrost switch is depressed, a message is sent to the Smart Junction Box (SJB) through the Controller Area Network (CAN). When the SJB receives a rear window defrost ON message through the CAN , the SJB starts an internal 10 minute timer and grounds the rear window defrost relay coil, which activates the rear window defrost relay. When the rear window defrost relay is active, power is sent to the rear window defrost grid through circuit CRD06 (BN/YE). The rear window defrost grid is grounded to the chassis through circuit GD150 (BK/WH).

For vehicles equipped with manual climate control assembly, when the rear window defrost switch is depressed, a ground signal is sent to the SJB through circuit CRD09 (BU/GY). When the SJB receives ground through circuit CRD09 (BU/GY), the SJB starts an internal 10 minute timer and grounds the rear window defrost relay coil, which activates the rear window defrost relay. When the rear window defrost relay is active,

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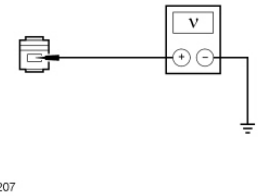
power is sent to the rear window defrost grid through circuit CRD06 (BN/YE). The rear window defrost grid is grounded to the chassis through circuit GD150 (BK/WH).

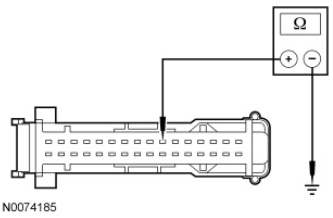
- DTC B1345 (Heated Backlite Input Circuit Short To Ground) - Short to ground detected on relay control circuit.

This pinpoint test is intended to diagnose the following:

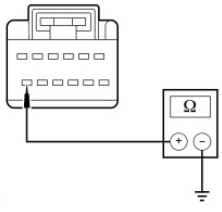
- Inoperative rear window defrost relay
- Wiring, terminals or connectors
- Inoperative SJB
- Inoperative HVAC module or manual climate control assembly

PINPOINT TEST H: THE DEFROST SYSTEM DOES NOT SHUT OFF AUTOMATICALLY

Test Step	Result / Action to Take
H1 RETRIEVE THE DTCs	
• Carry out the SJB continuous and on-demand self tests. • **Are any DTCs present?**	**Yes** If DTC B1345 is present, GO to H3 . For all other DTCs, REFER to the Smart Junction Box (SJB) DTC Chart. **No** If no DTCs are present, GO to H2 .
H2 CHECK CIRCUIT CRD06 (BN/YE) FOR A SHORT TO VOLTAGE	
• Disconnect: Rear Window Defrost Relay. • Disconnect: Rear Window Defrost Grid C402A. • Start the engine. • Measure the voltage between rear window defrost grid C402A-1, circuit CRD06 (BN/YE), harness side and ground.  A0010207 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. **No** GO to H3 .
H3 CHECK THE REAR WINDOW DEFROST RELAY	
• Ignition OFF. • Disconnect: Rear Window Defrost Relay. • Carry out the rear window defrost relay component test.	**Yes** For vehicles equipped with HVAC module, GO to H4 . For vehicles equipped with manual climate control assembly, GO to H5 .

Refer to Wiring Diagrams Cell 149 for component testing. • **Did the rear window defrost relay pass the component test?**	**No** INSTALL a new rear window defrost relay. CLEAR the DTCs. TEST the system for normal operation.
H4 CHECK THE REAR WINDOW DEFROST SWITCH PID CC_RDEF	
• Connect: Rear Window Defrost Relay. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - HVAC Module. • Monitor the HVAC module PID CC_RDEF while activating the rear window defrost switch ON and OFF. • **Does the PID agree with the rear window defrost switch status?**	**Yes** GO to H7 . **No** INSTALL a new HVAC module. REFER to Section 412-01 for removal and installation procedures. CLEAR the DTCs. TEST the system for normal operation.
H5 CHECK CIRCUIT CRD09 (BU/GY) INPUT TO SJB MODULE	
• Disconnect: SJB C2280D. • Ignition ON. • Monitor the resistance between SJB C2280D-7, circuit CRD09 (BU/GY), harness side and ground while activating and deactivating the rear window defrost switch.  N0074185 • **Is the resistance less than 30 ohms when the rear defrost switch is activated; and greater than 10,000 ohms when the rear window defrost switch is deactivated?**	**Yes** GO to H7 . **No** GO to H6 .
H6 CHECK CIRCUIT CRD09 (BU/GY) FOR A SHORT TO GROUND	
• Disconnect: Manual Climate Control Assembly C294C. • Measure the resistance between manual climate control assembly C294C-12, circuit CRD09 (BU/GY), harness side and ground.	**Yes** INSTALL a new manual climate control assembly. REFER to Section 412-01 for removal and installation procedures. CLEAR the DTCs. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

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 • **Is the resistance greater than 10,000 ohms?**	
H7 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all SJB connectors and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 for removal and installation procedures. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test I: The Delayed Accessory is Inoperative

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

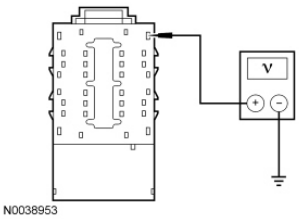
The accessory delay relay is located in the Smart Junction Box (SJB), and the relay coil receives battery voltage through circuit SBB01 (RD) at all times. When the ignition key is turned to the ON position, the SJB activates the accessory delay relay by grounding the relay coil. When the accessory delay relay is active, voltage is provided to the LH front window control switch through circuit CBP80 (YE/GN). When the ignition key is turned to the OFF position, the SJB continues to ground the accessory delay relay coil for approximately 10 minutes, or until a door is opened.

- DTC B1302 (Accessory Delay Relay Coil Circuit Failure) - Open or short to ground in coil circuit.

This pinpoint test is intended to diagnose the following:
- Fuse
- Accessory delay relay
- Wiring, terminals or connectors
- SJB

PINPOINT TEST I: THE DELAYED ACCESSORY IS INOPERATIVE

Test Step	Result / Action to Take
I1 CHECK FOR CORRECT OPERATION OF THE DOOR AJAR SWITCHES	
• Open and close the LH and RH front doors. Verify the interior lights turn on when the doors are open,	**Yes** GO to I2 .

and off when the doors are closed. • **Do the interior lights operate correctly?**	**No** REFER to Section 417-02 to diagnose the interior lighting and door ajar switches.
I2 CHECK THE ACCESSORY DELAY RELAY	
• Ignition OFF. • Disconnect: Accessory Delay Relay. • Carry out the accessory delay relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the accessory delay relay pass the component test?**	**Yes** GO to I3 . **No** INSTALL a new accessory delay relay. CLEAR the DTCs. TEST the system for normal operation.
I3 CHECK CIRCUIT SBB01 (RD) FOR VOLTAGE	
• Disconnect: SJB C2280E. • Measure the voltage between SJB C2280E-32, circuit SBB01 (RD), harness side and ground  • **Is the voltage greater than 10 volts?**	**Yes** GO to I4 . **No** VERIFY Battery Junction Box (BJB) fuse 1 (50A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes or the circuit short. REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
I4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all SJB connectors and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 for removal and installation procedures. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test J: The Delayed Accessory Relay Does Not Turn Off

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

The accessory delay relay is located in the Smart Junction Box (SJB), and the relay coil receives battery voltage through circuit SBB01 (RD) at all times. When the ignition key is turned to the ON position, the SJB

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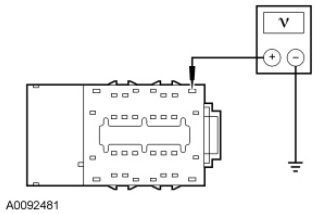
activates the accessory delay relay by grounding the relay coil. When the accessory delay relay is active, voltage is provided to the LH front window control switch through circuit CBP80 (YE/GN). When the ignition key is turned to the OFF position, the SJB continues to ground the accessory delay relay coil for approximately 10 minutes, or until a door is opened.

- DTC B1304 (Accessory Delay Relay Coil Circuit Short To Battery) - Short to battery detected in the relay control circuit.

This pinpoint test is intended to diagnose the following:
- Accessory delay relay
- Wiring, terminals or connectors
- SJB

PINPOINT TEST J: THE DELAYED ACCESSORY RELAY DOES NOT TURN OFF

Test Step	Result / Action to Take
J1 CHECK FOR STUCK/STICKING ACCESSORY DELAY RELAY	
• Disconnect: Accessory Delay Relay. • Ignition ON. • Attempt to operate the power windows. • **Do the power windows still operate?**	**Yes** GO to J3 . **No** GO to J2 .
J2 CHECK THE ACCESSORY DELAY RELAY	
• Ignition OFF. • Carry out the accessory delay relay component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the accessory delay relay pass the component test?**	**Yes** GO to J4 . **No** INSTALL a new accessory delay relay. CLEAR the DTCs. TEST the system for normal operation.
J3 CHECK CIRCUIT CBP80 (YE/GN) FOR A SHORT TO POWER	
• Disconnect: SJB C2280A. • Ignition ON. • Measure the voltage between SJB C2280A-29, circuit CBP80 (YE/GN), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. **No** GO to J4 .

 • **Is any voltage present?**	
J4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all SJB connectors and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 for removal and installation procedures. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test K: The Power Rear Window is Inoperative

Refer to Wiring Diagrams Cell 100 , Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the power rear window motor receives voltage at all times through circuit SBB10 (YE/RD). When the accessory delay relay is active, voltage is sent to the power rear window motor microprocessor and rear window control switch (part of the overhead console switch assembly) through circuit CBP05 (YE). The power rear window motor is grounded through circuit GD148 (BK/YE). The power rear window motor receives a voltage input signal from the rear window control switch through circuit CPW58 (YE/OG) to operate the rear window downward; and through CPW59 (VT/BN) to operate the rear window upward. Ground is provided to the rear window control switch through circuit GD133 (BK).

This pinpoint test is intended to diagnose the following:

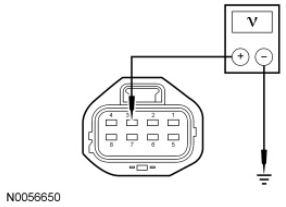
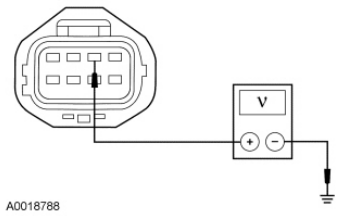
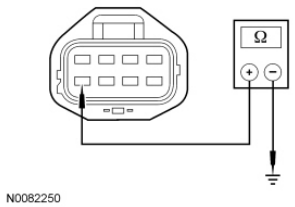
- Fuse(s)
- Wiring, terminals or connectors
- Power rear window control switch
- Power rear window motor
- Rear window regulator

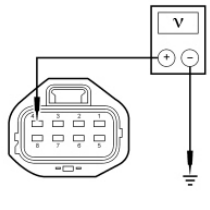
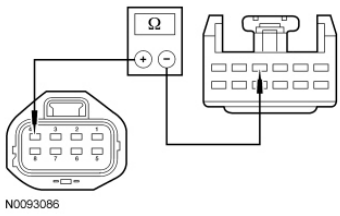
PINPOINT TEST K: THE POWER REAR WINDOW IS INOPERATIVE

NOTE: The initialization procedure must be carried out when repairs are carried out on any part of the power rear window system including when the power rear window motor is removed from the window regulator drum housing, a new power rear motor is installed, a new power rear window regulator is installed, a new power rear window glass module is installed and any operation in which grease or lubricants are applied to the power rear window system.

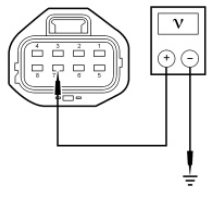
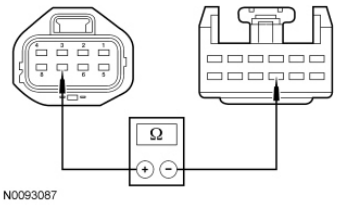
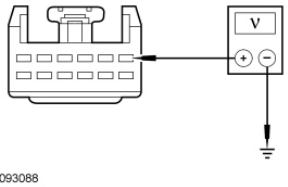
Test Step	Result / Action to Take

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K1 CHECK CIRCUIT SBB10 (YE/RD) FOR VOLTAGE	
• Disconnect: Rear Window Motor C351. • Measure the voltage between power rear window motor C351-3, circuit SBB10 (YE/RD), harness side and ground.  N0056650 • **Is the voltage greater than 10 volts?**	**Yes** GO to K2 . **No** VERIFY Battery Junction Box (BJB) fuse 10 (20A) is OK. If OK, REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation.
K2 CHECK CIRCUIT CBP05 (YE) FOR VOLTAGE	
• Ignition ON. • Measure the voltage between power rear window regulator motor C351-2, circuit CBP05 (YE), harness side and ground.  A0018788 • **Is the voltage greater than 10 volts?**	**Yes** GO to K3 . **No** VERIFY Smart Junction Box (SJB) fuse 5 (5A) is OK. If OK, REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation.
K3 CHECK THE POWER REAR WINDOW MOTOR GROUND	
• Ignition OFF. • Measure the resistance between power rear window motor C351-8, circuit GD148 (BK/YE), harness side and ground.  N0082250	**Yes** GO to K4 . **No** REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation.

• **Is the resistance less than 5 ohms?**	
K4 CHECK CIRCUIT CPW58 (YE/OG) FOR VOLTAGE	
• Ignition ON. • While pressing the power rear window control switch, measure the voltage between power rear window motor C351-4, circuit CPW58 (YE/OG), harness side and ground.  N0056645 • **Is the voltage greater than 10 volts?**	**Yes** GO to K6 . **No** GO to K5 .
K5 ISOLATE OPEN IN CIRCUIT CPW58 (YE/OG)	
• Ignition OFF. • Disconnect: Rear Window Control Switch C912. • Measure the resistance between power rear window motor C351-4, circuit CPW58 (YE/OG), harness side and power rear window control switch C912-4, circuit CPW58 (YE/OG), harness side.  N0093086 • **Is the resistance less than 5 ohms?**	**Yes** GO to K8 . **No** REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation.
K6 CHECK CIRCUIT CPW59 (VT/BN) FOR VOLTAGE	
• While pulling the power rear window control switch, measure the voltage between power rear window motor C351-7, circuit CPW59 (VT/BN), harness side and ground.	**Yes** INSTALL a new power rear window motor. REFER to Window Regulator Motor - Rear in this section. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation. **No** GO to K7 .

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 N0056647 • **Is the voltage greater than 10 volts?**	
K7 ISOLATE OPEN IN CIRCUIT CPW59 (VT/BN)	
• Ignition OFF. • Disconnect: Rear Window Control Switch C912. • Measure the resistance between power rear window motor C351-7, circuit CPW59 (VT/BN), harness side and power rear window control switch C912-9, circuit CPW59 (VT/BN), harness side.  N0093087 • **Is the resistance less than 5 ohms?**	**Yes** GO to K8 . **No** REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation.
K8 CHECK CIRCUIT CBP05 (YE) FOR VOLTAGE AT THE REAR WINDOW CONTROL SWITCH	
• Ignition ON. • Measure the voltage between power rear window control switch C912-1, circuit CBP05 (YE), harness side and ground.  N0093088 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new power rear window control switch. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation. **No** REPAIR the circuit. INITIALIZE the power rear window motor. REFER to Window Motor Initialization - Rear in this section. TEST the system for normal operation.

Component Test

Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the wire grid from the exterior. A broken grid wire will appear as a brown spot.

2. Run the engine at idle. Set the heated rear window switch to ON. The indicator light should come on.

3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window positive lead to battery side and the negative lead to ground side. The meter should read 10-13 volts. A lower voltage reading indicates a loose ground connection.

4. Contact a good ground point with the negative lead of the meter. The voltage reading should not change.

5. With the negative lead of the meter grounded, touch each grid line of the heated rear window glass at its midpoint with the positive lead. A reading of approximately 6 volts indicates the line is good. A reading of 0 volt indicates the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates the circuit is broken between the midpoint of the grid line and ground.

6. Pinpointing the exact position of the break can be accomplished (if the voltmeter reads 0 volt when the midpoint of the grid line is touched with the positive lead of the voltmeter) by moving the positive lead of the voltmeter toward the B+ side of the grid line and touching the grid line until the voltmeter reads 12 volts. If the voltmeter reads 12 volts when the midpoint of the grid line is touched with the positive lead of the voltmeter, simply move the positive lead of the voltmeter toward the ground connection of the grid line and touch the grid line until the voltmeter reads 0 volt.

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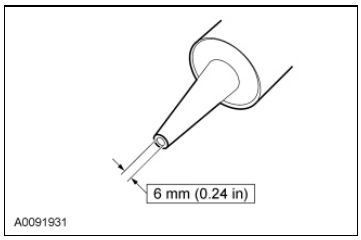
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Glass Reseal - Windshield

Material

Item	Specification
Dow Urethane Adhesive BetasealTM Express	-
Sika Urethane Adhesive Sika Tack ASAP	-
Motorcraft® Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Remove the RH and LH side A-pillar trim panel. For additional information, refer to Section 501-05 .
2. Remove the sun visors, retainers and, if equipped, the overhead console. For additional information, refer to Section 501-12 .
3. If equipped, remove the roof opening panel trim.
4. Remove the interior mirror. For additional information, refer to Section 501-09 .
5. Lower the front portion of the headliner.
6. Remove the cowl panel grille. For additional information, refer to Section 501-02 .
7. Clean the edge formed by the existing urethane adhesive and the glass on the inside at the top, sides and outside on the bottom of the windshield with glass cleaner.
8. Cut the urethane adhesive applicator tip to specification.



9. **NOTE:** Use either a high-ratio electric or battery-operated caulk gun that will apply the urethane adhesive with less effort and a continuous bead.

   NOTE: Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

   Apply a bead of urethane adhesive over the top of the existing urethane adhesive.

   - Apply the urethane adhesive to the top and sides of the windshield glass from the interior of the vehicle.

- Apply the urethane adhesive to the bottom of the windshield glass from the exterior of the vehicle.

10. **NOTE:** The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.

    After the urethane adhesive has cured, check the windshield seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.

11. Install the cowl panel grille. For additional information, refer to Section 501-05 .

12. Raise the front portion of the headliner.

13. Install the interior mirror. For additional information, refer to Section 501-09 .

14. Install the sun visors, retainers and, if equipped, the overhead console. For additional information, refer to Section 501-12 .

15. If equipped, install the roof opening panel trim.

16. Install the RH and LH side A-pillar trim panels. For additional information, refer to Section 501-05 .

17. Clean the exterior and interior of the windshield glass with glass cleaner.

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Window Motor Initialization - Front

NOTE: Initialization is required to learn both the full UP and full DOWN positions and the profile of the glass as it travels through the glass channel. Once initialized, obstacle detection is enabled.

NOTE: The front window motor must be de-initialized, then initialized whenever the LH front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

NOTE: A new (original factory setting) or de-initialized LH front window motor will not operate in one-touch up or one-touch down mode until initialized. If a new LH front window motor has been installed, proceed to the initialization procedure.

NOTE: If diagnosing a LH front window switch problem, perform the window initialization procedure before replacing the window switch.

NOTE: All LH front window components (window glass, window regulator, window motor, seals and glass top run) must be installed and tightened to specification before carrying out the initialization procedure.

NOTE: Excessive bounce-back (window reverses direction with no obstructions present) may indicate that a de-initialization procedure may need to be performed.

De-initialization procedure

NOTE: The LH front window motor must be reset to its original factory settings first, then perform the following de-initialization procedure.

1. Hold the LH front door open.
2. **NOTE:** Steps 2 and 3 must be performed within 8 seconds.

   Cycle the ignition key from OFF and back to ON 5 times.
3. **NOTE:** The glass will stop moving after a short distance during this step.

   Press the LH front window control switch to the one-touch DOWN position (second detent) and release.
4. Verify that the LH front window does not operate in one-touch up or one-touch down modes. If the window still performs one-touch up/down operations, carefully repeat this procedure.

Initialization procedure

⚠ WARNING: Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.

NOTE: The LH front window must be in the full OPEN position for this procedure to operate correctly.

NOTE: If the initialization procedure is only partially completed, the LH front window motor will remain de-initialized and will not operate in one-touch up or one-touch down mode.

5. Hold the LH front door open.

6. Cycle the ignition key from OFF and back to ON 5 times.

7. Press and hold the LH front window control switch until the window glass stalls for one second at the bottom of its travel and release the switch.

8. **NOTE:** If this operation is interrupted at any time before the window glass stalls into the glass top run, repeat Steps 6 through 8.

   Pull and hold the LH front window control switch until the window glass stalls for one second into the glass top run and release the switch.

9. Test the LH front window for correct operation by carrying out the one-touch-up and one-touch-down features.

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Window Motor Initialization - Rear

⚠ WARNING: Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.

NOTE: The rear window motor is in error mode when shipped and will be inoperative until initialized.

NOTE: This procedure must be carried out when repairs are performed on any part of the power rear window system including when: the power rear window motor is removed from the window regulator drum housing, a new power rear motor is installed, a new power rear window regulator is installed, a new power rear window glass module is installed, and any operation in which grease or lubricants are applied to the power rear window system.

NOTE: All power rear window components (window glass module, window regulator, window motor and glass runs) must be installed and tightened to specification before carrying out this procedure.

1. Open the driver door. The door must remain open through the entire procedure.

2. Insert the key into the ignition and cycle to the RUN position 5 times, ending in the RUN position.

3. **NOTE:** When performing this step, movement of the rear window may not be seen, but the rear window motor will be active.

   Depress and hold the power rear window control switch in the down position for 3 seconds and then release.

4. **NOTE:** If the rear window does not operate when performing this step, repeat steps 1,2 and 3.

   Depress and hold the power rear window control switch in the down position for 3 seconds after the rear window stalls in the full down position.

5. Depress and hold the power rear window control switch in the up position for 3 seconds after the rear window stalls in the full up position.

6. Verify correct operation of the power rear window by moving the window to the VENT, fully OPEN and fully CLOSED positions. If the window does not operate correctly, carefully repeat this procedure.

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Window Grid Wire Repair

General Equipment

Polypropylene Film Fine Line Tape (Commercially available)

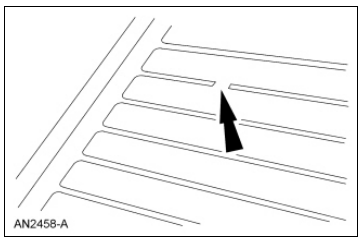
Material

Item	Specification
Motorcraft® Lacquer Touch-Up Paint (match color to exterior grid wire) PMP-19500-XXXXX	ESR-M2P100-C
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	-
Motorcraft® Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

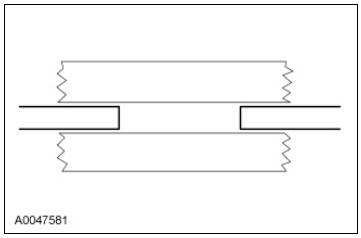
NOTE: The grid line material is not embedded into the glass, but is baked to the glass surface and consequently can be scraped off. An undamaged grid line will have small ridges that project above the surface of the glass and can easily be felt when running a fingernail across them. Grid lines that have been "razor bladed" will feel smooth when a fingernail is dragged across the affected area. Inoperative lines may appear to the eye to be undamaged due to residue remaining on the glass and will require diagnosis with a voltmeter or 12V test lamp. For additional information, refer to Diagnosis and Testing in this section.

1. Bring the vehicle up to a room temperature of at least 16°C (60°F) or above.
2. ***NOTICE:*** **Do not use scrapers, sharp instruments or abrasive window cleaners on the interior surface of the rear window glass as this may cause damage to the grid lines.**

   Clean the entire grid line repair area with glass cleaner and 0000 steel wool to remove all dirt, wax, grease, oil or other foreign material.
3. Mark the location of the grid break on the exterior of the rear window glass.



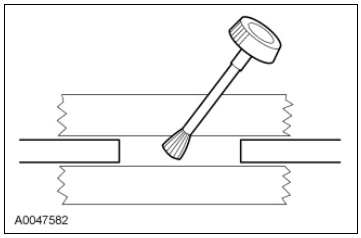
4. Using a polypropylene film fine line tape, mask the area directly above and below the grid break extending the tape 26 mm (1.02 in) beyond the concern area in both directions. The break area should be at the center of the mask.



5. **NOTE:** If the brown layer is not broken or missing, apply only the silver grid repair compound to the break. If both the brown and silver layers of the grid are broken or missing, apply a coating of the lacquer touch up paint across the break in the grid line prior to applying the rear window defroster repair compound. Do not overlap the silver grid line with the paint. Several applications may be necessary to achieve a color match.

   NOTE: Allow at least 5 minutes of drying time between applications for the touch up paint or the silver repair coating. Applying fewer coats or not allowing adequate drying time between coats will produce repaired resistance that is greater than OEM resistance, resulting in poor defrost performance and excessive localized heating.

   Apply the repair coating to the grid break area in several smooth, continuous strokes. Extend the silver repair coating at least 6.35 mm (0.25 in) on both sides of the break area.
   Apply a minimum of 6 applications of the grid repair compound.



6. **NOTE:** The repair coating air-dries in approximately one minute and can be energized after 5 minutes. Optimum adhesion occurs after approximately 24 hours.

   Allow the repair area to dry completely and remove the mask.

7. ***NOTICE:*** **Be careful not to damage the grid line with the razor blade. If this occurs, additional repair may be necessary.**

   Remove any excess repair compound above or below the grid line with a razor blade.

8. **NOTE:** The interior side of the grid lines are not painted, but due to the silver tarnishing will tend to change the grid to a gold or brown color. The repair area will be bright silver and will also tarnish over time to match the rest of the grid.

   Test the system for normal operation.

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Lead Terminal Repair

General Equipment

Defroster Connector 7L2Z-14421-A

Material

Item	Specification
Motorcraft® Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Bring the vehicle up to room temperature of at least 16°C (60°F) or above.

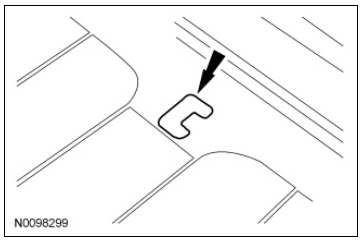
2. **NOTE:** The new terminal will cover the original terminal location, but it must be placed so that the terminal conductive areas will be placed on a good conductive base.

   Clean the bus bar in the area to be repaired with steel wool (000 to 0000 grade), and then with glass cleaner to remove all dirt, wax, grease, oil or other foreign material.

3. ***NOTICE:*** **Do not use any type of flame torch or flame-heated soldering gun for this procedure. Use of these tools provide inadequate heat generation at the tip and the exhaust heat can cause damage to plastic trim parts in the area. Use only an electric soldering gun with 100 watts or more of power. Before using the soldering gun, be sure to melt a small amount of rosin core solder to the tip. The solder will assist in achieving better heat transfer from the soldering gun tip to the new terminal.**

   NOTE: Depending on the original terminal location, and whether the terminal is covered by pillar trim, will determine where to locate the new terminal. Some grid line bus bars may only allow the placement of the terminal above or below the original tab location due to space limitations. For most vehicle applications, the replacement tab location will cover the original tab location, but still allow the replacement tab to attach to the bus bar on good conductive material.

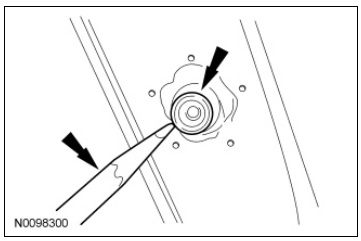
   Place the replacement terminal over the original tab location, making sure the conductive areas of the terminal will be on a good conductive area. Do not place the terminal tab foot on the original location, which does not have conductive material.



4. Hold the terminal in place with an item such as a regular lead pencil at a 90 degree angle from the terminal. (Holding at other than a 90 degree angle may allow the terminal to slip when the solder

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liquefies.)



5. **NOTE:** The new terminal has pre-applied solder and flux. When the proper temperature is achieved, the solder will liquefy.

   Place the soldering gun tip on the base of the terminal near the pre-applied solder areas of the tab. Energize the soldering gun and watch for the pre-applied area of the terminal to liquefy. The solder should liquefy in approximately 40-45 seconds after heating. As soon as the solder completely changes on either side of the terminal, de-energize the soldering gun and continue to hold the terminal in place with the soldering gun and pencil for an additional 30 seconds.

6. Remove the soldering gun and pencil from the terminal. The terminal should be allowed to cool for another 2 minutes before the wiring lead is attached to the terminal.

7. Attach the electrical lead connection to this terminal, turn on the heated rear window and verify the operation.

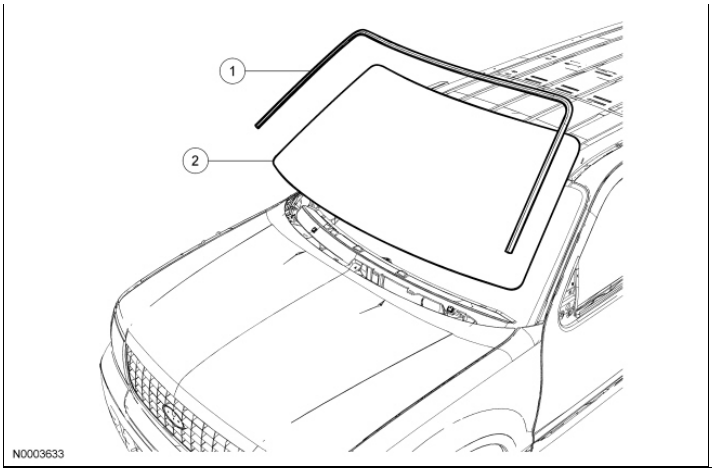
Windshield Glass

Special Tool(s)

 ST1320-A	Deluxe Windshield Removal Tool 164-R2450 or equivalent
 ST2085-A	The Pumper 164-R2459 or equivalent

Material

Item	Specification
Dow Urethane Adhesive BetasealTM Express	-
Dow Urethane One Step Glass Primer BetaprimeTM 5500 / 5500A / 5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Motorcraft® Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A



Item	Part Number	Description
1	03682	Windshield glass moulding
2	03100	Windshield glass

Removal

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1. Remove the RH and LH side A-pillar trim panels. For additional information, refer to Section 501-05 .

2. Remove the sun visors and retainers and, if equipped, the overhead console. For additional information, refer to Section 501-12 .

3. If equipped, remove the roof opening panel trim.

4. Remove the interior mirror. For additional information, refer to Section 501-09 .

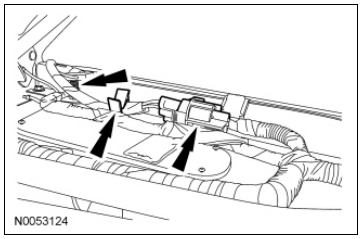
5. Lower the front portion of the headliner.

6. Remove the cowl panel grille. For additional information, refer to Section 501-02 .

7. **NOTE:** LH shown, RH similar.

   If equipped, disconnect the heated windshield electrical connectors.

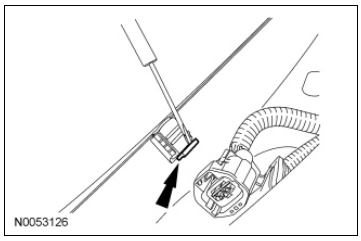
   - Disconnect the connector.
   - Remove the connector from the retainer.
   - Remove the connector from the stud.



8. **NOTE:** LH shown, RH similar.

   Lower the setting blocks.

   - Use a flat screwdriver to release the setting block and lower.



9. Before cutting the urethane adhesive, remove dirt and other foreign material from the windshield pinch weld area.
   - Use a clean shop towel or oil-free compressed air.

10. **⚠ WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

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

    NOTICE: **To avoid rust formation, use extreme care not to scratch the paint or primer or**

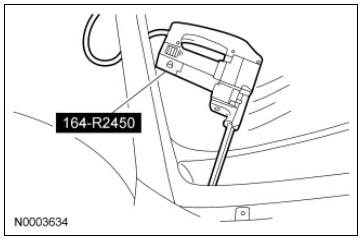
otherwise damage the pinch weld during glass removal.

NOTE: Insert the blade into the Deluxe Windshield Removal Tool so that the flat side is against the glass. This will leave the entire urethane adhesive bead on the pinch weld and allow a dry fit of the replacement windshield glass.

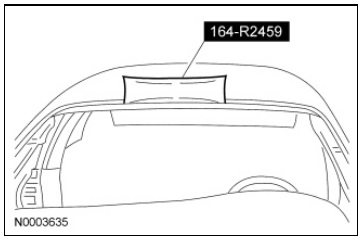
NOTE: Lubricate the urethane adhesive with water to aid the Deluxe Windshield Removal Tool when cutting the urethane adhesive.

NOTE: Support the windshield glass to prevent the glass from dropping while cutting the urethane adhesive.

Using the Deluxe Windshield Removal Tool, cut the urethane adhesive from the windshield glass starting at the upper center of the windshield glass and working toward the bottom corners.



11. Using The Pumper, distance the windshield from the body.



12. Using the Deluxe Windshield Removal Tool, cut the remaining urethane adhesive.

13. **NOTE:** Removing the windshield glass requires more than one technician.

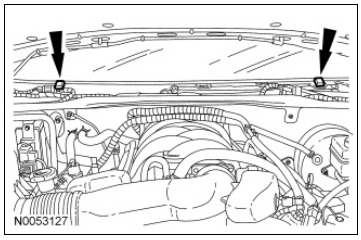
    NOTE: If reinstalling the windshield glass, tape the windshield at the windshield stops to aid in alignment of the glass during installation.

    Carefully remove the windshield glass from the vehicle and place on a stable work surface.

Installation

1. **NOTE:** Raise the setting block until flush with top. Lock the blocks into place after windshield is installed.

   Raise the setting blocks.



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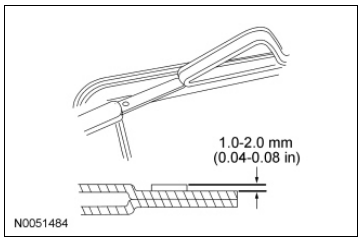
2. Dry-fit the new windshield glass on the existing urethane adhesive bead on the pinch weld.
    - Position the windshield glass on the pinch weld.
    - Center the windshield glass in the opening.
    - Make alignment marks with tape or non-staining grease pencil (preferably at the windshield glass setting blocks) on the windshield glass and the body.

3. After the dry-fit alignment, remove the glass assembly from the windshield opening and place on a stable work surface with the interior side of the glass facing upward.

4. ⚠ **WARNING: Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   NOTE: Avoid scratching the pinch weld. Repair all minor scratches or exposed metal on the pinch weld following manufacturer's instructions. Use the same brand pinchweld primer, glass primer and urethane adhesive.

   Using an appropriate tool, trim the urethane adhesive leaving a 1 mm to 2 mm (0.04 in to 0.08 in) base of original equipment urethane adhesive on the pinch weld.



5. Using a clean shop towel, brush or oil-free compressed air, clean the pinch weld area around the existing urethane adhesive. Remove any foreign material or water that may have entered during windshield removal.

6. If installing the original windshield glass, remove the excess urethane adhesive from the glass leaving a thin layer to bond with the new urethane adhesive bead.

7. **NOTE:** Inspect the flat foil connectors at the bottom of the new windshield for damage prior to installation. Do not install a windshield with damaged flat foil connectors.

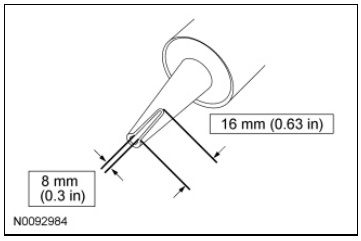
   Clean the inside of the new windshield glass with glass cleaner.

    - Make sure to thoroughly clean the surface of the blackened border area where the urethane adhesive will be applied.

8. **NOTE:** Be sure to use the same brand and cure-rate products for the urethane adhesive and glass primer. Do not mix different brands of urethane adhesive and glass primer. Refer to the Material Chart in this procedure.

   If installing a new windshield glass, apply glass primer according to manufacturer's instructions. Allow at least 6 minutes to dry.

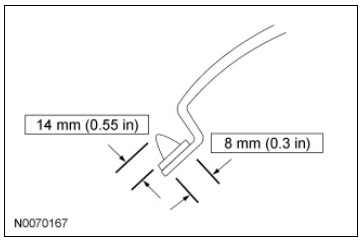
9. Cut the urethane adhesive applicator tip to specification.



10. **NOTE:** Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane adhesive with less effort and continuous bead.

    NOTE: The windshield glass must be positioned within 10 minutes of applying the urethane adhesive.

    Apply a uniform bead of urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld, starting and ending at the bottom of the windshield near the center, making sure there are no gaps in the bead.



11. ⚠ **WARNING: Do not drive vehicle until the urethane adhesive seal has cured. Follow urethane adhesive manufacturer's curing directions. Inadequate or incorrect curing of the urethane adhesive seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

    NOTICE: **Before positioning the windshield glass, open vehicle windows to prevent the air pressure of closing doors from affecting the urethane adhesive bond.**

    Using the alignment marks made previously, position the windshield glass on the pinch weld.

12. **NOTE:** The urethane adhesive must cure for a minimum of one hour before testing for air and water leaks.

    After the urethane adhesive has cured, check for water leaks and add urethane adhesive where needed.

13. **NOTE:** Follow the same routing for the electrical connector that was used during removal.

    If equipped, connect the heated windshield electrical connectors.

14. Install the cowl panel grille. For additional information, refer to Section 501-02 .

15. Raise the front portion of the headliner.

16. Install the interior mirror. For additional information, refer to Section 501-09 .

17. Install the sun visors, retainers and, if equipped, the overhead console. For additional information, refer to Section 501-12 .

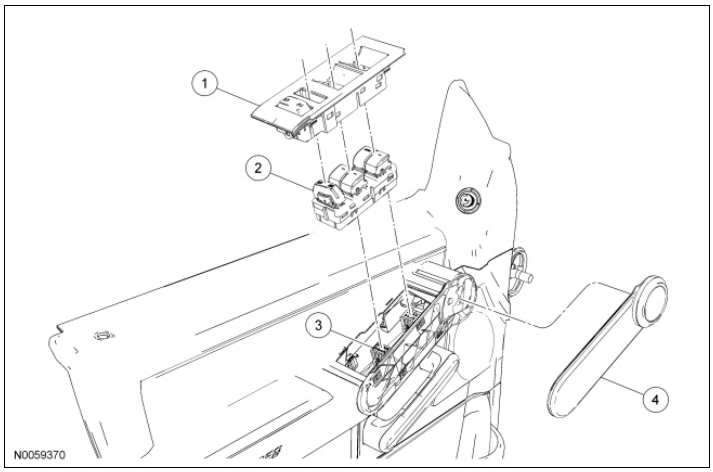
18. If equipped, install the roof opening panel trim.

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19. Install the RH and LH side A-pillar trim panels. For additional information, refer to Section 501-05 .

20. Clean the exterior and interior of the windshield glass with glass cleaner.

Window Control Switch



Item	Part Number	Description
1	14A464B	Window control switch bezel
2	14529	Window control switch
3	14524 RH/ 14525 LH	Window control switch electrical connectors
4	14A563 RH/ 14A564 LH	Interior door handle cover

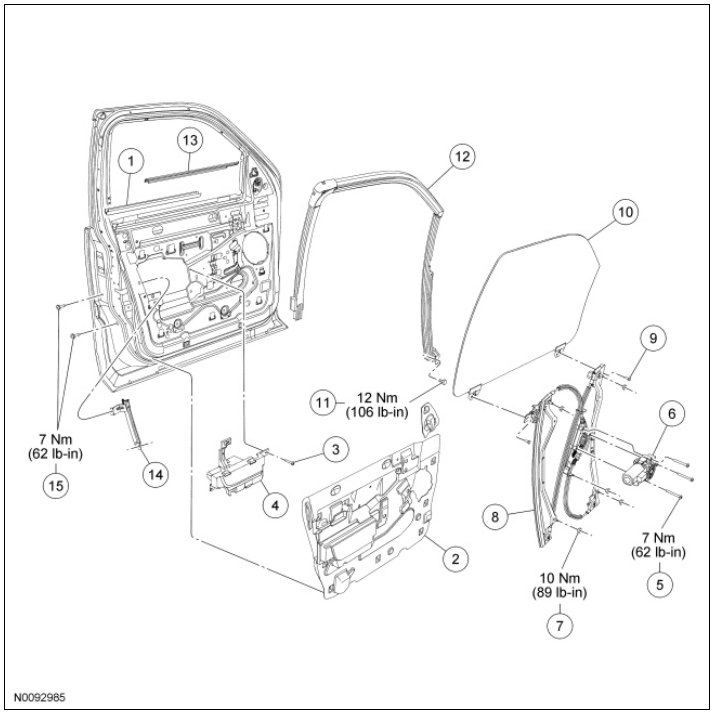
Removal and Installation

1. Remove the interior door handle cover.
2. Lift the window control switch bezel upward to release the clips.
3. Disconnect the window control switch electrical connectors from the window control switch.
4. Disconnect the window control switch from the window control switch bezel to remove.
5. To install, reverse the removal procedure.

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Glass, Frames and Mechanisms - Exploded View, Front Door

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	7821434 RH/ 7821435 LH	Interior moulding
2	78237A04 RH/ 78237A05 LH	Front door weather shield
3	-	Door trim panel reinforcement screw
4	7840380	Door trim panel reinforcement
5	-	Window regulator motor bolt (3 required)
6	7823394 RH/ 7823395 LH	Window regulator motor
7	W705817	Window regulator assembly nut (5 required)
8	7823200 RH/ 7823201 LH	Window regulator assembly (includes motor)
9	W707874	Front door window glass-to-regulator assembly rivet (2 required)
10	7821410 RH/ 7821411 LH	Front door window glass
11	W503923	Front door glass top run channel assembly bolt
12	7821596 RH/ 7821597 LH	Front door run channel assembly
13	7821452 RH/ 7821453 LH	Exterior moulding

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14	78222A00 RH/ 78222A01 LH	Front door glass run retainer
15	W710236	Front door glass run screws (2 required)

1. For additional information, refer to the procedures in this section.

Door Glass Top Run - Front

Removal and Installation

NOTE: For LH front only, the front window motor must be initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

1. Remove the front door window glass. For additional information, refer to Window Glass - Front Door in this section.

2. Remove the exterior moulding.

3. Remove the front door glass top run channel assembly bolt.
   - To install, tighten to 12 Nm (106 lb-in).

4. Remove the front door glass top run channel assembly through the top opening of the front door.

5. To install, reverse the removal procedure.
   - For LH front window only, initialize the LH front window motor. For additional information, refer to Window Motor Initialization - Front in this section.

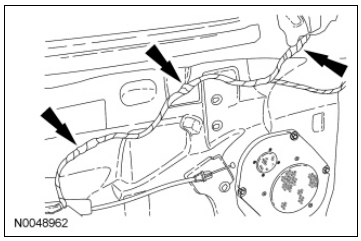
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Window Glass - Front Door

Removal and Installation

NOTE: For LH front only, the front window motor must be initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the front door speaker. For additional information, refer to Section 415-00 .
3. Remove the interior moulding.
4. Remove the exterior mirror front door weather shield.
5. Disconnect the exterior mirror electrical connector.
6. Release the 3 door wiring harness pin-type retainers.



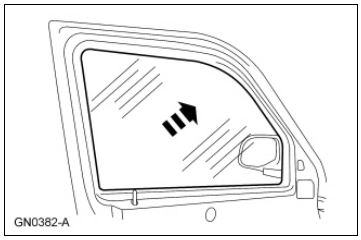
7. Remove the front door weather shield.
8. ***NOTICE:*** **Make sure the holes in the glass bracket do not become enlarged during the rivet removal process. Damage to the window regulator will occur if the holes become enlarged. The new rivets may become loose, resulting in a clicking noise concern.**

   NOTE: Use a 4.5 mm (0.1772 in) drill bit to drill out the glass-to-regulator rivets.

   Remove the 2 front door window glass-to-regulator rivets.

   - Position the front door window glass as necessary to access the front door window glass-to-regulator rivets.

9. Remove the front window glass.
   - Pull the glass out through the top inboard side of the door.



10. To install, reverse the removal procedure.
    - For LH front window only, initialize the LH front window motor. For additional information, refer to Window Motor Initialization - Front in this section.

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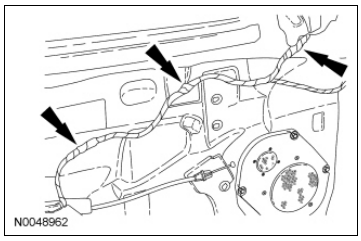
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Window Regulator - Front Door

Removal and Installation

NOTE: For LH front only, the front window motor must be initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the front door speaker. For additional information, refer to Section 415-00 .
3. Remove the exterior mirror front door weather shield.
4. Disconnect the exterior mirror electrical connector.
5. Release the 3 door wiring harness pin-type retainers.



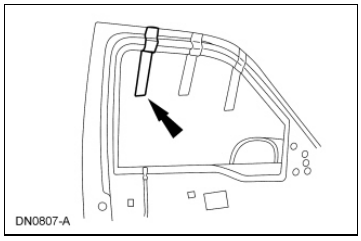
6. Remove the front door weather shield.
7. Remove the door trim panel reinforcement screw.
8. Remove the door trim panel reinforcement.
9. ***NOTICE:*** **Make sure the holes in the glass bracket do not become enlarged during the rivet removal process. Damage to the window regulator will occur if the holes become enlarged. The new rivets may become loose, resulting in a clicking noise concern.**

   NOTE: Use a 4.5 mm (0.1772 in) drill bit to drill out the glass-to-regulator rivets.

   Remove the 2 front door window glass-to-regulator rivets.

   - Position the front door window glass as necessary to access the front door window glass-to-regulator rivets.

10. Secure the front door glass in the full UP position with tape.



11. Disconnect the window regulator motor electrical connector.

12. Remove the 5 window regulator assembly nuts.
    - To install, tighten to 10 Nm (89 lb-in).

13. Remove the window regulator assembly.

14. To install, reverse the removal procedure.
    - For LH front window only, initialize the LH front window motor. For additional information, refer to Window Motor Initialization - Front in this section.

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Window Regulator Motor - Front Door

Removal and Installation

NOTE: For LH front only, the front window motor must be initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

1. Remove the front door window regulator. For additional information, refer to Window Regulator - Front Door in this section.

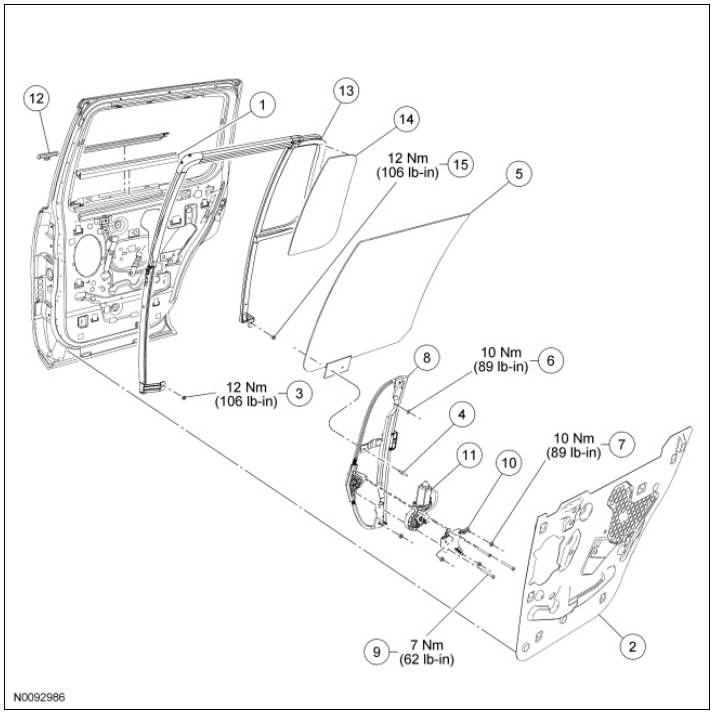
2. Remove the 3 front door window regulator motor bolts.
   - To install, tighten to 7 Nm (62 lb-in).

3. Remove the front door window regulator motor.

4. To install, reverse the removal procedure.
   - For LH front window only, initialize the LH front window motor. For additional information, refer to Window Motor Initialization - Front in this section.

Glass, Frames and Mechanisms - Exploded View, Rear Door

NOTE: Explorer shown, Explorer Sport Trac similar.



Item	Part Number	Description
1	7825860 RH/ 7825861 LH	Interior moulding
2	7827458 RH/ 7827459 LH	Rear door weather shield
3	W705817	Door below channel assembly nut
4	W705426	Rear door window glass-to-regulator assembly rivet
5	7826224 RH/ 7826225 LH	Rear door window glass
6	W705817	Window regulator nut (2 required)
7	W705817	Window regulator motor bracket nut (3 required)
8	7827000 RH/ 7827001 LH	Window regulator assembly (includes motor)
9	-	Window regulator motor bolt (3 required)
10	-	Window regulator motor bracket
11	7827144 RH/ 7827145 LH	Window regulator motor
12	7825596 RH/ 7825597 LH	Exterior moulding
13		Rear door glass top run channel assembly

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	7825766 RH/ 7825767 LH	
14	-	Fixed rear door glass (part of 7825766 RH/7825767 LH)
15	N800510	Rear door glass top run channel assembly bolt

1. For additional information, refer to the procedures in this section.

Window Glass - Fixed, Rear Door

Removal and Installation

1. Remove the rear door window glass. For additional information, refer to Window Glass - Rear Door in this section.
2. Remove the exterior moulding.
3. Remove the rear door glass top run channel assembly. For additional information, refer to Door Glass Top Run - Rear in this section.
4. To install, reverse the removal procedure.

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Door Glass Top Run - Rear

Removal and Installation

1. Remove the rear door window glass. For additional information, refer to Window Glass - Rear Door in this section.

2. Remove the exterior moulding.

3. Remove the rear door glass top run assembly bolt.
   - To install, tighten to 12 Nm (106 lb-in).

4. Remove the rear door glass top run channel assembly.
   - Remove the rear door glass top run channel assembly through the top opening of the rear door.

5. To install, reverse the removal procedure.

Window Glass - Rear Door

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .

2. Remove the rear door speaker. For additional information, refer to Section 415-00 .

3. Remove the interior moulding.

4. Remove the rear door weather shield.

5. Remove the rear door glass top run channel assembly bolt.
   - To install, tighten to 12 Nm (106 lb-in).

6. Remove the rear door below belt channel assembly nut.
   - To install, tighten to 12 Nm (106 lb-in).

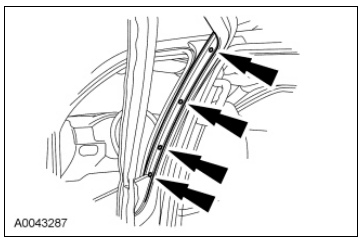
7. ***NOTICE:*** **Make sure the hole in the glass bracket does not become enlarged during the rivet removal process. Damage to the window regulator will occur if the hole becomes enlarged. The new rivet may become loose, resulting in a clicking noise concern.**

   NOTE: Use a 4.5 mm (0.1772 in) drill bit to drill out the glass-to-regulator rivets.

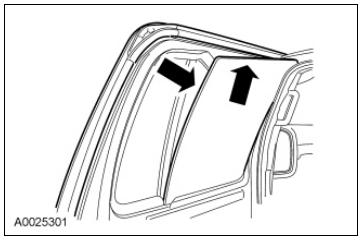
   Remove the rear door window glass-to-regulator rivet.

   - Position the rear door window glass as necessary to access the rear door window glass-to-regulator rivet.

8. Remove the applique on the rear door.
   - Remove the screws.



9. Remove the rear door window glass.
   - Pull the glass out through the top inboard side of the door.



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10. To install, reverse the removal procedure.

Window Regulator - Rear Door

Removal and Installation

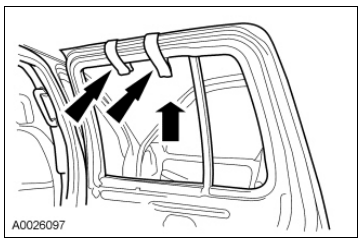
1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Remove the rear door speaker. For additional information, refer to Section 415-00 .
3. Remove the interior moulding.
4. Remove the rear door weather shield.
5. ***NOTICE:*** **Make sure the hole in the glass bracket does not become enlarged during the rivet removal process. Damage to the window regulator will occur if the hole becomes enlarged. The new rivet may become loose, resulting in a clicking noise concern.**

   NOTE: Use a 4.5 mm (0.1772 in) drill bit to drill out the glass-to-regulator rivets.

   Remove the rear door window glass-to-regulator rivet.

   - Position the rear door window glass as necessary to access the rear door window glass-to-regulator rivet.

6. Secure the rear door window glass in the full UP position with tape.



7. Disconnect the window regulator motor electrical connector.
8. Remove the 2 rear window regulator mounting nuts.
   - To install, tighten to 10 Nm (89 lb-in).
9. Remove the 3 window regulator motor bracket nuts.
   - To install, tighten to 10 Nm (89 lb-in).
10. Remove the window regulator assembly.
11. To install, reverse the removal procedure.

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Window Regulator Motor - Rear Door

Removal and Installation

1. Remove the interior moulding.

2. Remove the rear door trim panel and weather shield. For additional information, refer to Section 501-05 .

3. Remove the 3 window regulator motor bolts.
   - To install, tighten to 7 Nm (62 lb-in).

4. Remove the window regulator motor.

5. To install, reverse the removal procedure.

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Window Glass - Rear Quarter

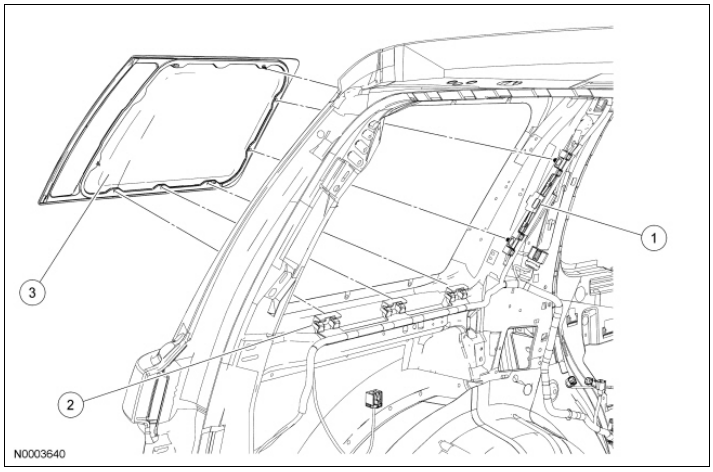
Special Tool(s)

 ST1320-A	Deluxe Windshield Removal Tool 164-R2450 or equivalent

Material

Item	Specification
Dow Urethane Adhesive BetasealTM Express	-
Dow Urethane One Step Glass Primer BetaprimeTM 5500 / 5500A / 5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Motorcraft® Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	-	Wiring harness bracket
2	-	Wiring harness bracket

3	29710	Rear quarter window glass

Removal

1. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .

2. Remove the wiring harness brackets.

3. Before cutting the urethane adhesive, remove dirt and other foreign material from the windshield pinch weld area.
   - Use a clean shop towel or oil-free compressed air.

4. **⚠ WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

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

   NOTICE: **To avoid rust formation, use extreme care not to scratch the paint or primer or otherwise damage the pinch weld during glass removal.**

   NOTE: Insert the blade into the Deluxe Windshield Removal Tool so that the flat side is against the glass. This will leave the entire urethane adhesive bead on the pinch weld and allow a dry fit of the replacement glass.

   NOTE: Lubricate the urethane adhesive with water to aid the Deluxe Windshield Removal Tool when cutting the urethane adhesive.

   NOTE: Locating tabs need to be cut through in order to remove the rear quarter window glass. The new rear quarter window glass will be equipped with new locating tabs.

   NOTE: Support the glass to prevent the glass from dropping while cutting the urethane adhesive.

   Using the Deluxe Windshield Removal Tool, cut the urethane adhesive from the quarter window glass starting at the upper center of the quarter window glass and working toward the bottom corners.

5. Using the Deluxe Windshield Removal Tool, cut the remaining urethane adhesive and carefully remove the quarter glass from the vehicle and place on a stable work surface.

Installation

1. Dry fit the rear quarter window glass in the window opening.
   - Position the quarter window glass on the pinch weld.
   - Center the quarter glass in the opening for best fit.
   - Make alignment marks with tape or non-staining grease pencil on the quarter window glass and the body.

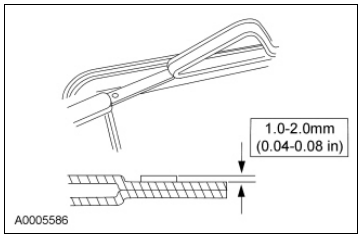
2. After the dry-fit alignment, remove the glass from the opening and place on a stable work surface with the interior side of the glass facing upward.

3. **⚠ WARNING: Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

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NOTE: Avoid scratching the pinch weld. Repair all minor scratches or exposed metal on the pinch weld following manufacturer's instructions. Use the same brand pinch weld primer, glass primer and urethane adhesive.

Using an appropriate tool, trim the urethane adhesive leaving a 1 mm to 2 mm (0.04 in to 0.08 in) base of original equipment urethane adhesive on the pinch weld.



4. Using a clean shop towel, brush or oil-free compressed air, clean the pinch weld area around the existing urethane adhesive. Remove any foreign material or water that may have entered during glass removal.

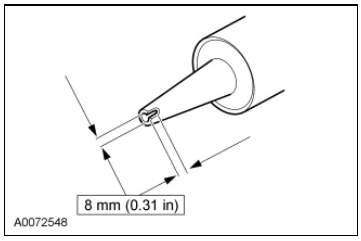
5. If reinstalling the original quarter window glass, remove the excess urethane adhesive from the glass leaving a thin layer to bond with the new urethane adhesive bead.

6. Clean the inside of the new quarter window glass with glass cleaner.
    - Make sure to thoroughly clean the surface of the blackened border area where the urethane adhesive will be applied.

7. **NOTE:** Be sure to use the same brand and cure-rate products for the urethane adhesive and glass primer. Do not mix different brands of urethane adhesive and glass primer. Refer to the Material Chart in this procedure.

   If installing a new rear quarter window glass, apply glass primer according to manufacturer's instructions. Allow at least 6 minutes to dry.

8. Cut the urethane adhesive applicator tip to specification.

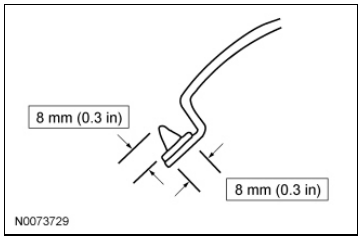


9. **NOTE:** Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane adhesive with less effort and continuous bead.

   NOTE: The rear quarter glass must be positioned within 10 minutes of applying the urethane adhesive.

   Use caution when applying urethane adhesive. Apply to the outside edges of the locating tabs on the glass surface. Start at the bottom and work around to the sides of the rear quarter window glass.

    - Make sure there are no gaps in the urethane bead.



10. ⚠ **WARNING: Do not drive vehicle until the urethane adhesive seal has cured. Follow urethane adhesive manufacturer's curing directions. Inadequate or incorrect curing of the urethane adhesive seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

    NOTICE: **Before positioning the quarter window glass, open vehicle windows to prevent the air pressure of closing doors from affecting the urethane adhesive bond.**

    Using the alignment marks made previously, position the quarter window glass on the pinch weld.

11. **NOTE:** The urethane adhesive must cure for a minimum of one hour before testing for air and water leaks.

    After the urethane adhesive has cured, check for water leaks and add urethane adhesive where needed.

12. Install the wiring harness brackets.

13. Install the rear quarter trim panel. For additional information, refer to Section 501-05 .

14. Clean the exterior and interior of the quarter window glass with glass cleaner.

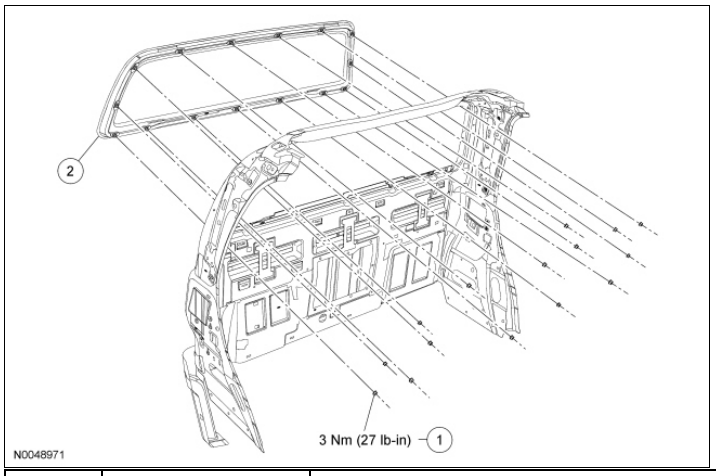
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Window Glass - Rear, Fixed

Material

Item	Specification
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B1



Item	Part Number	Description
1	N621901	Rear window glass mounting nut (15 required)
2	3542006	Rear window glass

Removal

NOTE: If the rear window glass is being removed to repair a dust/water leak, remove and reinstall the existing rear window glass.

1. Remove the cab rear panel. For additional information, refer to Section 501-05 .
2. Remove the 15 rear window glass mounting nuts.
3. ***NOTICE:*** **Use only a plastic windshield setting tool to slide under the seal to separate the foam core butyl from the glass. Once the glass starts to separate from the body, constant hand pressure will break the seal and the glass can be removed. Failure to use a plastic windshield setting tool can damage the body or the glass frame.**

   Remove the rear window glass.

Installation

1. **NOTE:** Remove as much as possible of the foam core butyl from the body and rear window glass prior to installation.

   Install the rear window glass.

- Apply foam core butyl to the window. Overlap the foam core butyl by 25 mm (0.984 in) at the bottom middle of the rear window glass.
- Carefully install the rear window glass into the body opening.

2. Install the 15 rear window glass mounting nuts.
   - Tighten to 3 Nm (27 lb-in).
   - Test the rear window glass for water leaks.

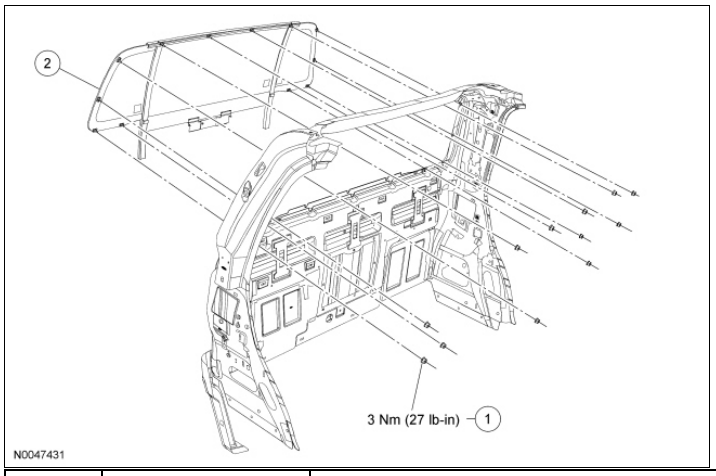
3. Install the cab rear panel. For additional information, refer to Section 501-05 .

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Window Glass - Rear, Power

Material

Item	Specification
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B1



Item	Part Number	Description
1	N621901	Rear window glass mounting nut (12 required)
2	78422A12	Rear window glass

Removal

NOTE: The power rear window motor must be initialized when repairs are performed on any part of the power rear window system including when: the power rear window motor is removed from the window regulator drum housing, a new power rear motor is installed, a new power rear window regulator is installed, a new power rear window glass module is installed, and any operation in which grease or lubricants are applied to the power rear window system.

NOTE: If the rear window glass is being removed to repair a dust/water leak, remove and reinstall the existing rear window glass.

1. Remove the rear window glass regulator. For additional information, refer to Window Regulator - Rear in this section.

2. Remove both C-pillar upper trim panels. For additional information, refer to Section 501-05 .

3. Remove the 12 rear window glass mounting nuts.

4. ***NOTICE:*** **Use only a plastic windshield setting tool to slide under the seal to separate the foam core butyl from the glass. Once the glass starts to separate from the body, constant hand pressure will break the seal and the glass can be removed. Failure to use a plastic windshield setting tool can damage the body or the glass frame.**

Remove the rear window glass.

Installation

1. **NOTE:** Remove as much as possible of the foam core butyl from the body and rear window glass prior to installation.

   Install the rear window glass.

   - Apply foam core butyl to the window. Overlap the foam core butyl by 25 mm (0.984 in) at the bottom middle of the rear window glass.
   - Carefully install the rear window glass into the body opening.

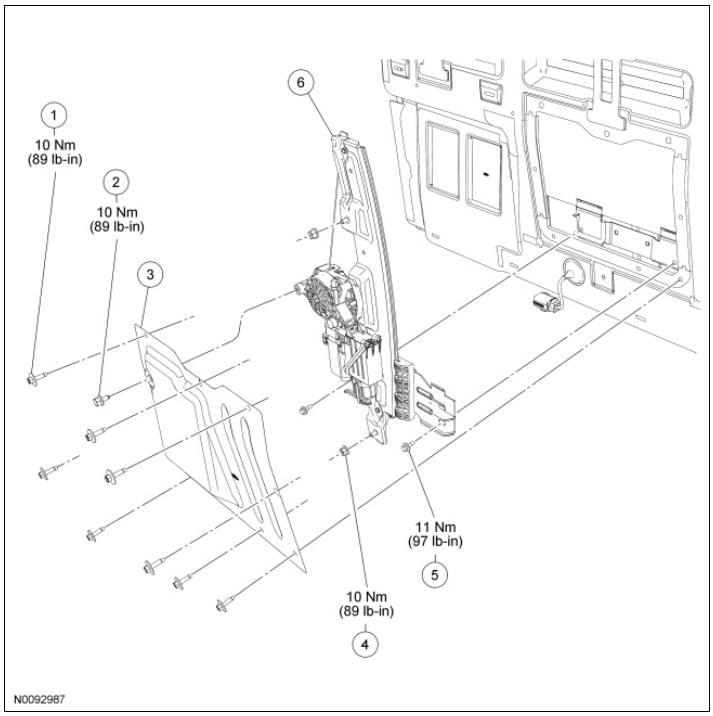
2. Install the 12 rear window glass mounting nuts.
   - Tighten to 3 Nm (27 lb-in).
   - Test the rear window glass for water leaks.

3. Install both C-pillar upper trim panels. For additional information, refer to Section 501-05 .

4. Install the rear window glass regulator. For additional information, refer to Window Regulator - Rear in this section.
   - Initialize the power rear window motor. For additional information, refer to Window Motor Initialization - Rear in this section.

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Window Regulator - Rear



Item	Part Number	Description
1	W704734	Window regulator cover bolt (8 required)
2	N800510	Window regulator cover-to-motor bolt
3	78403E82	Window regulator cover
4	W705817	Window regulator mounting nut (2 required)
5	N800510	Window regulator-to-window bolt (2 required)
6	784400	Window regulator assembly

Removal and Installation

NOTE: The power rear window motor must be initialized when repairs are performed on any part of the power rear window system including when: the power rear window motor is removed from the window regulator drum housing, a new power rear motor is installed, a new power rear window regulator is installed, a new power rear window glass module is installed, and any operation in which grease or lubricants are applied to the power rear window system.

1. Remove the cab rear panel. For additional information, refer to Section 501-05 .

2. Position the insulator aside.

3. Remove the 8 window regulator cover bolts.
   - To install, tighten to 10 Nm (89 lb-in).

4. Remove the window regulator cover-to-motor bolt.
   - To install, tighten to 10 Nm (89 lb-in).

5. Remove the window regulator cover.

6. Remove the 2 window regulator mounting nuts.
   - To install, tighten to 10 Nm (89 lb-in).

7. Remove the 2 window regulator-to-window bolts.
   - To install, tighten to 11 Nm (97 lb-in).

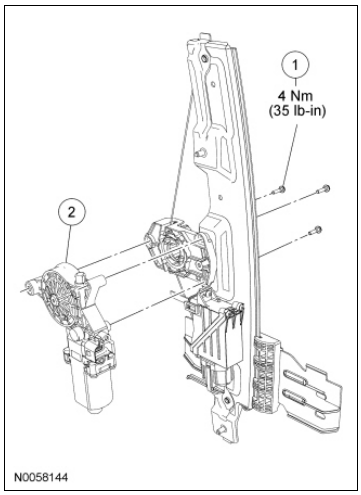
8. Disconnect the electrical connector.

9. Remove the window regulator.

10. To install, reverse the removal procedure.
    - Initialize the power rear window motor. For additional information, refer to Window Motor Initialization - Rear in this section.

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Window Regulator Motor - Rear



Item	Part Number	Description
1	-	Window regulator motor bolt (3 required) (part of 7844000)
2	14553	Window regulator motor

Removal and Installation

NOTE: The power rear window motor must be initialized when repairs are performed on any part of the power rear window system including when: the power rear window motor is removed from the window regulator drum housing, a new power rear motor is installed, a new power rear window regulator is installed, a new power rear window glass module is installed, and any operation in which grease or lubricants are applied to the power rear window system.

1. Remove the rear window glass regulator. For additional information, refer to Window Regulator - Rear in this section.

2. Remove the 3 window regulator motor bolts.
   - To install, tighten to 4 Nm (35 lb-in).

3. Remove the window regulator motor.

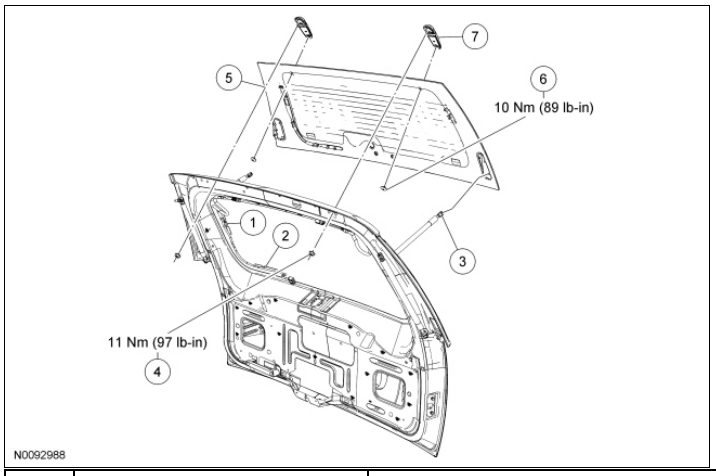
4. To install, reverse the removal procedure.
   - Initialize the power rear window motor. For additional information, refer to Window Motor Initialization - Rear in this section.

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Window Glass - Liftgate

Material

Item	Specification
Threadlock 262 TA-26	WSK-M2G351-A6



Item	Part Number	Description
1	17A413 RH/ 18C673 LH	Heated rear window grid electrical wire
2	-	Rear window glass electrical connector
3	7842105 RH/ 7842104 LH	Liftgate window glass strut
4	N621926	Liftgate window glass hinge-to-body retaining nut (2 required)
5	7842004	Liftgate window glass
6	-	Liftgate hinge-to-glass screw (2 required)
7	78420A68 RH / 78420A69 LH	Liftgate hinge

Removal and Installation

1. If installing a new liftgate window glass, remove the rear window wiper motor. For additional information, refer to Section 501-16 .

2. Position the liftgate trim panel aside to access the liftgate window glass electrical connectors and the 2 liftgate window glass hinge-to-glass screws.

3. Disconnect the liftgate window glass electrical connectors.

4. **NOTE:** Open and support the liftgate window glass before removing the liftgate window glass struts.

   Remove the liftgate window glass struts.

- To avoid breaking the liftgate window glass, disconnect the liftgate window glass struts from the liftgate window glass before disconnecting the liftgate window glass struts from the rear liftgate.

5. Remove the 2 liftgate hinge-to-glass screws.
   - Apply threadlock into the liftgate window glass hinge-to-glass bolt hole, making sure that the threadlock is on the threads.
   - To install, tighten to 10 Nm (89 lb-in).

6. With the help of an assistant, remove the liftgate window glass.

7. To install, reverse the removal procedure.

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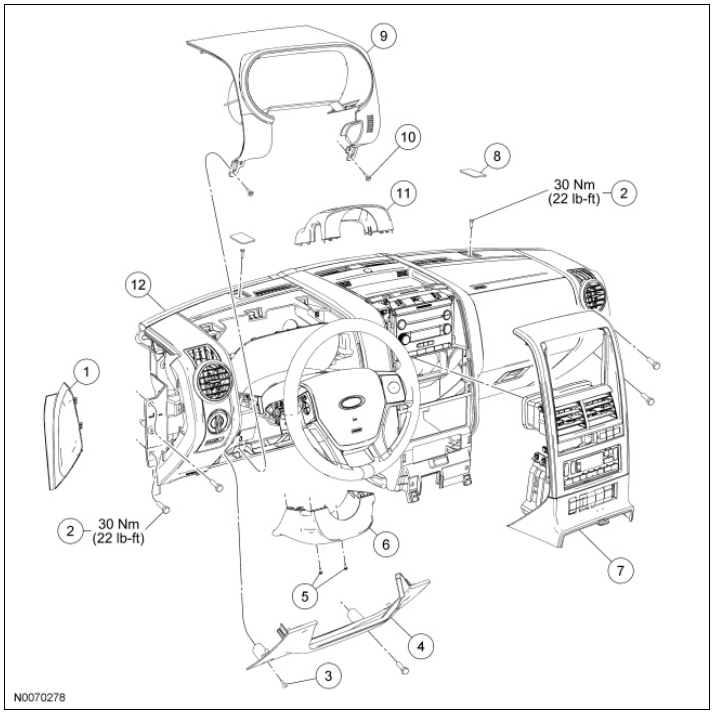
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Torque Specifications

Description	Nm	lb-ft	lb-in
Center ground strap bolt	9	-	80
Instrument panel bolts	30	22	-
Instrument panel floor brace bolts and nuts	9	-	80
Rear floor console bolts	9	-	80
Steering column shaft-to-steering column bolt	30	22	-

Instrument Panel - Exploded View

NOTE: Explorer/Explorer Sport Trac shown, Mountaineer similar.



Item	Part Number	Description
1	04480 RH/ 04481 LH	Instrument panel side finish panel (2 required)
2	W706246	Instrument panel bolts (6 required)
3	W707628	Steering column opening trim panel screw (2 required)
4	04459	Steering column opening trim panel
5	-	Steering column cover screws (2 required)
6	3530	Lower steering column cover
7	04302	Instrument panel center finish panel
8	044F58	Instrument panel upper cowl bolt cover (2 required)
9	044D70	Instrument cluster finish panel
10	W705314	Instrument cluster finish panel screw (2 required)
11	3530	Upper steering column cover
12	04320	Instrument panel

1. For additional information, refer to the procedures in this section.

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Instrument Panel Finish Panel - Center

Removal and Installation

1. Remove the selector lever trim ring.

2. Remove the front floor console finish panel.
   - Disconnect the power point electrical connector.

3. Remove the instrument panel center finish panel.
   - Disconnect the electrical connectors.

4. To install, reverse the removal procedure.

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Instrument Cluster Finish Panel

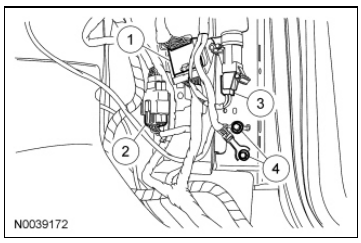
Removal and Installation

1. Remove the 2 steering column opening trim panel screws.
2. Remove the steering column opening trim panel.
3. Remove the 2 steering column cover screws.
4. Remove the 2 instrument cluster finish panel screws.
5. Remove the instrument cluster finish panel.
6. To install, reverse the removal procedure.

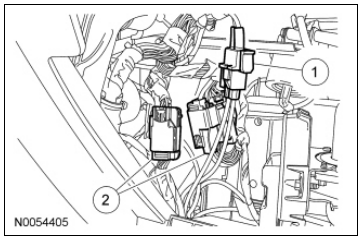
Instrument Panel

Removal and Installation

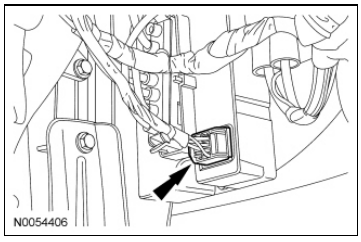
1. Remove the A-pillar and LH cowl side trim panels. For additional information, refer to Section 501-05 .
2. Remove the transmission selector lever. For additional information, refer to Section 307-05 .
3. Remove the steering wheel. For additional information, refer to Section 211-04 .
4. Remove the instrument panel side finish panels.
5. Remove the instrument panel center finish panel.
6. Remove the RH cowl side panel and disconnect the instrument panel connectors behind it in this order.
    1. Disconnect the bulkead electrical connector and detach it from the cowl.
    2. Disconnect the electrical connector.
    3. Disconnect the inertia switch electrical connector.
    4. Disconnect the 2 ground strap bolts.



7. Lower the glove compartment and disconnect the instrument panel harness connectors.
    1. Disconnect the vacuum harness connector.
    2. Disconnect the instrument panel harness electrical connectors.

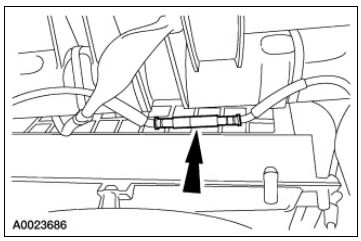


8. Disconnect the automatic temperature control solenoid and manifold electrical connector.

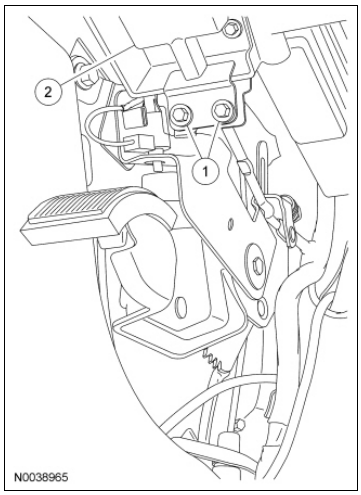


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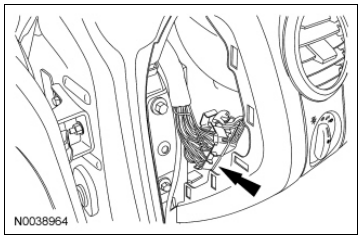
9. Disconnect the antenna lead-in cable.



10. Remove the parking brake release handle.
    1. Remove the 2 screws.
    2. Remove the release handle.



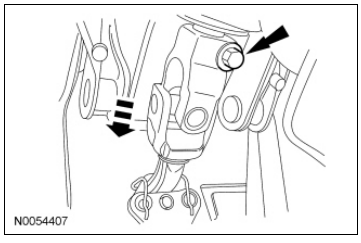
11. Disconnect the LH side instrument panel bulkhead electrical connector.



12. **NOTE:** Install a new steering column shaft-to-steering column bolt.

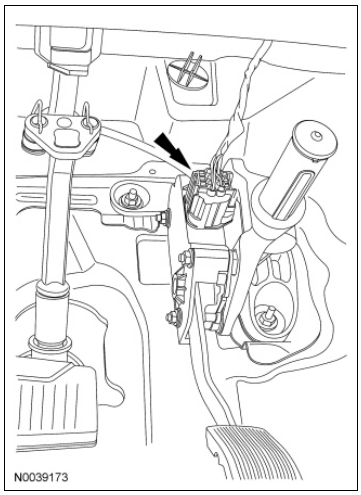
    Remove and discard the steering column shaft-to-steering column bolt.

    - To install, tighten to 30 Nm (22 lb-ft).

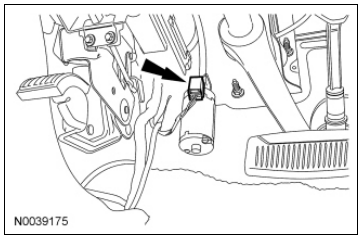


13. Separate the steering column shaft from the steering column.

14. From atop the accelerator pedal, disconnect the RH adjustable pedal electrical connector (if equipped).



15. From the LH side of the brake pedal, disconnect the adjustable pedal motor electrical connector (if equipped).

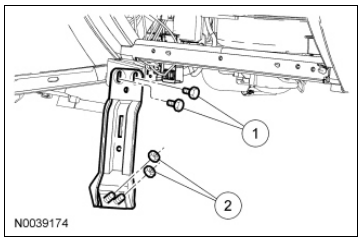


16. **NOTE:** RH side shown, LH side similar.

    Remove the RH and LH instrument panel center braces.

    1. Remove the 4 instrument panel brace bolts.
    2. Remove the 4 instrument panel brace nuts.

    • To install, tighten to 9 Nm (80 lb-in).



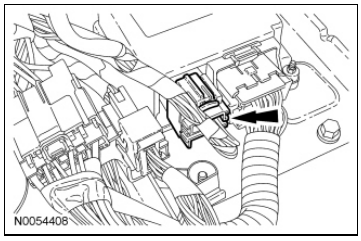
17. Remove the 2 instrument panel bolts.
    • Remove the covers and remove the bolts.
        ♦ To install, tighten to 30 Nm (22 lb-ft).

18. Remove the driver front seat. For additional information, refer to Section 501-10 .

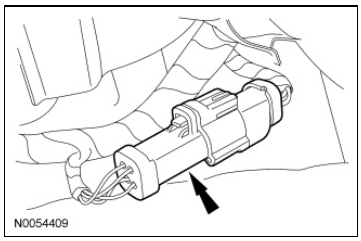
19. Position the carpet away from the Restraints Control Module (RCM).

20. Disconnect the small RCM electrical connector.

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21. Disconnect the stability control sensor cluster jumper harness electrical connector and detach the instrument panel harness from the floorpan.



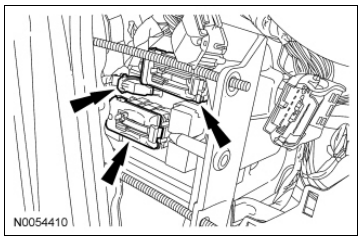
22. Loosen the RH instrument panel bolts one half of the bolt length, but do not completely remove the bolts.
    - To install, tighten to 30 Nm (22 lb-ft).

23. **NOTE:** The instrument panel may be supported by installing long bolts or threaded rods with the same diameter and thread pitch (in place of the LH instrument panel bolts), to support the instrument panel while allowing it to be moved away from the dash panel.

    Remove the 2 LH instrument panel bolts and correctly support the instrument panel.

    - To install, tighten to 30 Nm (22 lb-ft).

24. Position the LH side of the instrument panel rearward and disconnect the Smart Junction Box (SJB) electrical connectors.



25. Position the instrument panel back to the original position and remove the LH instrument panel supports (if necessary).

26. ***NOTICE:*** **To avoid damage to the instrument panel, an assistant is required to support the panel before carrying out this step.**

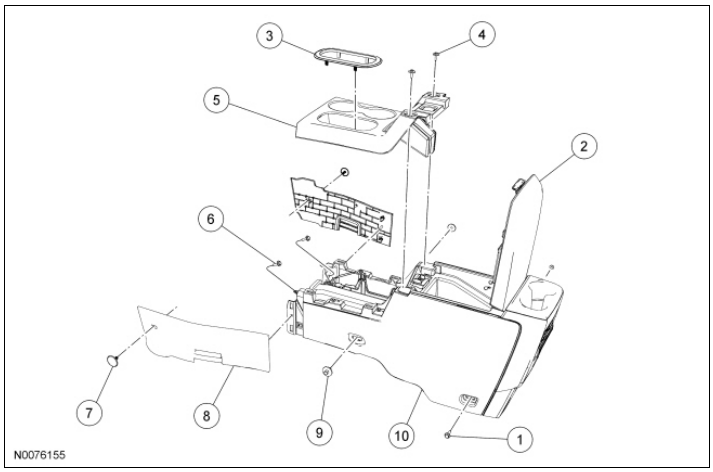
    NOTICE: **Before removing the instrument panel, make sure all electrical connector wiring is free and not caught up on other components or damage to the wire harness may occur.**

    Remove the RH instrument panel bolts and remove the instrument panel.

27. To install, reverse the removal procedure.
    - Make sure to align the trim panel retaining clips to the adjacent retaining clip holes.

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Console - Front, Floor



Item	Part Number	Description
1	W705549	Front floor console rear bolt (2 required)
2	06024	Front floor console stowage door
3	7E391	Selector lever bezel
4	W705796	Front floor console finish panel screw (2 required)
5	045A76	Front floor console finish panel
6	-	Front floor console-to-instrument panel screw (2 required)
7	31172	Front floor console pushpin retainer (2 required)
8	04608	Front floor console extension trim panel
9	W706391	Front floor console middle bolt (2 required)
10	045A36	Front floor console

Removal and Installation

1. Move the front seats to the full rearward position.

2. Remove the LH and RH front floor console rear bolts.

3. Position the front seats to the full rearward position.

4. Remove the selector lever bezel.

5. Open and lift the front floor console stowage door upward.

6. Remove the 2 front floor console finish panel screws.

7. Remove the front floor console finish panel.
   - Disconnect the electrical connector.

8. Disconnect the front floor console electrical connectors.

9. Remove the 2 front floor console-to-instrument panel screws.

10. Remove the LH and RH front floor console pushpin retainers.

11. Remove the LH and RH front floor console extension trim panels.

12. Remove the LH and RH front floor console middle bolts.

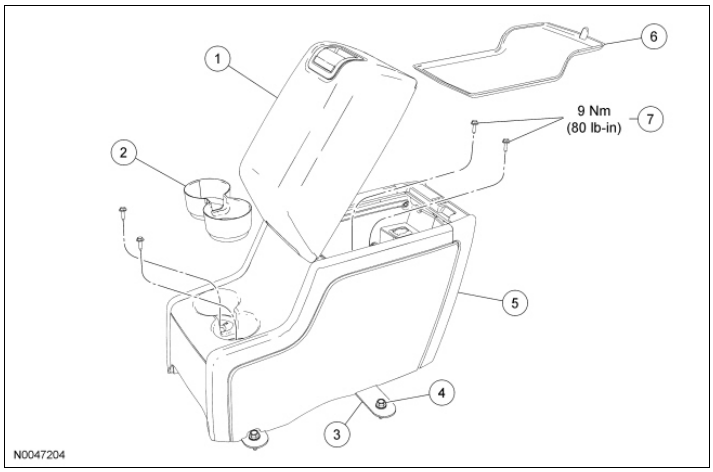
13. Remove the front floor console.
    - Pull the front floor console toward the rear of the vehicle.

14. To install, reverse the removal procedures.
    - Make sure to align the trim panel retaining clips to the adjacent retaining clip holes.

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Console - Rear, Floor



Item	Part Number	Description
1	78045C80	Rear console arm rest (part of 78045)
2	78046B94	Cup holder insert
3	78672A44	Rear floor console bracket
4	W706636	Rear floor console bracket bolt (4 required)
5	7867442	Rear console assembly
6	78047A03	Storage compartment insert
7	W705549	Rear floor console bolts (4 required)

Removal and Installation

NOTE: The rear floor console bracket does not need to be removed to remove the console.

1. Open the armrest and remove the storage compartment insert.

2. Remove the 4 rear floor console bolts.
   - To install, tighten to 9 Nm (80 lb-in).

3. ***NOTICE:*** **To prevent damage to the 2 plastic guide pegs located on the bottom of the console, pull the console straight up when removing.**

   Disconnect the electrical connector and remove the rear floor console.

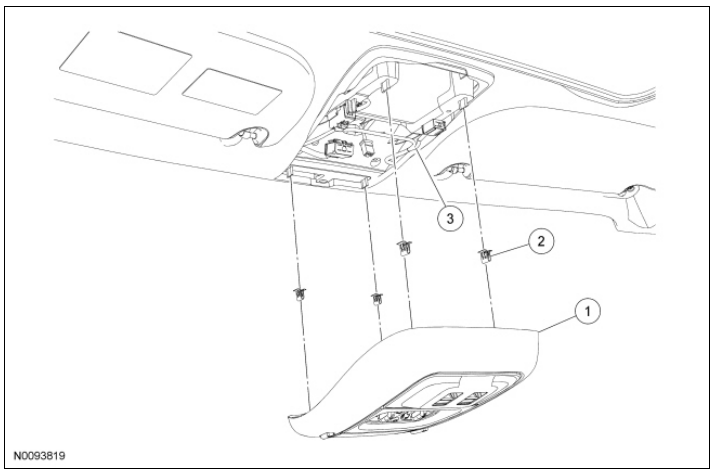
4. ***NOTICE:*** **To prevent damage to the 2 plastic guide pegs located on the bottom of the console, install the console straight down until the pegs are correctly seated in the holes.**

   To install, reverse the removal procedure.

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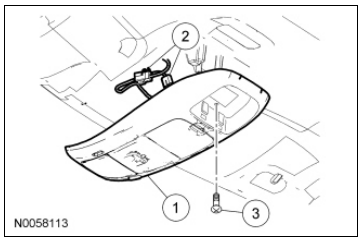
Console - Overhead

Overhead Console With Roof Opening Panel



Item	Part Number	Description
1	519A70	Overhead console
2	-	Overhead console retaining clip (4 required) (part of 519A70)
3	14334	Overhead console wiring harness

Overhead Console Without Roof Opening Panel



Item	Part Number	Description
1	519A70	Overhead console
2	-	Overhead console electrical connector (part of 14334)
3	-	Overhead console screw

Removal and Installation

Vehicles with roof opening panel

1. Pull the overhead console downward to release the retaining clips.

Vehicles without roof opening panel

2. Open the overhead console garage door opener storage compartment.

3. Remove the overhead console screw.

All vehicles

4. Remove the overhead console.

5. Disconnect the electrical connectors.

6. To install, reverse the removal procedure.
    - On vehicles with a roof opening panel, make sure to align the overhead console retaining clips to the adjacent retaining clip holes.

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Power Point

Special Tool(s)

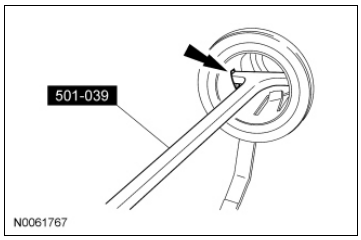
 ST3024-A	Remover, Power Point Socket 501-039 or equivalent

Removal

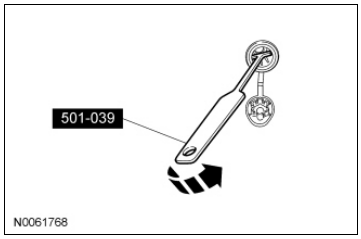
NOTE: Power point cover may differ depending on location.

1. Open the power point cover.

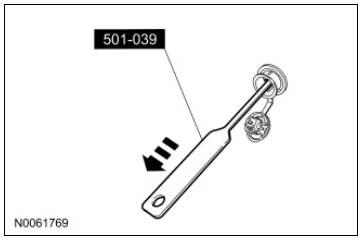
2. Install the Power Point Socket Remover in one of the power point socket slots.



3. Position the Power Point Socket Remover so that it engages in the adjacent slot.



4. Using the Power Point Socket Remover, pull the power point socket out of the retainer.



5. Disconnect the electrical connector.

Installation

1. Connect the electrical connector.

2. Slide the power point socket into the retainer.

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General Specifications

Item	Specification
Lock Repair/Replacement Specifications	
Ignition Cylinder Lock Kit	4L3Z-11582-BB
Door Lock Kit	4L2Z-7821991-BB
Lubricants	
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Penetrating and Lock Lubricant (US) XL-1; Penetrating Fluid (Canada) CXC-51-A	-

Torque Specifications

Description	Nm	lb-ft	lb-in
Door latch screws	12	-	106
Exterior door handle nuts	9	-	80
Hood latch bolts	12	-	106
Liftgate latch screws	12	-	106
Liftgate striker bolts	30	22	-
Liftgate window latch screws	12	-	106
Pickup bed storage compartment latch bolts	12	-	106
Pickup bed storage compartment release handle bolts	12	-	106
Tailgate access panel bolts	5	-	44
Tailgate latch bolts	25	18	-
Tailgate latch remote control nuts	9	-	80
Tailgate release handle nuts	9	-	80

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Handles, Locks, Latches and Entry Systems

NOTE: The Smart Junction Box (SJB) is also known as the generic electronic module GEM.

Hood Latch

The hood latch system contains a latch fastened to the body and a hood latch striker attached to the hood. The latch is controlled by the hood latch release handle and cable.

Front Door

The front door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The front doors are locked/unlocked by the Remote Keyless Entry (RKE) transmitter, the keyless entry keypad, the door lock control switches or the driver door lock cylinder.

Rear Door

The rear door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The rear doors can be locked/unlocked by the RKE transmitter, the keyless entry keypad, or the door lock control switches. The rear doors have a child safety lock feature, which is a manual lock on the inside of the rear door frame. When the child safety feature is on, the rear doors cannot be opened from the interior door handle.

Liftgate

The liftgate system contains a latch located on the bottom of the inside frame of the liftgate, which is controlled by the exterior liftgate release handle. The liftgate window latch is mounted on the upper center portion of the liftgate frame and includes the ajar switch and the latch actuator. The liftgate window latch is actuated by the release switch mounted on the license plate housing, the RKE transmitter, or the keyless entry keypad. The liftgate window glass release switch operates only when all the doors are unlocked.

Tailgate

The tailgate release handle is integrated with a lock cylinder. The 2 latches are actuated by 2 actuating rods that are controlled by the release handle and remote control.

Power Lock/Unlock

The Smart Junction Box (SJB) controls the power locking/unlocking feature of all of the vehicle doors, including the liftgate. The determination to lock or unlock the vehicle is based off the input received from the door lock control switch(es), the keyless entry keypad or the Remote Keyless Entry (RKE) transmitter (if the vehicle speed is less than 5 km/h [3 mph]). Power locking and unlocking of the doors function independently of the key position, vehicle speed or transmission position. The SJB activates internal relays to supply power for the door lock actuators.

The liftgate window glass is released, using the keyless entry keypad or the RKE transmitter, and does not operate if the vehicle speed is greater than 5 km/h (3 mph).

Autolock

The autolock feature locks all the doors when all the doors, including the liftgate, are closed, after the brake pedal is pressed, and the vehicle speed exceeds 20 km/h (12 mph). This feature also relocks the doors (if any doors were open) after the brake pedal is pressed, once the SJB receives door closed inputs from all door ajar switches and vehicle speed exceeds 20 km/h (12 mph). The autolock feature can be enabled/disabled, refer to Autolock and Auto-Unlock Programming in this section for programming information. The autolock feature also uses inputs from the key position, the stoplamp switch and vehicle speed through the Controller Area Network (CAN) from the ABS module.

Auto-Unlock

The auto-unlocking feature unlocks all the doors when all of the following conditions are met:

- All the doors are closed
- The key is in the run position and the vehicle was in motion at a speed greater than 20 km/h (12 mph) for a minimum of 2 seconds since the last key start. The vehicle then comes to a stop and the key is turned to the OFF or ACC position
- The driver door is opened within 10 minutes of the key being turned to the OFF or ACC position

The doors do not auto-unlock if:

- The doors are locked using the door lock control switches
- The doors are locked with the keyless entry keypad or the RKE transmitter within 10 minutes of turning the key to the OFF or ACC position
- 10 minutes elapse and the driver door is not opened

The auto-unlock feature can be enabled/disabled independently of autolock. Refer to Autolock and Auto-Unlock Programming in this section for programming information.

Smart Unlock

The smart unlock feature prevents all the doors from being locked with the key in the ignition lock cylinder. When the SJB receives a lock command from a front door lock control switch, and the key is in the ignition lock cylinder with one of the front doors open, the SJB commands all the doors to unlock.

Unlock Inhibit Feature

NOTE: The unlock inhibit feature is configured off from the factory.

The unlock inhibit feature prevents the doors from being unlocked from the door lock control switches after certain conditions have been met. This feature is designed to prevent vehicle theft.

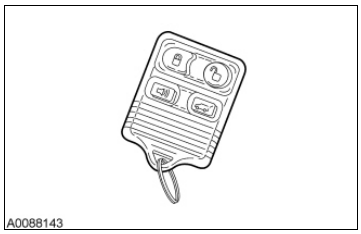
The conditions for the unlock inhibit feature are:

- The key is out of the ignition
- All doors are closed
- The vehicle has been locked using the Remote Keyless Entry (RKE) transmitter, keyless entry keypad (if equipped), or the door lock control switch (while the front door was open then subsequently closed)
- 20 seconds have elapsed once all doors are closed and locked

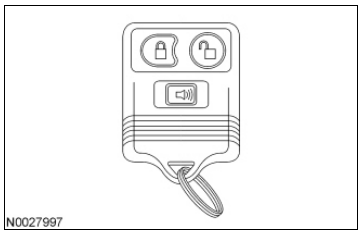
Remote Keyless Entry (RKE) Transmitter

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Explorer, Mountaineer



Explorer Sport Trac



The RKE transmitter initiates the following electronic system functions:

- Unlocks the driver door (with stepped unlock enabled)
- Unlocks all doors
- Locks all doors
- Releases the liftgate window glass (Explorer only)
- Activates/deactivates the panic alarm
- Commands the interior lamps on (when unlocking) and off (when locking)
- Sounds the horn once when LOCK is pressed twice within 3 seconds, and the doors are closed
- Sounds the horn twice when LOCK is pressed twice within 3 seconds, and any door is open

The RKE transmitter has a normal operating range of 10 m (33 ft).

The RKE transmitters can be programmed using a scan tool or by using the remote keyless entry transmitter programming procedure. Refer to Remote Keyless Entry (RKE) Transmitter Programming in this section for programming information.

Remote Keyless Entry (RKE) Transmitter Lock/Unlock Control - Lock

The RKE transmitter feature requests that all the doors be locked when the lock button is pressed. On any press of the lock button with all doors closed, the SJB provides 1 flash of the parking lamps. If any door is ajar, no flash occurs. As soon as the last door is closed, the SJB provides the flash of the parking lamps. If 2 presses of the lock button are received within 3 seconds the horn chirps once, and the parking lamps flash twice to indicate that all the doors are closed and locked. If any door is ajar when the second lock request is received within 3 seconds of the first, the RKE transmitter feature requests the SJB chirp the horn twice without flashing the parking lamps to indicate it locked all the doors, but 1 or more doors are ajar. When the key is in the ON or START position, the parking lamp flashes and horn chirp confirmations do not occur.

Remote Keyless Entry (RKE) Transmitter Lock/Unlock Control - Unlock

The RKE transmitter feature provides lock/unlock functions independently of key position or transmission position. The RKE feature will not unlock the doors if the vehicle speed is greater than 20 km/h (12 mph). The RKE transmitter feature provides a stepped (if enabled) process for unlocking the doors. Upon receipt of the first request for unlocking the doors, the RKE control feature requests the SJB to unlock the driver door only. If another unlock request is received within 3 seconds of the first, the RKE transmitter feature requests the

SJB to unlock all the doors. This feature can be changed to global unlock, so that all the doors unlock on the first press of the unlock button. Refer to Stepped Unlock Programming in this section for programming information.

Remote Keyless Entry (RKE) Liftgate Glass Release (Explorer, Mountaineer)

The RKE transmitter feature provides liftgate release function independently of key position. The vehicle speed must be less than 5 km/h (3 mph) for this function to work.

Remote Keyless Entry (RKE) Transmitter Memory Seat

The RKE transmitter feature provides memory seat/adjustable pedals easy entry feature. When the unlock button is pressed, the driver seat and adjustable pedals move to the desired memory position (the seat and pedal position corresponds to the transmitter being used). This feature can be enabled/disabled. For additional information, refer to Remote Memory Activation and Remote Memory Deactivation in this section.

Panic Alarm

The panic alarm feature provides audible and visual alarms which are evident from the exterior of the vehicle. The panic alarm feature requests that the parking lamps are flashed and the horn sounds until deactivation. The flashing of the outputs occurs simultaneously. Activation of the panic alarm is accomplished by pressing the panic button on an RKE transmitter whenever the key is in the OFF or ACC position. At all other times this feature is disabled. Deactivation of an active PANIC alarm is accomplished by any of the following actions:

- A second press of the RKE transmitter panic button
- The key is switched out of the OFF or ACC position
- A period of 2 minutes and 45 seconds has elapsed since the initial activation

Keyless Entry Keypad

The keypad, located on the exterior of the driver door, provides a method for customers to access their vehicle without a key or RKE transmitter. The keypad feature:

- Locks all doors
- Unlocks the driver door
- Unlocks all doors
- Programs/erases the customer key code
- Enables/disables auto-unlocking
- Enables/disables autolocking
- Releases the liftgate window glass

The keypad feature operates independently of key position status, vehicle speed, or transmission position. When a keypad button is pressed, the keypad buttons illuminate to provide better visibility. If the lock all doors command is entered or 5 seconds have elapsed since the last button press, the illumination is turned off.

Each vehicle equipped with a keypad is programmed with a 5-digit entry code. This code is provided to the customer through a wallet card in the Owner's Literature. In addition, this code is available through a scan tool and is also printed on the SJB label. When entering codes, each digit must be entered within 5 seconds of the previous button press.

Locking the Doors with the Keyless Entry Keypad System

It is not necessary to enter the factory set or personal code prior to locking all doors. To lock all doors, press

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the 7/8 and 9/0 controls at the same time.

Unlocking the Doors with the Keyless Entry Keypad System

To unlock the driver door, enter either the factory set code or a personal code; each digit must be pressed within 5 seconds of the prior digit. The interior lamps illuminate.

To unlock all doors, enter either the factory set code or a personal code (driver door unlocks) and press the 3/4 control within 5 seconds.

To open the liftgate window glass, enter the factory set code or a personal code (driver door unlocks) and press the 5/6 control within 5 seconds.

Anti-Scan Feature

To provide added security, the keypad is disabled for 1 minute after 35 button presses without a valid entry code being entered. The keypad illumination flashes during this 1-minute mode with all functionality disabled except for 7/8 and 9/0 still being allowed to lock the vehicle.

Anti-Scan is turned off after 1 minute of keypad inactivity.

Handles, Locks, Latches and Entry Systems

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

Power Locks

The SJB monitors the door lock control switches. When the SJB receives an unlock/lock command from either door lock control switch, the SJB energizes a relay (internal to the SJB) to supply the correct power and grounds for the door lock actuators.

Liftgate Glass Release

The SJB monitors the liftgate glass release switch. The doors must be unlocked electronically in order for the SJB to release the liftgate glass latch. When this condition is met and the SJB receives a request from the liftgate glass release switch, the SJB provides power to the latch release motor.

Keyless Entry Keypad

The SJB monitors the keyless entry keypad input. When the correct codes are entered into the SJB, the SJB carries out functions associated with the code entered. Based on input from the keypad, the SJB:

- Locks all doors
- Unlocks the driver door

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- Unlocks all doors
- Enters programming mode
- Enables/disables the autolock feature
- Enables/disables the auto-unlock feature
- Releases the liftgate glass latch

Remote Keyless Entry (RKE)

The SJB receives input from programmed RKE transmitters. Based on input from the RKE transmitter, the SJB:

- Locks all doors
- Unlocks the driver door (with stepped unlock enabled)
- Unlocks all doors
- Releases the liftgate glass latch
- Activates/deactivates the panic alarm
- Turns the interior lamps on (when unlocking) and off (when locking), provided the defeat switch on the dimmer switch is not active
- Sounds the horn once when LOCK is pressed twice within 3 seconds, and the doors are closed
- Sounds the horn twice when LOCK is pressed twice within 3 seconds, and any door is open/ajar

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Door/liftgate handles • Latches	• Smart Junction Box (SJB) fuse 6 (20A) • Door lock control switches • Wiring, terminals or connectors • Remote Keyless Entry (RKE) transmitter • Keyless entry keypad • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Smart Junction Box (SJB) DTC Chart

NOTE: Do not replace the SJB for DTCs B2276 or B2425.

DTC	Description	Action
B1300	Power Door Lock Circuit Failure	GO to Pinpoint Test F .
B1396	Power Door Lock Circuit Short to Battery	INSTALL a new SJB. REFER to Section 419-10 .
B1397	Power Door Unlock Circuit Short to Battery	INSTALL a new SJB. REFER to Section 419-10 .
B1982	Driver's Door Unlock Relay Coil Circuit Failure	GO to Pinpoint Test F .
B1983	Driver's Door Unlock Relay Coil Circuit Short to Battery	INSTALL a new SJB. REFER to Section 419-10 .
B2250	All Door's - Unlock All Relay Coil Circuit Failure	GO to Pinpoint Test F .
B2276	Less Than 2 Transmitters Programmed	PROGRAM the Remote Keyless Entry (RKE) transmitter(s). REFER to Remote Keyless Entry (RKE) Transmitter Programming in this section.
B2425	Remote Keyless Entry Out of Synchronization	GO to Pinpoint Test J .
B2574	Drivers Door LOCK Switch Short to Ground	GO to Pinpoint Test E .
B2575	Drivers Door UNLOCK Switch Short to Ground	GO to Pinpoint Test E .

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B2667	Liftglass Release Switch Circuit Failure	GO to Pinpoint Test G .
B2670	Liftglass Release Relay Coil Short to Vbatt	INSTALL a new SJB. REFER to Section 419-10 .
B2671	Liftglass Release Relay Coil Circuit Failure	GO to Pinpoint Test F .
B2695	Keypad_A Switch Circuit Failure	GO to Pinpoint Test H .
B2696	Keypad_B Switch Circuit Failure	GO to Pinpoint Test H .
B2697	Keypad_C Switch Circuit Failure	GO to Pinpoint Test H .
All Other DTCs	-	REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

Symptom Chart

Electrical Symptom Chart

Mechanical Symptom Chart

Pinpoint Tests

Pinpoint Test A: All Door Locks Are Inoperative

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The SJB fuse 6 (20A) provides voltage for the power lock/unlock system. Ground for the power lock/unlock system is internal to the SJB. The SJB contains internal relays that are energized depending on input received.

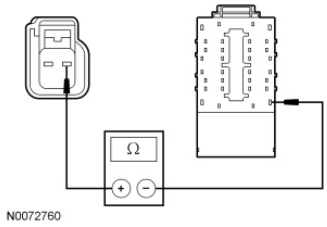
When the SJB receives a lock request from the door lock control switch, the SJB provides voltage to the door lock actuators through circuit CPL11 (GY/BN). Ground for the LH front door actuator is provided through circuit CPL51 (BU/GN) and ground for the remaining door lock actuators is provided through circuit CPL52 (VT/GY). When the SJB receives an unlock request, voltage and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST A: ALL DOOR LOCKS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES	
• Press the lock and unlock button of both door lock control switches while observing the door lock operation. • **Are the door locks inoperative from both switches?**	**Yes** GO to A2 . **No** GO to Pinpoint Test D .
A2 RETRIEVE THE RECORDED SJB DTCs FROM THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Are DTCs B1300, B1982, B2250, B2574, B2575 or B2671 recorded?**	**Yes** For DTCs B2574 and B2575, GO to Pinpoint Test E . For DTCs B1300, B1982, B2250, and B2671, GO to Pinpoint Test F . **No** GO to A3 .
A3 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280a . • Disconnect: LH Front Door Lock Actuator C525 . • Measure the resistance between the LH front door lock actuator C525-1, circuit CPL11 (GY/BN), harness side and the SJB C2280a-4, circuit CPL11 (GY/BN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly.	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been

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• Operate the system and verify the concern is still present. • **Is the concern still present?**	caused by a loose or corroded connector.

Pinpoint Test B: A Single/More Than One Door Lock Is Inoperative

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

When the SJB receives a lock request from the door lock control switch, the SJB provides voltage to the door lock actuators through circuit CPL11 (GY/BN). Ground for the LH front door actuator is provided through circuit CPL51 (BU/GN) and ground for the remaining door lock actuators is provided through circuit CPL52 (VT/GY). When the SJB receives an unlock request, voltage and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock actuator
- Liftgate lock actuator
- SJB

PINPOINT TEST B: A SINGLE/MORE THAN ONE DOOR LOCK IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 RETRIEVE THE RECORDED SJB DTCs FROM THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Check for recorded SJB DTCs from the continuous and the on-demand self-test. • **Are DTCs B1300, B1982, B2250 or B2671 recorded?**	**Yes** GO to Pinpoint Test F . **No** GO to B2 .
B2 CHECK THE DOOR LATCH FOR BINDING	
• Lock and unlock the inoperative door lock using the door lock rod. • **Does the door lock and unlock?**	**Yes** GO to B4 . **No** GO to B3 .
B3 CHECK THE LOCK ROD FOR BINDING	
• Operate the door lock rod manually while observing the door lock rod for any binding or if the rod is bent. • **Is the door lock rod bent or binding?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** INSTALL a new door latch. REFER to Front Door Latch , Rear Door Latch or Liftgate Latch

	in this section. TEST the system for normal operation.
B4 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Inoperative Door Lock Actuator . • **NOTE:** The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch. • While pressing the door lock control switch in the LOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows: • **Is the voltage momentarily greater than 10 volts?**	**Yes** GO to B5 . **No** REPAIR the circuit. TEST the system for normal operation.

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-1	CPL11 (GY/BN)
RH front	C603-1	CPL11 (GY/BN)
LH rear	C704-1	CPL11 (GY/BN)
RH rear	C804-1	CPL11 (GY/BN)
Liftgate	C457-1	CPL11 (GY/BN)

B5 CHECK CIRCUIT CPL52 (VT/GY) OR CIRCUIT CPL51 (BU/GN) FOR VOLTAGE	
• **NOTE:** The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch. • While pressing the door lock control switch in the UNLOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows:	**Yes** INSTALL a new door lock actuator. REFER to Front Door Lock Actuator , Rear Door Lock Actuator , or Liftgate Latch Actuator in this section. TEST the system for normal operation. **No** GO to B6 .

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-2	CPL51 (BU/GN)
RH front	C603-2	CPL52 (VT/GY)
LH rear	C704-2	CPL52 (VT/GY)

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RH rear	C804-2	CPL52 (VT/GY)
Liftgate	C457-2	CPL52 (VT/GY)

- **Is the voltage momentarily greater than 10 volts?**

B6 CHECK CIRCUIT CPL51 (BU/GN) OR CIRCUIT CPL52 (VT/GY) FOR AN OPEN	
• Disconnect: SJB C2280a . • Measure the resistance between the inoperative door lock actuator, harness side and the SJB, harness side as follows:	**Yes** GO to B7 . **No** REPAIR the circuit. TEST the system for normal operation.

Inoperative Door Lock Actuator Connector-Pin	SJB Connector-Pin	Circuit
LH front C525-2	C2280a-17	CPL51 (BU/GN)
RH front C603-2	C2280a-1	CPL52 (VT/GY)
LH rear C704-2	C2280a-1	CPL52 (VT/GY)
RH rear C804-2	C2280a-1	CPL52 (VT/GY)
Liftgate C457-2	C2280a-1	CPL52 (VT/GY)

- **Is the resistance less than 5 ohms?**

B7 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: The Door Locks Operate Only One Way

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The SJB sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests. When the lock or unlock switch is pressed, the voltage signal is

routed to ground.

The SJB contains internal relays that are energized depending on input received. When the SJB receives a lock or unlock request from the door lock control switch, the SJB energizes the appropriate relay(s) to lock or unlock the doors.

This pinpoint test is intended to diagnose the following:

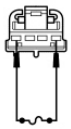
- Wiring, terminals or connectors
- SJB

PINPOINT TEST C: THE DOOR LOCKS OPERATE ONLY ONE WAY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

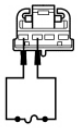
Test Step	Result / Action to Take
C1 CHECK THE RECORDED SJB DTCs FROM THE SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC B2574 or B2575 present?**	**Yes** GO to Pinpoint Test E . **No** GO to C2 .
C2 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES	
• Ignition OFF. • Press the lock and unlock button of both door lock control switches while observing the door lock operation. • **Do the door locks operate only one way from both switches?**	**Yes** GO to C4 . **No** GO to C3 .
C3 CHECK CIRCUIT CPL42 (GY/YE) (LOCK INPUT) OR CIRCUIT CPL43 (VT/GY) (UNLOCK INPUT) FOR AN OPEN (SINGLE SWITCH INOPERATIVE)	
• Disconnect: Suspect Door Lock Control Switch . • Unlock the doors from the working door lock control switch. • Connect a fused jumper wire between the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-4, circuit GD133 (BK), harness side; or between the RH door lock control switch C605-1, circuit CPL42 (GY/YE), harness side and the RH door lock control switch C605-4, circuit GD151 (BK/GN), harness side.	**Yes** REMOVE the jumper wire. INSTALL a new door lock control switch. REFER to Door Lock Control Switch in this section. TEST the system for normal operation. **No** REMOVE the jumper wire. REPAIR the input circuit in question. TEST the system for normal operation.

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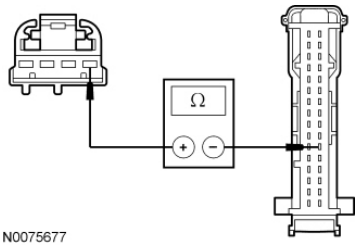
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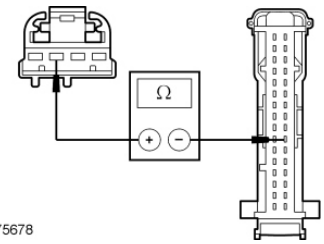
- Remove the jumper wire.
- Connect a fused jumper wire between the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-4, circuit GD133 (BK), harness side; or between the RH door lock control switch C605-3, circuit CPL43 (VT/GY), harness side and the RH door lock control switch C605-4, circuit GD151 (BK/GN), harness side.



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- **Do the doors lock and unlock with the jumper wire?**

C4 CHECK CIRCUIT CPL42 (GY/YE) (LOCK INPUT) OR CIRCUIT CPL43 (VT/GY) (UNLOCK INPUT) FOR AN OPEN (BOTH SWITCHES INOPERATIVE)	
• Disconnect: LH Door Lock Control Switch C505 . • Disconnect: SJB C2280b . • If the doors do not lock, measure the resistance between the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side and the SJB C2280b-27, circuit CPL42 (GY/YE), harness side.  N0075677 • If the doors do not unlock, measure the resistance between the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side and the SJB C2280b-26, circuit CPL43 (VT/GY), harness side.	**Yes** GO to C5 . **No** REPAIR the circuit in question. TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	
C5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: All Door Locks Are Inoperative From One Switch

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The SJB sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests. When the lock or unlock switch is pressed, the voltage signal is routed to ground. Ground for the LH door lock control switch is provided through circuit GD133 (BK). Ground for the RH door lock control switch is provided through circuit GD151 (BK/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch

PINPOINT TEST D: ALL DOOR LOCKS ARE INOPERATIVE FROM ONE SWITCH

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
D1 CHECK THE SUSPECT DOOR LOCK CONTROL SWITCH FOR CORRECT OPERATION	
• Disconnect: Inoperative Door Lock Control Switch . • Carry out the door lock control switch component test.	**Yes** REPAIR circuit GD133 (BK) or circuit GD151 (BK/GN) for an open. TEST the system for normal operation.

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Refer to Wiring Diagrams Cell 149 for component testing. • **Is the door lock control switch OK?**	**No** INSTALL a new door lock control switch. REFER to Door Lock Control Switch in this section. TEST the system for normal operation.

Pinpoint Test E: DTC B2574 or B2575

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The SJB sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests. When the lock or unlock switch is pressed, the voltage signal is routed to ground. Ground for the LH door lock control switch is provided through circuit GD133 (BK). Ground for the RH door lock control switch is provided through circuit GD151 (BK/GN).

- DTC B2574 (Drivers Door LOCK Switch Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the lock request input circuit CPL42 (GY/YE).
- DTC B2575 (Drivers Door UNLOCK Switch Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the unlock request input circuit CPL43 (VT/GY).

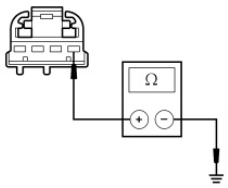
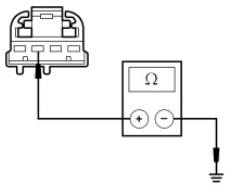
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- SJB

PINPOINT TEST E: DTC B2574 OR B2575

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
E1 CHECK THE RECORDED SJB DTCs FROM THE SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC B2574 or B2575 present?**	**Yes** GO to E2 . **No** GO to Symptom Chart .
E2 CHECK THE LH DOOR LOCK CONTROL SWITCH	
• Disconnect: LH Door Lock Control Switch C505 . • Clear the DTCs and repeat the SJB self-test. • **Is DTC B2574 or B2575 present?**	**Yes** LEAVE the switch disconnected. GO to E3 . **No** INSTALL a new LH door lock control switch. REFER to Door Lock Control Switch in this section. TEST the system for normal operation.

E3 CHECK THE RH DOOR LOCK CONTROL SWITCH	
• Disconnect: RH Door Lock Control Switch C605 . • Clear the DTCs and repeat the SJB self-test. • **Is DTC B2574 or B2575 present?**	**Yes** LEAVE the switch disconnected. GO to E4 . **No** INSTALL a new RH door lock control switch. REFER to Door Lock Control Switch in this section. TEST the system for normal operation.
E4 CHECK THE LOCK INPUT CIRCUIT OR THE UNLOCK INPUT CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280b . • For DTC B2574, measure the resistance between the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side and ground.  N0101970 • For DTC B2575, measure the resistance between the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side and ground.  N0101971 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E5 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
E5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present.	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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• **Is the concern still present?**	

Pinpoint Test F: DTC B1300, B1982, B2250, or B2671

Refer to Wiring Diagrams Cell 110 , Power Door Locks for schematic and connector information.

Normal Operation

The SJB contains the all lock, all unlock, driver unlock, and the liftgate glass release relays. They are all non-servicable relays. All 4 relays receive voltage through SJB fuse 6 (20A) and have an internal SJB ground. Based on input from the door lock control switches, keypad, or Remote Keyless Entry (RKE) the SJB grounds the coil side of the relays, which in turn energizes the relay, and sends voltage to the appropriate output.

If the SJB fuse 6 (20A) has failed or is removed, all 4 DTCs will be present.

DTC Description	Fault Trigger Conditions
• B1300 - Power Door Lock Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to ground or open on the all lock relay coil circuit.
• B1982 - Driver's Door Unlock Relay Coil Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to ground or open on the driver door unlock relay coil circuit.
• B2250 - All Door's - Unlock All Relay Coil Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to ground or open on the all unlock relay coil circuit.
• B2671 - Liftglass Release Relay Coil Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to ground or open on the liftgate glass release relay coil circuit.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- All lock actuators
- Liftgate glass actuator
- SJB

PINPOINT TEST F: DTC B1300, B1982, B2250, OR B2671

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take

F1 RETRIEVE THE RECORDED SJB DTCs FROM THE SELF-TEST	
• Check for recorded SJB DTCs from the self-test. • **Are all 4 DTCs B1300, B1982, B2250, and B2671 recorded?**	**Yes** VERIFY the SJB fuse 6 (20A) is OK. If it has failed, GO to F2 . If it is OK, INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation.
F2 CHECK CIRCUIT CPL59 (BN/BU) FOR A SHORT TO GROUND	
• INSTALL a new SJB fuse 6 (20A). • Operate the liftgate glass actuator by pressing the liftgate glass release switch. • **Is the SJB fuse 6 (20A) OK?**	**Yes** GO to F4 . **No** GO to F3 .
F3 CHECK THE LIFTGATE GLASS ACTUATOR FOR A SHORT	
• Disconnect: Liftgate Glass Actuator C4040 . • INSTALL a new SJB fuse 6 (20A). • Operate the liftgate glass actuator by pressing the liftgate glass release switch. • **Is the SJB fuse 6 (20A) OK?**	**Yes** INSTALL a new liftgate glass actuator. REFER to Liftgate Window Latch Actuator in this section. TEST the system for normal operation. **No** REPAIR circuit CPL59 (BN/BU) for a short to ground. TEST the system for normal operation.
F4 CHECK CIRCUIT CPL11 (GY/BN) FOR A SHORT TO GROUND	
• INSTALL a new SJB fuse 6 (20A). • Operate the door lock actuators by pressing LOCK on the door lock control switch. • **Is the SJB fuse 6 (20A) OK?**	**Yes** REPAIR circuit CPL51 (BU/GN) or CPL52 (VT/GY) for a short to ground. TEST the system for normal operation. **No** REPAIR circuit CPL11 (GY/BN) for a short to ground. TEST the system for normal operation.

Pinpoint Test G: The Liftgate Glass Latch Release Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

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Normal Operation

The SJB does not release the liftgate glass unless the doors have been unlocked electronically or the request is initiated from a Remote Keyless Entry (RKE) transmitter.

The SJB sends a voltage signal to the liftgate glass release switch through circuit CPL45 (BN). When the switch is pressed, the signal is routed to ground through circuit GD143 (BK/VT). When the SJB detects a request from the liftgate glass release switch, the SJB provides voltage to the liftgate glass latch release actuator through circuit CPL59 (BN/BU). Ground for the liftgate glass latch is provided through circuit GD149 (BK/GY).

The liftgate glass release switch circuit CPL45 (BN) changes to CPL45 (GN), and the ground circuit GD143 (BK/VT) changes to GD143 (GN) in the 13412 wiring harness.

- DTC B2667 (Liftglass Release Switch Circuit Failure) - an on-demand DTC that sets when the SJB detects a short to ground on the liftgate glass release switch input circuit.

This pinpoint test is intended to diagnose the following:

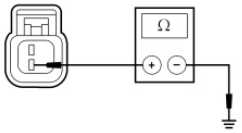
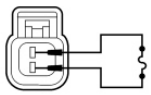
- Wiring, terminals or connectors
- Liftgate glass release switch
- Liftgate glass actuator
- SJB

PINPOINT TEST G: THE LIFTGATE GLASS LATCH RELEASE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

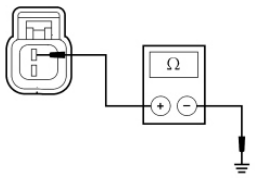
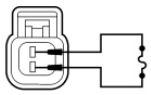
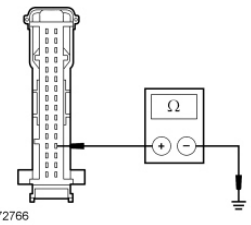
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

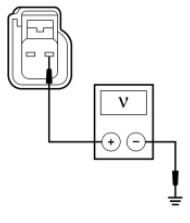
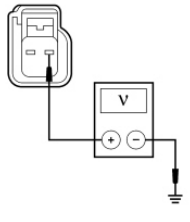
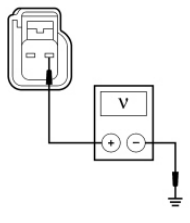
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
G1 CHECK THE DOOR LOCK OPERATION	
• Lock and unlock the doors using a door lock control switch. • **Do the door locks operate correctly?**	**Yes** GO to G2 . **No** GO to Symptom Chart .
G2 CHECK THE RECORDED SJB DTCs FROM THE SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC B2667 present?**	**Yes** GO to G3 . **No** GO to G5 .
G3 CHECK THE LIFTGATE GLASS RELEASE SWITCH (SHORT TO GROUND)	
• Disconnect: Liftgate Glass Release Switch C4039 .	**Yes** GO to G4 .

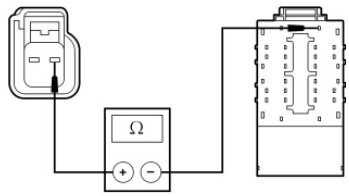
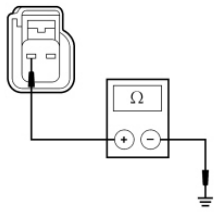
• Clear the DTC and carry out the SJB self-test. • **Is DTC B2667 still present?**	**No** INSTALL a new liftgate glass release switch.
G4 CHECK THE LIFTGATE GLASS RELEASE SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280b . • Measure the resistance between the liftgate glass release switch C4039-2, circuit CPL45 (GN), harness side and ground.  N0058822 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G14 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G5 CHECK THE LIFTGATE GLASS RELEASE SWITCH	
• Disconnect: Liftgate Glass Release Switch C4039 . • Unlock the doors with the door lock control switch. • Connect a fused jumper wire between the liftgate glass release switch C4039-2, circuit CPL45 (GN), harness side and the liftgate glass release switch C4039-1, circuit GD143 (GN), harness side.  N0072765 • **Does the liftgate glass latch release?**	**Yes** INSTALL a new liftgate glass release switch. TEST the system for normal operation. **No** LEAVE the jumper wire connected. GO to G6 .
G6 CHECK FOR SJB DTCs FROM THE SELF-TEST	
• Ignition ON. • With the jumper wire still connected, carry out the SJB self-test. • **Is DTC B2667 retrieved?**	**Yes** REMOVE the jumper wire. GO to G9 . **No** REMOVE the jumper wire. GO to G7 .
G7 CHECK THE GROUND CIRCUIT TO THE SWITCH FOR AN OPEN	

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• Ignition OFF. • Disconnect: Negative Battery Cable . • Measure the resistance between the liftgate glass release switch C4039-1, circuit GD143 (GN), harness side and ground.  N0026505 • **Is the resistance less than 5 ohms?**	**Yes** GO to G8 . **No** REPAIR the circuit. TEST the system for normal operation.
G8 CHECK THE LIFTGATE GLASS RELEASE SWITCH INPUT CIRCUIT FOR AN OPEN	
• Connect a fused jumper wire between the liftgate glass release switch C4039-2, circuit CPL45 (GN), harness side and the liftgate glass release switch C4039-1, circuit GD143 (GN), harness side.  N0072765 • Disconnect: SJB C2280b . • Measure the resistance between the SJB C2280b-29, circuit CPL45 (BN), harness side and ground.  N0072766 • **Is the resistance less than 5 ohms?**	**Yes** GO to G14 . **No** REPAIR circuit CPL45 (BN) for an open. TEST the system for normal operation.
G9 CHECK FOR A SHORT TO VOLTAGE TO THE LIFTGATE GLASS LATCH	
• Disconnect: Liftgate Glass Latch C4040 . • Measure the voltage between the liftgate glass latch C4040-1, circuit CPL59 (BN/BU), harness side and ground.	**Yes** GO to G10 . **No** GO to G11 .

 N0072767 • **Is any voltage present?**	
G10 CHECK CIRCUIT CPL59 (BN/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280a . • Ignition ON. • Measure the voltage between the liftgate glass latch C4040-1, circuit CPL59 (BN/BU), harness side and ground.  N0072767 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to G14 .
G11 CHECK FOR VOLTAGE TO THE LIFTGATE GLASS LATCH	
• Ignition OFF. • Connect: Liftgate Glass Release Switch C4039 . • Unlock the doors with the door lock control switch. • **NOTE:** The SJB only supplies voltage to the liftgate glass latch momentarily. It is important to monitor the meter while pressing the liftgate glass release switch. • While pressing the liftgate glass release switch, measure the voltage between the liftgate glass latch C4040-1, circuit CPL59 (BN/BU), harness side and ground.  N0072767 • **Is the voltage momentarily greater than 10 volts?**	**Yes** GO to G13 . **No** GO to G12 .
G12 CHECK CIRCUIT CPL59 (BN/BU) FOR AN OPEN	

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• Disconnect: SJB C2280a . • Measure the resistance between the liftgate glass latch C4040-1, circuit CPL59 (BN/BU), harness side and the SJB C2280a-31, circuit CPL59 (BN/BU), harness side.  N0072768 • **Is the resistance less than 5 ohms?**	**Yes** GO to G14 . **No** REPAIR the circuit. TEST the system for normal operation.
G13 CHECK THE GROUND CIRCUIT TO THE LATCH FOR AN OPEN	
• Disconnect: Negative Battery Cable . • Measure the resistance between the liftgate glass latch C4040-2, circuit GD149 (BK/GY), harness side and ground.  N0026508 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new liftgate window latch. REFER to Liftgate Window Latch in this section. TEST the system for normal operation. **No** REPAIR circuit GD149 (BK/GY) for an open. TEST the system for normal operation.
G14 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Doors Do Not Lock/Unlock Using The Keyless Entry Keypad

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The SJB monitors for a ground signal on the 12-volt reference circuits CPK29 (GY/BU), CPK30 (VT/GN), and CPK31 (YE/GN) for the keyless entry keypad. When an individual keypad button is pressed, an

individual or a combination of the reference circuits are connected to ground. The SJB then determines which button was pressed based on which circuit(s) has a ground signal. Circuit RPK27 (BU) is the ground for the keypad buttons and is internally grounded in the SJB. Once the SJB determines that the 5-digit personal entry code, or the factory set 5-digit entry code has been entered on the keypad, the SJB then energizes the driver door unlock relay to unlock the driver door.

To unlock all the doors and liftgate, the 3/4 button must be pressed within 5 seconds of the 5-digit code being entered.

To lock all the doors and liftgate, the 5-digit code does not need to be entered. Press the 7/8 and 9/0 buttons at the same time.

The keyless entry keypad has an anti-scan feature to help prevent theft. If a valid 5-digit code is not entered within 7 attempts (35 consecutive button presses), the keyless entry keypad will go into anti-scan mode. In anti-scan mode, the keypad illumination will flash and all input will be ignored except for pressing the 7/8 and 9/0 buttons, which will lock all doors.

- DTC B2695 (Keypad_A Switch Circuit Failure) - an on-demand DTC that sets when the SJB detects a short to ground on a keypad input circuit.
- DTC B2696 (Keypad_B Switch Circuit Failure) - an on-demand DTC that sets when the SJB detects a short to ground on a keypad input circuit.
- DTC B2697 (Keypad_C Switch Circuit Failure) - an on-demand DTC that sets when the SJB detects a short to ground on a keypad input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Keyless entry keypad
- SJB

PINPOINT TEST H: THE DOORS DO NOT LOCK/UNLOCK USING THE KEYLESS ENTRY KEYPAD

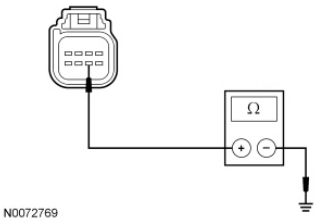
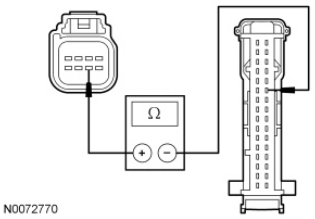
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
H1 CHECK THE SJB KEYCODE PID	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger . • Observe the KEYCODE PID. Read and record the 5-digit factory set entry code. • Enter the 5-digit factory set entry code on the keyless entry keypad. • **Do the doors unlock?**	**Yes** The system is operating as designed. INFORM the customer of the correct system operation. **No** GO to H2 .
H2 RETRIEVE THE RECORDED SJB DTCs FROM THE SELF-TEST	
	Yes

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• Check for recorded SJB DTCs from the self-test. • **Is DTC B2695, B2696, or B2697 recorded?**	GO to H3 . **No** GO to H6 .
H3 REPEAT THE SJB SELF-TEST	
• Disconnect: Keyless Entry Keypad C500 . • Clear the DTCs, then repeat the SJB self-test. • **Is DTC B2695, B2696, or B2697 recorded?**	**Yes** GO to H4 . **No** INSTALL a new keyless entry keypad. REFER to Keyless Entry Keypad in this section. CLEAR the DTCs. REPEAT the self-test.
H4 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280b . • Measure the resistance between the keypad, harness side and ground as follows: **Keypad Connector-Pin** / **Circuit** C500-1 — CPK29 (GY/BU) C500-3 — CPK30 (VT/GN) C500-7 — CPK31 (YE/GN) • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to H5 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
H5 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO CIRCUIT RPK27 (BU)	
• Measure the resistance between the keypad, harness side and ground as follows: **Keypad Connector-Pin** / **Circuits** / **Keypad Connector-Pin** C500-6 — RPK27 (BU) and CPK29 (GY/BU) — C500-1 C500-6 — RPK27 (BU) and CPK30 (VT/GN) — C500-3 C500-6 — RPK27 (BU) and CPK31 (YE/GN) — C500-7 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to H12 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
H6 CHECK THE SJB KEY_PAD PID	

• Enter the following diagnostic mode on the scan tool: SJB DataLogger . • Press each keyless entry keypad button while observing the KEY_PAD PID. • **Does the PID display the correct values?**	**Yes** GO to H12 . **No** GO to H7 .
H7 CHECK FOR GROUND ON CIRCUIT RPK27 (BU)	
• Disconnect: Negative Battery Cable . • Disconnect: Keyless Entry Keypad C500 . • Measure the resistance between the keyless entry keypad C500-6, circuit RPK27 (BU), harness side and ground.  N0072769 • **Is the resistance less than 5 ohms?**	**Yes** GO to H9 . **No** GO to H8 .
H8 CHECK CIRCUIT RPK27 (BU) FOR AN OPEN	
• Disconnect: SJB C2280b . • Measure the resistance between the keyless entry keypad C500-6, circuit RPK27 (BU), harness side and the SJB C2280b-22, circuit RPK27 (BU), harness side.  N0072770 • **Is the resistance less than 5 ohms?**	**Yes** GO to H12 . **No** REPAIR the circuit. TEST the system for normal operation.
H9 CHECK THE KEYLESS ENTRY KEYPAD	
• Connect: Negative Battery Cable . • Ignition ON. • Connect a fused jumper wire between the keyless entry keypad harness side, while monitoring the SJB PID (KEY_PAD) as follows:	**Yes** INSTALL a new keyless entry keypad. REFER to Keyless Entry Keypad in this section. **No** GO to H10 .

Keyless Entry Keypad Connector-Pin/ Circuit	Keyless Entry Keypad Connector-Pin/ Circuit	SJB PID (KEY_PAD) Value

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C500-1 CPK29 (GY/BU)	C500-6 RPK27 (BU)	1/2
C500-3 CPK30 (VT/GN)	C500-6 RPK27 (BU)	7/8
C500-7 CPK31 (YE/GN)	C500-6 RPK27 (BU)	9/0

- **Does the PID display the correct values?**

H10 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN), AND CPK31 (YE/GN) FOR AN OPEN

- Ignition OFF.
- Disconnect: SJB C2280b .
- Measure the resistance between the SJB, harness side and the keyless entry keypad, harness side as follows:

SJB Connector-Pin	Circuit	Keyless Entry Keypad Connector-Pin
C2280b-23	CPK29 (GY/BU)	C500-1
C2280b-24	CPK30 (VT/GN)	C500-3
C2280b-25	CPK31 (YE/GN)	C500-7
C2280b-22	RPK27 (BU)	C500-6

- **Are the resistances less than 5 ohms?**

Yes
GO to H11 .

No
REPAIR the circuit in question. TEST the system for normal operation.

H11 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO EACH OTHER

- Measure the resistance between the keypad, harness side as follows:

Keypad Connector-Pin	Circuits	Keypad Connector-Pin
C500-1	CPK29 (GY/BU) and CPK30 (VT/GN)	C500-3
C500-1	CPK29 (GY/BU) and CPK31 (YE/GN)	C500-7

Yes
GO to H12 .

No
REPAIR the circuit in question. TEST the system for normal operation.

C500-3	CPK30 (VT/GN) and CPK31 (YE/GN)	C500-7	

- **Are the resistances greater than 10,000 ohms?**

Test Step	Result / Action to Take
H12 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Keyless Entry Keypad Illumination Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When the SJB detects a keyless entry keypad button is pressed, the SJB provides voltage to the keyless entry keypad through circuit CPK28 (GN/BK). Ground for the keyless entry keypad is provided through circuit GD133 (BK).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Keyless entry keypad
- SJB

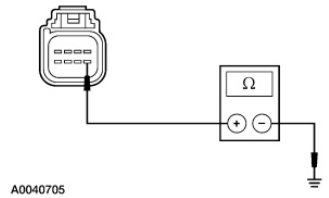
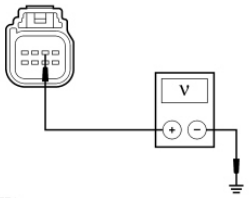
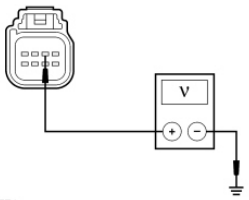
PINPOINT TEST I: THE KEYLESS ENTRY KEYPAD ILLUMINATION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

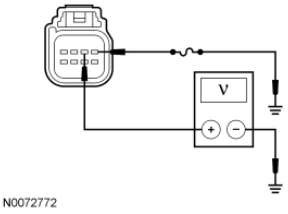
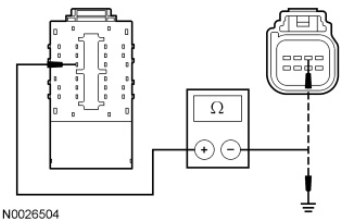
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
I1 CHECK THE SJB KEYPAD SWITCH PIDs	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger . • Observe the SJB PID (KEY_PAD) while pressing each keyless entry keypad button.	**Yes** GO to I2 . **No** GO to Pinpoint Test H .

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• **Do the PID values agree with the keypad button positions?**	
I2 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable . • Disconnect: Keyless Entry Keypad C500 . • Measure the resistance between the keyless entry keypad C500-5, circuit GD133 (BK), harness side and ground.  A0040705 • **Is the resistance less than 5 ohms?**	**Yes** GO to I3 . **No** REPAIR the circuit. TEST the system for normal operation.
I3 CHECK FOR CONSTANT VOLTAGE	
• Connect: Negative Battery Cable . • Ignition ON. • Measure the voltage between the keyless entry keypad C500-2, circuit CPK28 (GN/BK), harness side and ground.  N0072771 • **Is any voltage present?**	**Yes** GO to I4 . **No** GO to I5 .
I4 CHECK CIRCUIT CPK28 (GN/BK) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280a . • Ignition ON. • Measure the voltage between the keyless entry keypad C500-2, circuit CPK28 (GN/BK), harness side and ground.  N0072771	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to I7 .

• **Is any voltage present?**	
I5 CHECK FOR SJB OUTPUT	
• Ignition OFF. • Measure the voltage between the keyless entry keypad C500-2, circuit CPK28 (GN/BK), harness side and ground while connecting a fused (5A) jumper wire between the keyless entry keypad C500-1, circuit CPK29 (GY/BU), harness side and ground.  N0072772 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new keyless entry keypad. REFER to Keyless Entry Keypad in this section. TEST the system for normal operation. **No** GO to I6 .
I6 CHECK CIRCUIT CPK28 (GN) FOR AN OPEN OR A SHORT TO GROUND	
• Disconnect: SJB C2280a . • Measure the resistance between the SJB C2280a-18, circuit CPK28 (WH/GN), harness side and the keyless entry keypad C500-2, circuit CPK28 (GN/BK), harness side; and between the SJB C2280a-18, circuit CPK28 (WH/GN), harness side and ground.  N0026504 • **Is the resistance less than 5 ohms between the SJB and the keyless entry keypad; and greater than 10,000 between the SJB and ground?**	**Yes** GO to I7 . **No** REPAIR the circuit. TEST the system for normal operation.
I7 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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Pinpoint Test J: The Remote Keyless Entry (RKE) Transmitter Is Inoperative

Normal Operation

Remote locking and unlocking of the doors is accomplished by the SJB receiving a command message from the RKE transmitter. The SJB energizes the appropriate relays to lock or unlock the doors. The RKE transmitters and SJB also utilize a rolling code to prevent the code from being "captured" by a code grabber. The system advances the counter in the RKE transmitter and SJB every time an RKE transmitter button is pressed.

- DTC B2425 (Remote Keyless Entry Out of Synchronization) - a continuous DTC that sets when the SJB detects the rolling counter received from an RKE transmitter is 1,024 times greater than the rolling counter stored in the module.

This pinpoint test is intended to diagnose the following:

- RKE transmitter
- RKE transmitter battery
- RKE transmitter button pressed a substantial amount of times while outside the range of the vehicle
- RKE transmitter programming
- SJB

PINPOINT TEST J: THE RKE TRANSMITTER IS INOPERATIVE

NOTE: All RKE transmitters must be present to begin diagnosis of the RKE system.

NOTE: Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.

Test Step	Result / Action to Take
J1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• **NOTE:** Make sure the RKE transmitters are ones provided with the OEM system and not from an aftermarket system, or a dealer-installed system that may have been installed on the vehicle. • Check that the correct RKE transmitters are used with the vehicle. • **Are all the correct RKE transmitters present?**	**Yes** GO to J2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters must be present to proceed with diagnosis of the system.
J2 CHECK IF THE RKE TRANSMITTER IS OUT OF SYNCHRONIZATION WITH THE SJB	
• Check the recorded results from the SJB self-test. • **Is continuous DTC B2425 present?**	**Yes** GO to J3 . **No** GO to J7 .
J3 RESYNCHRONIZE THE INOPERATIVE RKE	

TRANSMITTER	
• Ignition OFF. • Press any button on the inoperative RKE transmitter 4 times consecutively within 30 seconds. • **Does the RKE transmitter operate correctly now?**	**Yes** The transmitter is now synchronized. CLEAR the DTCs. REPEAT the self-test. **No** GO to J4 .
J4 CHECK FOR A SECOND RKE TRANSMITTER	
• Check for another RKE transmitter that operates with the vehicle. • **Is there another RKE transmitter that operates with the vehicle?**	**Yes** GO to J5 . **No** GO to J6 .
J5 RESYNCHRONIZE THE INOPERATIVE RKE TRANSMITTER USING THE SECOND RKE TRANSMITTER	
• Press any button on the operational RKE transmitter. • Within 30 seconds, press a button on the inoperative RKE transmitter. • Check the inoperative RKE transmitter for correct operation. • **Does the inoperative RKE transmitter operate now?**	**Yes** The RKE transmitter is now synchronized. CLEAR the DTCs. REPEAT the self-test. **No** GO to J6 .
J6 PROGRAM THE INOPERATIVE RKE TRANSMITTER OR ALL THE RKE TRANSMITTERS	
• Program the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. Refer to Remote Keyless Entry (RKE) Transmitter Programming in this section. • **Does the inoperative RKE transmitter(s) operate now?**	**Yes** The transmitter(s) is now synchronized. INFORM the customer that any RKE transmitters not present need to be programmed. CLEAR the DTCs. REPEAT the self-test. **No** GO to J7 .
J7 MAKE SURE THE RKE TRANSMITTER SIGNAL IS BEING RECEIVED	
• Enter the following diagnostic mode on the scan tool: Remote Keyless Entry . • **NOTE:** The remote keyless entry test is accessed through the scan tool by selecting Toolbox, Body, Security. • Monitor the RKE Transmitter Identification Code (TIC) and the last command received through the scan tool menus. • Verify the RKE transmitter signal is being received. Press a button on the RKE transmitter while observing the scan tool. • **Does the TIC and RKE command show up on the scan tool screen when a button is pressed?**	**Yes** GO to J8 . **No** GO to J9 .

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J8 CHECK IF THE RKE TRANSMITTERS ARE PROGRAMMED	
• Enter the following diagnostic mode on the scan tool: Remote Keyless Entry . • Monitor the RKE transmitter TIC through the scan tool menus. • Verify the RKE transmitters are programmed to the vehicle. • **Does the TIC displayed under the RKE transmitter match any of the TICs stored in memory?**	**Yes** GO to J11 . **No** PROGRAM the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. REFER to Remote Keyless Entry (RKE) Transmitter Programming in this section. TEST the system for normal operation.
J9 CHECK THE RKE TRANSMITTER BATTERY	
• Using a thin coin, open the RKE transmitter. • Do not clean off any grease from the battery terminals on the back surface of the circuit board. • Verify the correct battery is used (CR2032). • Remove the RKE transmitter battery and measure the voltage. • **Is the voltage greater than 2.5 volts?**	**Yes** GO to J10 . **No** INSTALL a new battery. DO NOT reprogram the RKE transmitters (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.
J10 CHECK FOR NORMAL OPERATION WITH A KNOWN GOOD RKE TRANSMITTER	
• Enter the following diagnostic mode on the scan tool: Remote Keyless Entry . • Monitor the RKE transmitter TIC through the scan tool menus. • Using the customer's second RKE transmitter or a known good RKE transmitter that is correct for the vehicle (and programmed to the vehicle), verify the RKE transmitter signal is being received. • **Does the TIC show up on the scan tool when a button is pressed on the RKE transmitter?**	**Yes** PROGRAM the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. REFER to Remote Keyless Entry (RKE) Transmitter Programming in this section. TEST the system for normal operation. **No** GO to J11 .
J11 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: An Individual Button/Feature Is Inoperative From The Remote Keyless Entry (RKE) Transmitter

Normal Operation

When any Remote Keyless Entry (RKE) transmitter button is pressed, the SJB receives and processes the command to provide the appropriate output.

NOTE: The panic feature will only operate when the key is in the OFF position.

This pinpoint test is intended to diagnose the following:

- All door locks
- Horn system
- Liftgate glass latch
- Parking lamps
- RKE transmitter

PINPOINT TEST K: AN INDIVIDUAL BUTTON/FEATURE IS INOPERATIVE FROM THE RKE TRANSMITTER

Test Step	Result / Action to Take
K1 VERIFY THE DOOR LOCK OPERATION	
• Press the lock and unlock button from the driver door lock control switch while observing the door lock operation. • **Do the door locks operate correctly?**	**Yes** GO to K2 . **No** GO to Symptom Chart .
K2 VERIFY THE HORN OPERATION	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger . • Select the SJB PID (HORNRLY) and active command the horn on. • **Does the horn sound when commanded on?**	**Yes** GO to K3 . **No** REFER to Section 413-06 .
K3 VERIFY THE PARKING LAMP OPERATION	
• Place the headlamp switch in the PARKLAMP position. • **Do the parking lamps operate correctly?**	**Yes** For Explorer/Mountaineer, GO to K4 . For Sport Trac, REPLACE the inoperative RKE transmitter. PROGRAM the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. REFER to Remote Keyless Entry (RKE) Transmitter Programming in this section. TEST the system for normal operation. **No** REFER to Section 417-01 .

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K4 VERIFY THE LIFTGATE GLASS LATCH OPERATION	
• **NOTE:** The liftgate must be unlocked before verifying the liftgate glass release operation. • Press the liftgate glass release button on the liftgate. • **Does the liftgate glass release?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. REFER to Remote Keyless Entry (RKE) Transmitter Programming in this section. TEST the system for normal operation. **No** GO to Pinpoint Test G .

Pinpoint Test L: The Remote Keyless Entry (RKE) Transmitter Has Poor Range Performance

Normal Operation

The Remote Keyless Entry (RKE) transmitter has a normal operating range of 10 m (33 ft). The SJB has an internal antenna to receive the RKE transmitter signal. When the SJB receives a command from a programmed RKE transmitter, the SJB processes the command to provide the appropriate output.

This pinpoint test is intended to diagnose the following:

- Environmental interference
- RKE transmitter
- RKE transmitter battery
- SJB

PINPOINT TEST L: THE RKE TRANSMITTER HAS POOR RANGE PERFORMANCE

NOTE: All RKE transmitters must be present to begin diagnosis of the RKE system.

NOTE: Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems must be disconnected before diagnosing any RKE concerns.

Test Step	Result / Action to Take
L1 CHECK FOR THE CORRECT RKE TRANSMITTERS	
• **NOTE:** Make sure the RKE transmitters are ones provided with the OEM system and not from an aftermarket system, or a dealer-installed system, that may have been installed on the vehicle. • Check that the correct RKE transmitters are used with the vehicle. • **Are all the correct RKE transmitters present?**	**Yes** GO to L2 . **No** The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters must be present to proceed with diagnosis of the system.
L2 CHECK ALL RKE TRANSMITTERS FOR POOR RANGE PERFORMANCE	

• **NOTE:** The 10 m (33 ft) measurement of range is not the standard but is a guideline that clearly indicates a vehicle is experiencing normal range performance. • Check all RKE transmitters for poor range performance (less than 10 m [33 ft]). • **Do all RKE transmitters experience poor range performance?**	**Yes** GO to L4 . **No** GO to L3 .
L3 CHECK THE RKE TRANSMITTER BATTERY	
• Using a thin coin, open the RKE transmitter. • Do not clean off any grease from the battery terminals on the back surface of the circuit board. • Verify the correct battery is used (CR2032). • Remove the RKE transmitter battery and measure the voltage. • **Is the voltage greater than 2.5 volts?**	**Yes** REPLACE the inoperative RKE transmitter. PROGRAM the inoperative RKE transmitter individually using a scan tool or program all RKE transmitters using the manual key cycle method. REFER to Remote Keyless Entry (RKE) Transmitter Programming in this section. TEST the system for normal operation. **No** INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the RKE transmitters (weak or dead batteries do not erase Transmitter Identification Codes (TICs) from memory). TEST the system for normal operation.
L4 CHECK THE LOCATION OF THE VEHICLE AND THE APPROACH ANGLES AROUND THE VEHICLE	
• Make sure the poor performance is consistent in nature and is not from one approaching angle. • RKE transmitter range performance may be degraded in certain locations. For example, if the vehicle is within 0.5 miles (0.8 km) of high-power devices or radio/TV towers, the operating distance of the transmitters may be reduced. • **Is the poor range performance consistent around the vehicle?**	**Yes** GO to L5 . **No** The system is operating correctly at this time. The range may have been affected by environmental interference.
L5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly.	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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• Operate the system and verify the concern is still present. • **Is the concern still present?**	

Pinpoint Test M: The Autolock Does Not Operate Correctly

Normal Operation

When autolock is enabled the SJB requires the following inputs:

- Transmission Range (TR) sensor
- Door ajar switches (all doors closed)
- Ignition switch position
- Vehicle speed

The vehicle speed and TR sensor inputs are received through the Controller Area Network (CAN). Once the SJB receives all 4 inputs, the doors automatically lock.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door ajar switches
- Ignition switch
- Vehicle speed signal
- SJB

PINPOINT TEST M: THE AUTOLOCK DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
M1 VERIFY THE AUTOLOCK FEATURE IS ENABLED	
• Verify the autolock feature is enabled. Refer to Autolock and Auto-Unlock Programming in this section. • **Is the autolock feature enabled?**	**Yes** GO to M2 . **No** PROGRAM the autolock feature. REFER to Autolock and Auto-Unlock Programming in this section.
M2 CHECK THE COURTESY LAMP OPERATION	
• Open and close each door, liftgate and liftgate window glass while checking the courtesy lamp operation. • **Do the courtesy lamps operate correctly?**	**Yes** GO to M3 . **No** REFER to Section 417-02 .
M3 CHECK THE SJB PIDs	
• Ignition ON.	**Yes** GO to M4 .

• Enter the following diagnostic mode on the scan tool: SJB DataLogger . • Monitor the SJB transmission gear selected PID (TRANSGEAR). • Monitor the SJB ignition switch status PID (GEM-IGN). • Monitor the SJB vehicle speed PID (VSS_GEM). • **Are the correct values received?**	**No** To diagnose an incorrect vehicle speed PID, REFER to Section 206-09 . To diagnose an incorrect transmission gear selected PID, REFER to Section 307-01A or Section 307-01B . To diagnose an incorrect ignition switch status PID, REFER to Section 211-05 .
M4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Smart Unlock Does Not Operate Correctly

Normal Operation

The smart unlock feature is controlled by the SJB. The SJB unlocks all doors after 1 second if the key is in the ignition and either front door is open when the vehicle is locked with a door lock control switch.

The doors can still be locked by using the manual door lock rod, a Remote Keyless Entry (RKE) transmitter, or the keyless entry keypad.

This pinpoint test is intended to diagnose the following:

- Key-in-ignition switch
- LH front door ajar switch
- SJB

PINPOINT TEST N: THE SMART UNLOCK DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
N1 CHECK THE KEY-IN-IGNITION WARNING CHIME	
• Insert the key in the ignition lock cylinder. • Open the driver door. • **Does the key-in-ignition warning chime work correctly?**	**Yes** GO to N2 . **No** REFER to Section 413-01 .

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N2 CHECK THE COURTESY LAMP OPERATION	
• Open and close each door, liftgate and liftgate window glass while checking the courtesy lamp operation. • **Do the courtesy lamps operate correctly?**	**Yes** GO to N3 . **No** REFER to Section 417-02 .
N3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Auto-Unlock Does Not Operate Correctly

Normal Operation

The SJB energizes the unlock relay based on input from the ajar switches and the vehicle speed signal. The SJB unlocks the doors when the following conditions are met:

- The vehicle speed has exceeded 20 km/h (12 mph), for a minimum of 2 seconds, then dropped to 0 km/h (0 mph) (vehicle stopped).
- The key is turned to the OFF or ACC position.
- The LH front door is opened within 10 minutes of the key being turned to the OFF or ACC position.

The auto-unlock feature is cancelled if the doors are locked with the door lock control switch or the Remote Keyless Entry (RKE) transmitter within the 10 minute active window or if the 10 minute active window expires.

This pinpoint test is intended to diagnose the following:

- Door ajar switches
- Vehicle speed signal
- SJB

PINPOINT TEST O: THE AUTO-UNLOCK DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
O1 CHECK IF THE AUTO-UNLOCK IS ENABLED	
• Verify the auto-unlock feature is enabled. Refer to Autolock and Auto-Unlock	**Yes** GO to O2 .

Programming in this section. • **Is the auto-unlock enabled?**	**No** Enable the auto-unlock. REFER to Autolock and Auto-Unlock Programming in this section. TEST the system for normal operation.
O2 CHECK THE COURTESY LAMP OPERATION	
• Open and close each door while observing the courtesy lamp operation. • **Do the courtesy lamps operate correctly?**	**Yes** GO to O3 . **No** REFER to Section 417-02 .
O3 CHECK THE SJB IGNITION STATUS PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger . • Monitor the SJB PID (GEM_IGN). • **Does the ignition status PID indicate RUN?**	**Yes** GO to O4 . **No** REFER to Section 211-05 .
O4 CHECK THE VEHICLE SPEED OPERATION	
• Check the operation of the speedometer. • **Does the speedometer operate correctly?**	**Yes** GO to O5 . **No** REFER to Section 413-01 .
O5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: Hard To Open/Close Door From Either Door Handle

Normal Operation

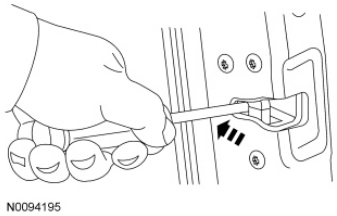
The door latch can be actuated from the interior or exterior door handle. When actuated, the door latch releases and allows the door to open. If the door latch or the door hinges have insufficient lubrication or if the striker or door are misaligned, it causes extra force to be used when opening or closing the door.

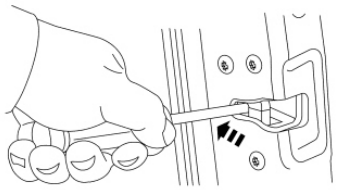
This pinpoint test is intended to diagnose the following:

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- Door alignment
- Door hinges
- Striker adjustment
- Door latch

PINPOINT TEST P: HARD TO OPEN/CLOSE DOOR FROM EITHER DOOR HANDLE

Test Step	Result / Action to Take
P1 CHECK THE LATCH OPERATION FROM BOTH DOOR HANDLES	
• Open and close the door using both the interior and exterior door handles. • **Does the door open normally from one of the door handles?**	**Yes** If the door is difficult/does not open from the exterior door handle, GO to Pinpoint Test Q . If the door is difficult/does not open from the interior door handle, GO to Pinpoint Test R . **No** If the door does not operate correctly from both door handles, GO to P2 .
P2 CHECK THE LATCH OPERATION	
• Open the door. • Using a screwdriver, fully close the latch (two clicks).  N0094195 • Verify that the latch releases easily while pulling on the interior/exterior door handle. • **Does the latch release easily?**	**Yes** GO to P4 . **No** GO to P3 .
P3 CHECK THE LATCH OPERATION AFTER LUBRICATION	
• Lubricate the door latch. REFER to Latch Lubrication in this section. • Using a screwdriver, fully close the latch (two clicks).	**Yes** The concern was caused by an insufficiently lubricated door latch. **No** INSTALL a new door latch. REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation.

 N0094195 • Verify that the latch releases easily while pulling on the interior/exterior door handle. • **Does the latch release easily?**	
P4 CHECK THE STRIKER ADJUSTMENT	
• Check the adjustment of the striker. REFER to Section 501-03 . • **Is the striker adjusted correctly?**	**Yes** GO to P5 . **No** ADJUST the striker as necessary. TEST the system for normal operation.
P5 CHECK THE DOOR ALIGNMENT	
• Check the alignment of the door. REFER to Section 501-03 . • **Is the door aligned correctly?**	**Yes** LUBRICATE the door hinges. TEST the system for normal operation. **No** ADJUST the door as necessary. TEST the system for normal operation.

Pinpoint Test Q: A Door Is Difficult/Does Not Open From The Exterior Door Handle

Normal Operation

The exterior door handle is connected to the door latch with an actuating rod. When the exterior door handle is pulled it causes the actuating rod to push down on the latch lever. The actuating rod can be adjusted for proper exterior door handle operation. When the latch lever is moved, the door latch releases, allowing the door to open.

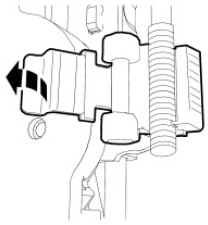
This pinpoint test is intended to diagnose the following:

- Broken or binding linkage
- Exterior door handle to latch rod adjustment
- Exterior door handle
- Door latch

PINPOINT TEST Q: A DOOR IS DIFFICULT/DOES NOT OPEN FROM THE EXTERIOR DOOR HANDLE

Test Step	Result / Action to Take
Q1 CHECK THE LATCH OPERATION FROM BOTH DOOR HANDLES	
	Yes

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• Open and close the door using both the interior and exterior door handles. • **Does the door open normally from one of the door handles?**	If the door is difficult/does not open from only the exterior door handle, GO to Q2 . **No** If the door does not operate correctly from both door handles, GO to Pinpoint Test P .
Q2 CHECK THE EXTERIOR DOOR HANDLE	
• Remove the door trim panel. Refer to Section 501-05 . • Open the clip and disconnect the exterior door handle actuating rod.  N0088081 • Pull and release the exterior door handle. • **Does the exterior door handle operate correctly?**	**Yes** GO to Q3 . **No** INSTALL a new exterior door handle. REFER to Exterior Front Door Handle or Exterior Rear Door Handle in this section. TEST the system for normal operation.
Q3 CHECK THE EXTERIOR DOOR HANDLE AND LINKAGE OPERATION	
• Operate the exterior door handle while observing the linkage. • **Are any of the exterior door handle components or linkages binding or broken?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** GO to Q4 .
Q4 CARRY OUT THE EXTERIOR DOOR HANDLE ADJUSTMENT	
• Carry out the exterior door handle to latch rod adjustment. Refer to Door Handle to Latch Rod Adjustment in this section. • **Does the exterior door handle operate correctly?**	**Yes** The concern was caused by an improperly adjusted exterior door handle. **No** INSTALL a new door latch. REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation.

Pinpoint Test R: A Door Is Difficult/Does Not Open From The Interior Door Handle

Normal Operation

The interior door handle is connected to the door latch by an actuating cable. When the interior door handle is pulled it causes the cable to pull on the latch lever. When the latch lever is moved, the door latch releases, allowing the door to open.

This pinpoint test is intended to diagnose the following:

- Broken or binding cable/linkage
- Door latch

PINPOINT TEST R: A DOOR IS DIFFICULT/DOES NOT OPEN FROM THE INTERIOR DOOR HANDLE

Test Step	Result / Action to Take
R1 CHECK THE LATCH OPERATION FROM BOTH DOOR HANDLES	
• Open and close the door using both the interior and exterior door handles. • **Does the door open normally from one of the door handles?**	**Yes** If the door is difficult/does not open from only the interior door handle, GO to R2 . **No** If the door does not operate correctly from both door handles, GO to Pinpoint Test P .
R2 CHECK THE INTERIOR DOOR HANDLE AND CABLE/LINKAGE OPERATION	
• Remove the door trim panel. Refer to Section 501-05 . • Install the interior door handle back onto the release cable. • Operate the interior door handle while observing the cable/linkage. • **Are any of the interior door handle components or cable/linkages binding or broken?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** INSTALL a new door latch. REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation.

Pinpoint Test S: Exterior Door Release Handle Sticks

Normal Operation

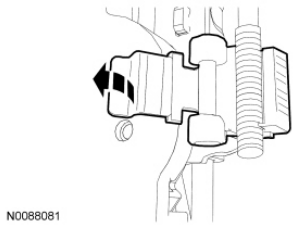
The exterior door handle is connected to the door latch with an actuating rod. When the exterior door handle is pulled it causes the actuating rod to push down on the latch lever. The actuating rod can be adjusted for proper exterior door handle operation. When the latch lever is moved, the door latch releases, allowing the door to open. The handle has a return spring to make sure the handle returns to a closed position.

This pinpoint test is intended to diagnose the following:

- Binding linkage
- Broken handle return spring
- Exterior door handle adjustment
- Door latch

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PINPOINT TEST S: EXTERIOR DOOR RELEASE HANDLE STICKS

Test Step	Result / Action to Take
S1 CHECK FOR A BROKEN RETURN SPRING	
• Remove the door trim panel. Refer to Section 501-05 . • Open the clip and disconnect the exterior door handle actuating rod.  N0088081 • Pull and release the exterior door handle. • **Does the exterior door handle return to a closed position once released?**	**Yes** GO to S2 . **No** INSTALL a new exterior door handle. REFER to Exterior Front Door Handle or Exterior Rear Door Handle in this section. TEST the system for normal operation.
S2 CARRY OUT THE EXTERIOR DOOR HANDLE ADJUSTMENT	
• Carry out the exterior door handle to latch rod adjustment. Refer to Door Handle to Latch Rod Adjustment in this section. • **Does the exterior door handle operate correctly?**	**Yes** The concern was caused by an improperly adjusted exterior door handle. **No** GO to S3 .
S3 CHECK THE EXTERIOR DOOR HANDLE AND LINKAGE OPERATION	
• Operate the exterior door handle while observing the linkage. • **Are any of the exterior door handle components or linkages binding?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** INSTALL a new door latch. REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation.

Pinpoint Test T: Interior Door Release Handle Sticks

Normal Operation

The interior door handle is connected to the door latch by an actuating cable. When the interior door handle is pulled it causes the cable to pull on the latch lever. When the latch lever is moved, the door latch releases, allowing the door to open. The handle has a return spring to make sure the handle returns to a closed position.

This pinpoint test is intended to diagnose the following:

- Binding cable

- Broken handle return spring
- Door latch

PINPOINT TEST T: INTERIOR DOOR RELEASE HANDLE STICKS

Test Step	Result / Action to Take
T1 CHECK FOR A BROKEN RETURN SPRING	
• Remove the interior door handle. Refer to Interior Door Handle - Front or Interior Door Handle - Rear in this section. • Pull and release the interior door handle. • **Does the interior door handle return to a closed position once released?**	**Yes** GO to T2 . **No** INSTALL a new interior door handle. REFER to Interior Door Handle - Front or Interior Door Handle - Rear in this section. TEST the system for normal operation.
T2 CHECK THE INTERIOR DOOR HANDLE CABLE OPERATION	
• Remove the door latch release cable. • Observe the door latch release cable for any damage or binding. • **Is the door latch release cable OK?**	**Yes** INSTALL a new door latch. REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation. **No** REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test U: Squeak/Rattle/Chucking Noise From Door

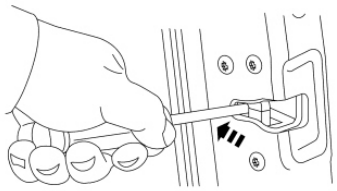
This pinpoint test is intended to diagnose the following:

- Door alignment
- Striker adjustment
- Door latch

PINPOINT TEST U: SQUEAK/RATTLE/CHUCKING NOISE FROM DOOR

Test Step	Result / Action to Take
U1 CHECK FOR ANY LOOSE COMPONENTS	
• Remove the door trim panel. REFER to Section 501-05 . • Inspect inside the door for any loose components.	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** GO to U2 .

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• **Are there any loose components inside the door?**	
U2 CHECK THE STRIKER ADJUSTMENT	
• Check the adjustment of the striker. REFER to Section 501-03 . • **Is the striker adjusted correctly?**	**Yes** GO to U3 . **No** ADJUST the striker as necessary. TEST the system for normal operation.
U3 CHECK THE DOOR ALIGNMENT	
• Check the alignment of the door. REFER to Section 501-03 . • **Is the door aligned correctly?**	**Yes** GO to U4 . **No** ADJUST the door as necessary. TEST the system for normal operation.
U4 CHECK THE LATCH OPERATION AFTER LUBRICATION	
• Lubricate the door latch. REFER to Latch Lubrication in this section. • Using a screwdriver, fully close the latch (two clicks).  N0094195 • Operate the door latch and listen for the noise. • **Is the original noise still present after the latch is lubricated?**	**Yes** INSTALL a new door latch. REFER to Front Door Latch or Rear Door Latch in this section. TEST the system for normal operation. **No** The concern was caused by an insufficiently lubricated door latch.

Pinpoint Test V: Manual Door Lock Cylinder Inoperative

Normal Operation

The door lock cylinder is connected to the door latch via a lock rod and can be used to manually lock/unlock a door.

This pinpoint test is intended to diagnose the following:

- Bent or binding lock rod and lever
- Door lock cylinder
- Door latch

PINPOINT TEST V: MANUAL DOOR LOCK CYLINDER INOPERATIVE

Test Step	Result / Action to Take
V1 CHECK THE LOCK CYLINDER OPERATION AFTER LUBRICATION	
• Spray a lock lubricant such as Motorcraft XL-1 into the lock cylinder opening for a couple seconds. • Operate the door lock cylinder with the key. • **Does the door lock and unlock using the door lock cylinder?**	**Yes** The concern was caused by an insufficiently lubricated lock cylinder. Spray a multi-purpose grease such as Motorcraft XL-5 into the lock cylinder for a couple seconds to provide long term lubrication. **No** GO to V2 .
V2 CHECK THE DOOR LOCK CYLINDER	
• Remove the door lock cylinder. Refer to Door Lock Cylinder in this section. • Operate the door lock cylinder with the key. • **Does the door lock cylinder rotate freely to both lock and unlock positions?**	**Yes** GO to V3 . **No** INSTALL a new door lock cylinder. REFER to Door Lock Cylinder in this section. TEST the system for normal operation.
V3 CHECK THE DOOR LOCK CYLINDER LINKAGE	
• Operate the door lock cylinder while observing the linkage. • **Is the door lock cylinder rod and lever bent or binding?**	**Yes** REPAIR as necessary. TEST the system for normal operation. **No** INSTALL a new door latch. REFER to Front Door Latch in this section. TEST the system for normal operation.

Pinpoint Test W: Unable To Remove The Key From The Ignition Lock Cylinder

Refer to Wiring Diagrams Cell 37 , Shift Interlock for schematic and connector information.

Normal Operation

The ignition switch contains a key removal inhibit solenoid. The solenoid prevents the ignition lock cylinder to be turned to lock and the key removed any time the transmission selector lever is in any position except park. The inhibit solenoid receives voltage at all times from the Smart Junction Box (SJB) fuse 8 (15A) on circuit SBP08 (VT/RD). When the transmission selector lever is in any gear except park, the selector switch closes and connects circuit GD138 (BK/WH) to circuit CDC41 (WH/BN), which supplies ground to the solenoid.

This pinpoint test is intended to diagnose the following:

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- Wiring, terminals or connectors
- Transmission selector lever
- Binding steering column components
- Ignition lock cylinder
- Ignition switch

PINPOINT TEST W: UNABLE TO REMOVE THE KEY FROM THE IGNITION LOCK CYLINDER

Test Step	Result / Action to Take
W1 CHECK FOR AN ENERGIZED KEY REMOVAL INHIBIT SOLENOID	
• Remove the SJB fuse 8 (15A). • Attempt to turn the ignition key to the run position and then back to the lock position and remove the key. • **Does the ignition lock cylinder turn to the lock position and can the key be removed?**	**Yes** REFER to Section 211-05 to continue diagnosis of the key removal inhibit solenoid system. **No** GO to W2 .
W2 CHECK THE IGNITION LOCK CYLINDER FOR BINDING	
• Remove the ignition lock cylinder. REFER to Ignition Lock Cylinder - Functional in this section. • Rotate the ignition lock cylinder through all positions using the key. • **Does the ignition lock cylinder freely rotate through all positions and can the key be removed from the lock cylinder?**	**Yes** REFER to Section 211-05 to continue diagnosis of the steering column for any binding steering column components or ignition switch. **No** INSTALL a new ignition lock cylinder. REFER to Ignition Lock Cylinder - Functional in this section. TEST the system for normal operation.

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Remote Keyless Entry (RKE) Transmitter Programming

NOTE: All Remote Keyless Entry (RKE) transmitters must be programmed at the same time.

NOTE: Programming of the RKE transmitters can be accomplished using a scan tool or by carrying out the following steps.

1. The vehicle must be electronically unlocked before entering program mode using the RKE transmitter, keyless entry keypad (if equipped) or door lock control switch while the driver door is open.

2. Turn the key from OFF to RUN 8 times within 10 seconds, with the eighth turn ending in RUN. If the module successfully enters the program mode, it locks and then unlocks all doors.

3. Within 20 seconds, press any button on an RKE transmitter, and the doors lock and then unlock to confirm that the RKE transmitter is programmed. Repeat this step for each RKE transmitter.

4. If the door locks do not respond for any RKE transmitter, wait several seconds and press the button again. If the door locks still fail to respond, refer to Handles, Locks, Latches and Entry Systems in this section. Make sure that no more than the maximum number of 6 RKE transmitters are attempted to be programmed.

5. Exiting the programming mode is accomplished if one of the following occurs:
   - The key transitions to the OFF position.
   - Twenty seconds have passed since entering programming mode or since the last RKE transmitter was programmed.
   - The maximum number of 6 RKE transmitters have been programmed.

Remote Memory Activation

1. Position the driver seat and adjustable pedals to the desired position.

2. Press the set button on the lower center of the instrument panel.

3. Within 5 seconds press one control on the Remote Keyless Entry (RKE) transmitter and then the 1 or 2 button on the lower center of the instrument panel to associate the RKE transmitter to the driver 1 or the driver 2 position. This stores the configuration for driver 1 or driver 2.

4. If a second memory setting is desired, repeat the procedure with the second RKE transmitter.

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Remote Memory Deactivation

1. Press the set button on the lower center of the instrument panel.

2. Within 5 seconds press one control on the Remote Keyless Entry (RKE) transmitter and then the set button on the lower center of the instrument panel to associate the RKE transmitter to the driver 1 or the driver 2 position.

3. If a second memory setting is desired to be deactivated, repeat the procedure with the second RKE transmitter.

Keyless Entry Keypad Code Programming

NOTE: A maximum of 3 personal entry codes can be programmed into the vehicle. The personal entry codes can be associated with up to two memory seat/adjustable pedal settings.

1. Enter the permanent factory keyless entry keypad code.
2. Press the 1/2 button within 5 seconds to activate the programming mode. Holding the 1/2 button for more than 2 seconds after activation erases all the stored customer codes. The existing codes do not need to be erased to program a new code.
3. Within 5 seconds, enter the new 5-digit keyless entry keypad code.
4. Press the 1/2, 3/4, or 5/6 to indicate which of the 3 personal entry code positions is to be programmed.
5. The door locks lock and unlock to confirm the new code is programmed.
6. To program an additional personal entry code, repeat Steps 2 through 4.

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Stepped Unlock Programming

1. With the ignition switch in the OFF position, press the LOCK and UNLOCK buttons on the Remote Keyless Entry (RKE) transmitter simultaneously for 4 seconds.
    - The parking lamps will flash twice to indicate the mode change.

2. Repeat Step 1 to enable/disable the stepped unlocking feature.

Autolock and Auto-Unlock Programming

Autolock Programming Using the Keyless Entry Keypad

1. Close all doors and windows.
2. Confirm that the ignition key is OFF.
3. Enter the 5-digit permanent entry code into the keyless entry keypad.
4. Within 5 seconds of entering the code, press and hold the 3/4 button on the keyless entry keypad.
5. Within 5 seconds of Step 3, and while holding the 3/4 button, press the 7/8 button on the keyless entry keypad and release it.
6. **NOTE:** If the autolock is disabled, the horn chirps once. If the autolock feature is enabled, the horn chirps once shortly and then sounds a second time with a longer sound of the horn once the above sequence is completed.

   Within 5 seconds of Step 3, release the 3/4 button on the keyless entry keypad.

Autolock Programming Using the Ignition Lock Cylinder

1. Close all doors and windows.
2. Confirm that the ignition key is OFF.
3. **NOTE:** Steps 5 through 9 must be carried out within 30 seconds.

   Turn the ignition key from OFF to RUN.
4. Press the door lock control switch UNLOCK button 3 times.
5. Turn the ignition key from RUN to OFF.
6. Press the door lock control switch UNLOCK button 3 times.
7. Turn the ignition key from OFF to RUN.
8. Verify the horn chirps. This indicates the enable/disable mode and now is ready to accept program changes.
9. Press the door lock control switch UNLOCK button then the LOCK button 1 time to command the module to toggle the autolock/relock feature.
10. Verify that the horn chirps. There should be 1 chirp indicating that autolock/relock feature has been disabled. If 1 chirp is heard, followed by a longer sound of the horn, the autolock/relock feature has just been enabled.
11. Turn the key to the OFF position or wait 2 minutes to exit the enable/disable mode.

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12. Verify that the horn chirps once to indicate that a feature has been changed and that autolock/relock has been toggled.

Auto-Unlock Programming Using the Keyless Entry Keypad

1. Close all doors and windows.
2. Confirm that the ignition key is OFF.
3. Enter the 5-digit permanent entry code into the keyless entry keypad.
4. Within 5 seconds of entering the code, press and hold the 3/4 button on the keyless entry keypad.
5. Within 5 seconds of Step 3, and while holding the 3/4 button, press the 7/8 button twice on the keyless entry keypad and release it.
6. **NOTE:** If the auto-unlock is disabled, the horn chirps once. If the auto-unlock feature is enabled, the horn chirps twice.

   Within 5 seconds of Step 3, release the 3/4 button on the keyless entry keypad.

Auto-Unlock Programming Using the Ignition Lock Cylinder

1. Close all doors and windows.
2. Confirm that the ignition key is OFF.
3. **NOTE:** Steps 5 through 9 must be carried out within 30 seconds.

   Turn the ignition key from OFF to RUN.
4. Press the door lock control switch UNLOCK button 3 times.
5. Turn the ignition key from RUN to OFF.
6. Press the door lock control switch UNLOCK button 3 times.
7. Turn the ignition key from OFF to RUN.
8. Verify the horn chirps. This indicates the enable/disable mode and now is ready to accept program changes.
9. Press the door lock control switch LOCK button then the UNLOCK button 1 time to command the module to toggle the auto-unlock feature.
10. Verify that the horn chirps. There should be 1 chirp indicating that auto-unlock feature has been disabled. If 1 chirp is heard, followed by a longer sound of the horn, the auto-unlock feature has just been enabled.
11. Turn the key to the OFF position or wait 2 minutes to exit the enable/disable mode.
12. Verify that the horn chirps once to indicate that a feature has been changed and that auto-unlock has been toggled.

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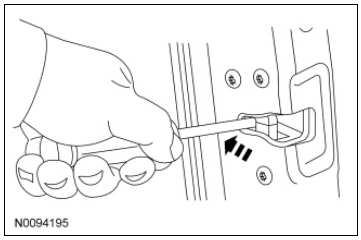
Latch Lubrication

Material

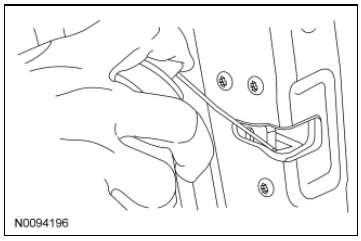
Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

1. Open the door.

2. Using a screwdriver, fully close the latch (2 clicks).



3. Spray the multi-purpose grease into the opening on the door latch for approximately 5 seconds.



4. Open the latch using either the interior or exterior door handle.

5. Open and close the door several times to circulate the lubricant inside the latch.

6. Wipe off any excess grease.

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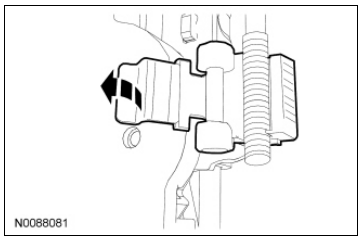
Door Handle to Latch Rod Adjustment

NOTE: If the vehicle is equipped with an adjustable door latch actuating rod, perform this procedure.

NOTE: An incorrectly adjusted exterior door handle can cause a loose handle, rattle noise, door hard to open from the outside door handle, or the outside door handle to not sit flush in the closed position.

NOTE: Prior to carrying out the adjustment procedure, the door latch, exterior door handle, and linkages must be installed on the door.

1. Raise the door glass to the full-up position.
2. Remove the door trim panel. For additional information, refer to Section 501-05 .
3. Position the water shield aside.
4. Open the clip and disconnect the exterior door handle actuating rod.

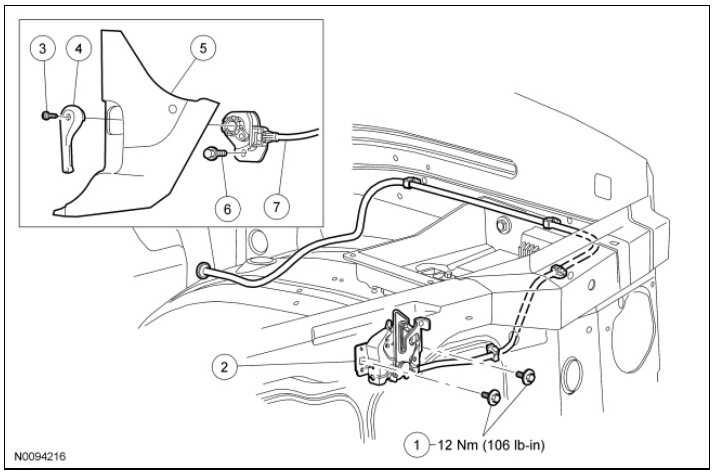


5. Position the actuating rod and latch actuating lever in a neutral position.
6. **NOTE:** Do not push up or pull down on the actuating rod or latch actuating lever.

   Reinstall the exterior door handle actuating rod back into the clip.
7. Close the clip and test the system to make sure that the exterior door handle is operating correctly.
8. Reseal the water shield.
9. Install the door trim panel. For additional information, refer to Section 501-05 .

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Hood Latch and Components - Exploded View



Item	Part Number	Description
1	N808727	Hood latch bolts (2 required)
2	16700	Hood latch
3	-	Hood latch release handle screw
4	16916	Hood latch release handle
5	7802344	A-pillar lower trim panel
6	N805375	Hood latch release cable assembly screw
7	16916	Hood latch release cable assembly

1. For additional information, refer to the procedures in this section.

Hood Latch

Removal and Installation

NOTE: Mark the position of the hood latch prior to removing the hood latch bolts to aid positioning during installation.

1. Remove the 2 hood latch bolts.
   - To install, tighten to 12 Nm (106 lb-in).

2. Disconnect the hood latch release cable from the hood latch and remove the latch.

3. To install, reverse the removal procedure.
   - Check the latch adjustment to make sure the latch was installed and aligned correctly.

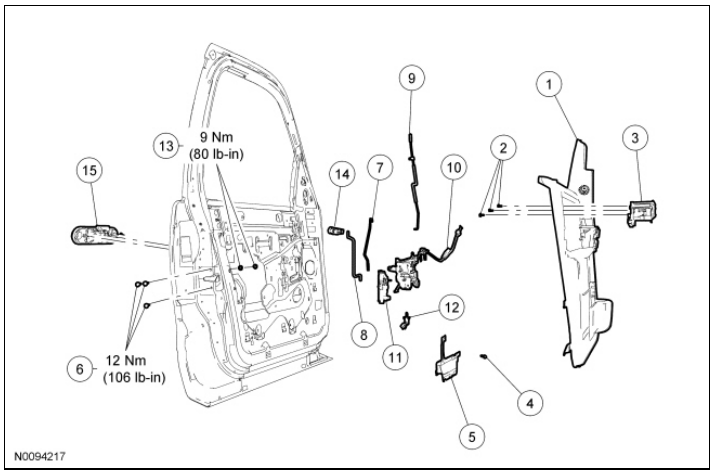
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Hood Latch Release Handle

Removal and Installation

1. Remove the hood latch. For additional information, refer to Hood Latch in this section.
2. Remove the screw and the hood latch release handle.
3. Remove the pin-type retainer and the LH A-pillar lower trim panel.
4. Remove the hood latch release cable assembly screw.
5. Release the hood latch release cable from the 4 cable locators and remove the cable.
6. To install, reverse the removal procedure.

Front Door Handles, Locks and Latches - Exploded View



Item	Part Number	Description
1	7823942/ 7823943	Interior front door trim panel (RH/LH)
2	-	Interior front door handle screws (3 required)
3	78224A52/ 78224A53	Interior front door handle (RH/LH)
4	-	Energy absorbing foam pad screw
5	7840380	Energy absorbing foam pad
6	N811471	Front door latch screws (3 required)
7	7822152/ 7822153	Exterior front door handle actuating rod (RH/LH)
8	7822135	Front door lock cylinder actuating lock rod
9	7821852/ 7821853	Front door push button rod (RH/LH)
10	7821812/ 7821813	Front door latch (RH/LH)
11	78218A42/ 78218A43	Front door lock actuator (RH/LH)
12	-	Front door ajar switch
13	-	Exterior front door handle nuts (2 required)
14	7821991	Door lock cylinder
15	7822404/ 7822405	Exterior front door handle (RH/LH)

1. For additional information, refer to the procedures in this section.

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Front Door Latch

Removal and Installation

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. **NOTE:** Slide the foam insulating block forward to release the 2 clips.

   Remove the screw and the energy absorbing foam pad.
4. Release the interior door handle actuating cable locator from the door frame.
5. Disconnect the front door latch harness electrical connector and release the harness locator from the door frame.
6. Open the clip and disconnect the exterior front door handle actuating rod.
7. Release the front door push button rod from the door frame retainer.
8. If equipped, disconnect the front door lock cylinder actuating rod from the lock cylinder.
9. Remove the 3 screws and the front door latch.
   - To install, tighten to 12 Nm (106 lb-in).
10. To install, reverse the removal procedure.

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Door Ajar Switch - Front Door

Removal and Installation

1. Remove the front door latch. For additional information, refer to Front Door Latch in this section.
2. Disconnect the front door ajar switch electrical connector.
3. Release the locking tab and rotate the front door ajar switch counterclockwise and remove the switch from the front door latch.
4. To install, reverse the removal procedure.

Front Door Lock Actuator

Removal and Installation

1. Remove the front door latch. For additional information, refer to Front Door Latch in this section.
2. Disconnect the front door ajar switch and the front door lock actuator electrical connectors.
3. Release the locking tab and remove the front door lock actuator.
4. To install, reverse the removal procedure.

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Door Lock Cylinder

Removal and Installation

NOTE: When any new lock cylinder is installed, the driver door and ignition lock cylinders should be installed as a set. This eliminates carrying an extra key which fits only 1 lock. If a new key is used, the new key code number is stamped on a metal tag attached to the key.

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .

2. Position the water shield aside.

3. Release the front door push button rod from the door frame retainer.

4. Remove the exterior front door handle nut (rear).
   - To install, tighten to 9 Nm (80 lb-in).

5. Remove the door lock cylinder.
   - Disconnect the front door lock cylinder actuating rod.

6. To install, reverse the removal procedure.

Interior Door Handle - Front

Removal and Installation

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Remove the 3 screws and the interior front door handle.
3. To install, reverse the removal procedure.

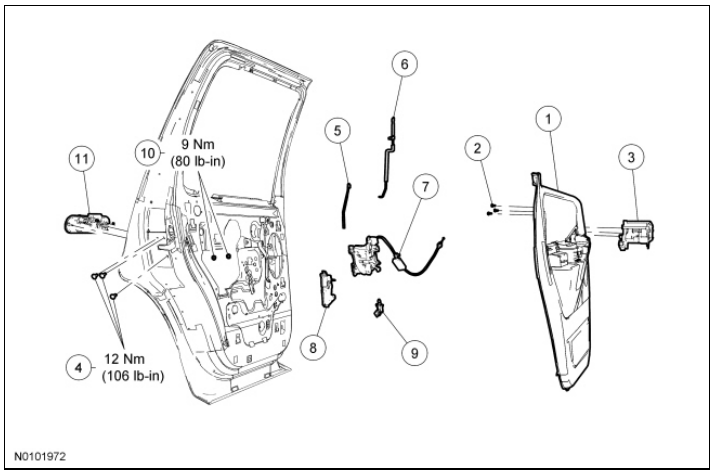
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Exterior Front Door Handle

Removal and Installation

1. Remove the front door trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. Remove the screw and the energy absorbing foam pad.
4. If equipped, disconnect the door lock cylinder actuating rod.
5. Open the clip and disconnect the exterior front door handle actuating rod.
6. Remove the 2 exterior front door handle nuts.
   - To install, tighten to 9 Nm (80 lb-in).
7. Remove the exterior front door handle.
8. To install, reverse the removal procedure.

Rear Door Handles, Locks and Latches - Exploded View



Item	Part Number	Description
1	7827406/ 7827407	Interior rear door trim panel (RH/LH)
2	-	Interior rear door handle screws (3 required)
3	78266B40/ 78266B41	Interior rear door handle (RH/LH)
4	N811471	Rear door latch screws (3 required)
5	7826596/ 7826597	Exterior rear door handle actuating rod (RH/LH)
6	7826460/ 7826461	Rear door push button rod (RH/LH)
7	7826412/ 7826413	Rear door latch (RH/LH)
8	78218A42/ 78218A43	Rear door lock actuator (RH/LH)
9	-	Rear door ajar switch
10	-	Exterior rear door handle nuts (2 required)
11	7826604/ 7826605	Exterior rear door handle (RH/LH)

1. For additional information, refer to the procedures in this section.

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Rear Door Latch

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. Release the interior door handle actuating cable locator from the door frame.
4. Open the clip and disconnect the exterior handle actuating rod.
5. Disconnect the rear door ajar switch and rear door lock actuator electrical connectors.
6. Remove the 3 rear door latch screws.
   - To install, tighten to 12 Nm (106 lb-in).
7. Release the rear door push button rod from the door frame retainer.
8. To install, reverse the removal procedure.

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Door Ajar Switch - Rear Door

Removal and Installation

1. Remove the rear door latch. For additional information, refer to Rear Door Latch in this section.
2. Release the locking tab, rotate the rear door ajar switch counterclockwise and remove the switch from the rear door latch.
3. To install, reverse the removal procedure.

Rear Door Lock Actuator

Removal and Installation

1. Remove the rear door latch. For additional information, refer to Rear Door Latch in this section.
2. Release the locking tab and remove the rear door lock actuator.
3. To install, reverse the removal procedure.

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Interior Door Handle - Rear

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Remove the 3 interior rear door handle screws and the interior rear door handle.
3. To install, reverse the removal procedure.

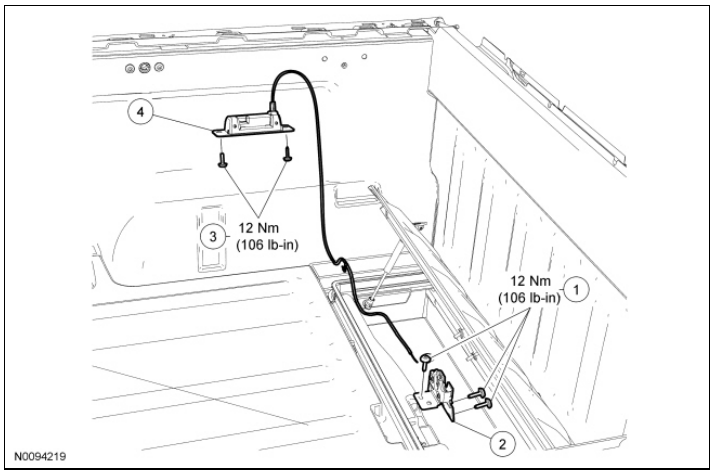
Exterior Rear Door Handle

Removal and Installation

1. Remove the rear door trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. Open the clip and disconnect the exterior rear door handle actuating rod.
4. Remove the 2 nuts and the exterior rear door handle.
   - To install, tighten to 9 Nm (80 lb-in).
5. To install, reverse the removal procedure.

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Pickup Bed Storage Compartment - Exploded View



Item	Part Number	Description
1	W706322	Pickup bed storage compartment latch bolts (3 required)
2	99286B48	Pickup bed storage compartment latch
3	W706322	Pickup bed storage compartment release handle bolts (2 required)
4	99286E08	Pickup bed storage compartment release handle and cable

1. For additional information, refer to the procedures in this section.

Pickup Bed Storage Compartment Latch

Removal and Installation

1. Remove the 3 pickup bed storage compartment latch bolts.
   - To install, tighten to 12 Nm (106 lb-in).

2. ***NOTICE:*** **Do not allow the pickup bed storage compartment lid to close until the latch has been connected to the cable. If the lid is closed prior to attaching the cable to the latch, releasing the latch is extremely difficult.**

   Disconnect the pickup bed storage compartment release cable from the pickup bed storage compartment latch.

3. Remove the pickup bed storage compartment latch.

4. To install, reverse the removal procedures.

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Pickup Bed Storage Compartment Release Handle

Removal and Installation

1. Remove the 2 pickup bed storage compartment release handle bolts.
   - To install, tighten to 12 Nm (106 lb-in).

2. ***NOTICE:*** **Do not allow the pickup bed storage compartment lid to close until the latch has been connected to the cable. If the lid is closed prior to attaching the cable to the latch, releasing the latch is extremely difficult.**

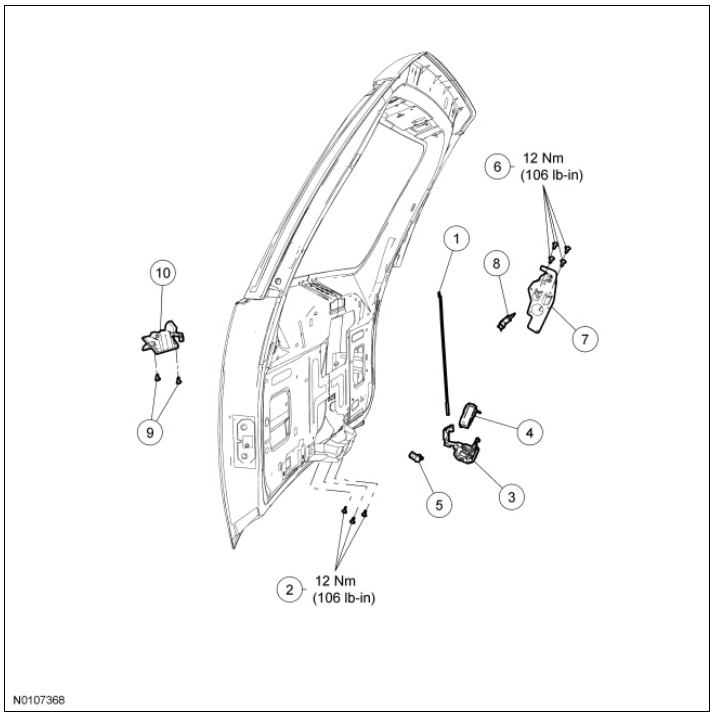
   Remove the pickup bed storage compartment latch. For additional information, refer to Pickup Bed Storage Compartment Latch in this section.

3. **NOTE:** Note the routing of the pickup bed storage compartment release cable.

   Release the routing clips and remove the pickup bed storage compartment release handle and cable as an assembly.

4. To install, reverse the removal procedures.

Liftgate Handle, Lock and Latch - Exploded View



Item	Part Number	Description
1	7843329	Liftgate handle actuating rod
2	W705830	Liftgate latch screws (3 required)
3	7843150	Liftgate latch
4	25218A42	Liftgate latch actuator
5	14018	Liftgate ajar switch
6	-	Liftgate window latch screws (4 required)
7	7840860	Liftgate window latch
8	13713	Liftgate window ajar switch
9	-	Liftgate release handle screws (2 required)
10	7843400	Liftgate release handle

1. For additional information, refer to the procedures in this section.

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Liftgate Latch

Removal and Installation

1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. Disconnect the liftgate release handle actuating rod.
4. Disconnect the liftgate latch actuator and the liftgate ajar switch electrical connectors.
5. Remove the 3 liftgate latch screws and remove the latch.
   - To install, tighten to 12 Nm (106 lb-in).
6. To install, reverse the removal procedure.

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Liftgate Latch Actuator

Removal and Installation

1. Remove the liftgate latch. For additional information, refer to Liftgate Latch in this section.
2. Release the locking tab and remove the liftgate latch actuator.
3. To install, reverse the removal procedure.

Door Ajar Switch - Liftgate

Removal and Installation

1. Remove the liftgate latch. For additional information, refer to Liftgate Latch in this section.
2. Release the locking tab, rotate the liftgate ajar switch counterclockwise and remove the ajar switch form the liftgate latch.
3. To install, reverse the removal procedure.

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Liftgate Window Latch

Removal and Installation

1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. Disconnect the liftgate window actuator and liftgate window ajar switch electrical connectors.
4. Remove the 4 screws and the liftgate window latch.
    - To install, tighten to 12 Nm (106 lb-in).
5. To install, reverse the removal procedure.

Liftgate Window Latch Actuator

Removal and Installation

1. Remove the liftgate window latch. For additional information, refer to Liftgate Window Latch in this section.
2. Remove the 3 screws and the liftgate window latch actuator.
3. To install, reverse the removal procedure.

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Door Ajar Switch - Liftgate Glass

Removal and Installation

1. Remove the liftgate window latch. For additional information, refer to Liftgate Window Latch in this section.

2. Rotate the liftgate window ajar switch counterclockwise and remove the ajar switch from the liftgate window latch.

3. To install, reverse the removal procedure.

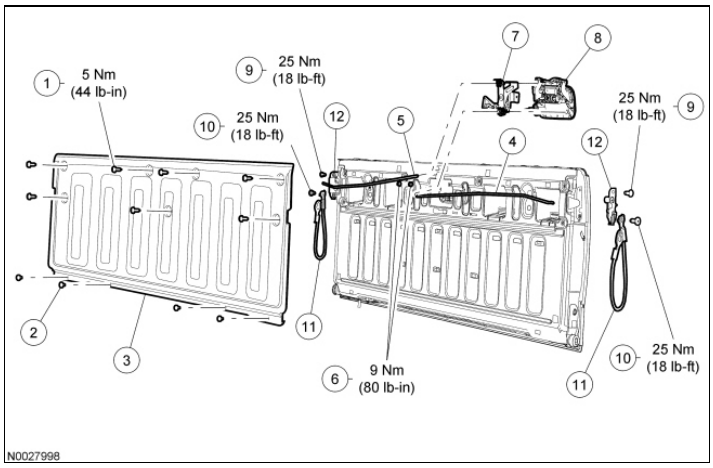
Liftgate Release Handle

Removal and Installation

1. Remove the liftgate trim panel. For additional information, refer to Section 501-05 .
2. Position the water shield aside.
3. Disconnect the liftgate release handle actuating rod.
4. Remove the 2 liftgate release handle screws.
5. Remove the liftgate release handle.
6. To install, reverse the removal procedure.

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Tailgate Handle, Lock and Latches - Exploded View



Item	Part Number	Description
1	W711876	Tailgate access panel bolts (7 required)
2	388577	Pin-type retainers (4 required)
3	40602	Tailgate access panel
4	83431A78	LH tailgate latch actuating rod
5	83431A78	RH tailgate latch actuating rod
6	N620480	Tailgate latch remote control nuts (2 required)
7	9943170	Tailgate latch remote control
8	9943400	Tailgate release handle
9	N806910	Tailgate latch bolt (upper)
10	NB11361	Tailgate latch bolt (lower)
11	5443052/ 5443053	Tailgate latch cable (RH/LH)
12	9943150	RH and LH tailgate latch

1. For additional information, refer to the procedures in this section.

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Tailgate Latch

Removal and Installation

1. Open and support the tailgate.

2. Remove the 7 bolts, the 4 pin-type retainers and the tailgate access panel.
   - To install, tighten to 5 Nm (44 lb-in).

3. Open the clip and release the tailgate latch actuating rod from the tailgate remote control.

4. Release the tailgate latch actuating rod locator from the tailgate.

5. Remove the 2 bolts and the tailgate latch.
   - To install, tighten to 25 Nm (18 lb-ft).

6. Remove the tailgate latch actuating rod.

7. To install, reverse the removal procedure.

Tailgate Latch Remote Control

Removal and Installation

1. Open and support the tailgate.

2. Remove the 7 bolts, the 4 pin-type retainers and the tailgate access panel.
   - To install, tighten to 5 Nm (44 lb-in).

3. Open the 2 clips and release the 2 tailgate latch actuating rods from the tailgate remote control.

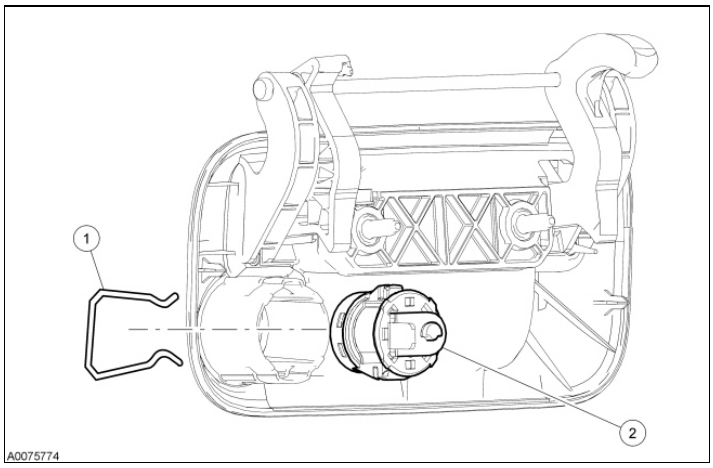
4. Release the 2 tailgate latch actuating rod locators from the tailgate.

5. Remove the 2 nuts and the tailgate remote control.
   - To install, tighten to 9 Nm (80 lb-in).

6. To install, reverse the removal procedure.

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Tailgate Lock Cylinder



Item	Part Number	Description
1	1522023	Retaining clip
2	1521990	Tailgate lock cylinder

Removal and Installation

NOTE: When a new lock cylinder is installed, the tailgate lock cylinder, door lock cylinders and the ignition lock cylinder should be installed as a set. This eliminates carrying an extra key which fits only one lock. If a new key is to be used, the new key code is attached to a tag.

NOTE: The individual door lock cylinders are repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build a new lock cylinder to the current key code of the vehicle.

1. Remove the tailgate release handle. For additional information, refer to Tailgate Release Handle in this section.

2. Remove the retaining clip and the tailgate lock cylinder.

3. To install, reverse the removal procedure.

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Tailgate Release Handle

Removal and Installation

1. Remove the tailgate latch remote control. For additional information, refer to Tailgate Latch Remote Control in this section.

2. Remove the tailgate release handle.

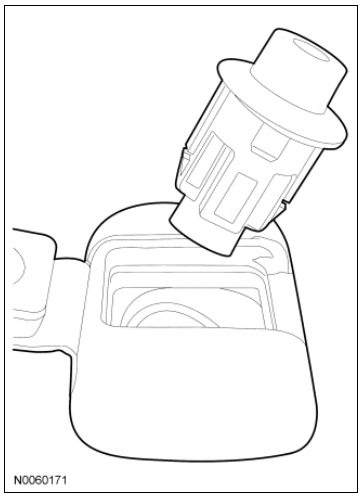
3. To install, reverse the removal procedure.

Tonneau Cover Lock Cylinder

Removal and Installation

1. Remove the tonneau cover latch release cable. For additional information, refer to Tonneau Cover Latch Release Cable in this section.

2. Remove the tonneau cover lock cylinder.



3. To install, reverse the removal procedure.

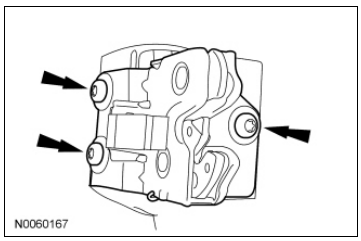
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Tonneau Cover Latch

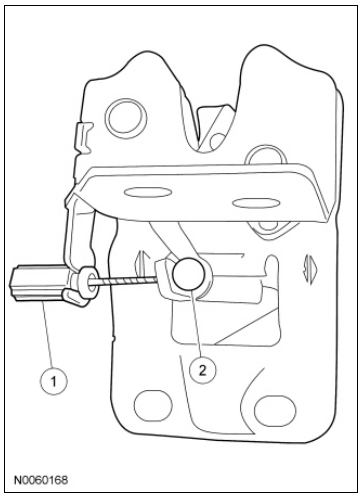
Removal and Installation

NOTE: Rear tonneau cover latch shown, front tonneau cover latch similar.

1. Remove the tonneau cover latch bolts.



2. Disconnect the tonneau cover cable.
    1. Disconnect the tonneau cover cable conduit.
    2. Disconnect the tonneau cover cable end.



3. Remove the tonneau cover latch.

4. To install, reverse the removal procedure.

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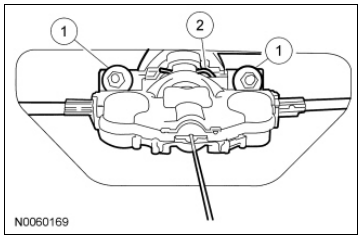
Tonneau Cover Latch Release Cable

Removal and Installation

NOTE: Rear tonneau cover latch release cable shown, front tonneau cover latch release cable similar.

1. Remove the tonneau cover latches. For additional information, refer to Tonneau Cover Latch in this section.

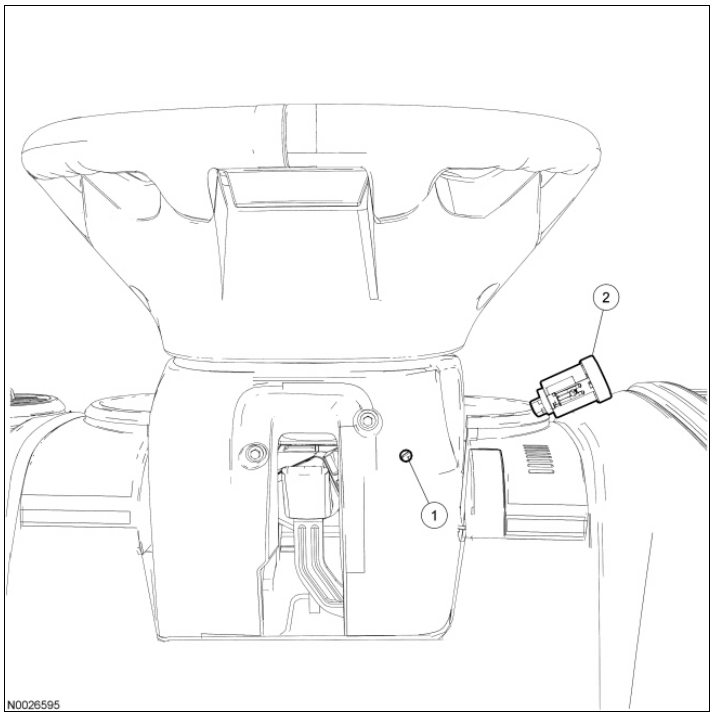
2. Disconnect the tonneau cover latch release cable.
    1. Remove the tonneau cover latch release cable bolts.
    2. Disconnect the tonneau cover latch release cable locking clip.



3. Remove the tonneau cover latch release cable.

4. To install, reverse the removal procedure.

Ignition Lock Cylinder - Functional



Item	Part Number	Description
1	-	Ignition switch locking pin access hole
2	11582	Ignition lock cylinder

Removal

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Insert the ignition key and position the ignition lock cylinder to the ACC position.

2. Using a suitable tool, depress the ignition lock cylinder release pin through the access hole while pulling the ignition lock cylinder outward.

Installation

1. Make sure the ignition lock cylinder is in the ACC position.

2. Insert the ignition lock cylinder into the ignition lock cylinder access hole located on the steering column.
   - Make sure to align the locking pin with the locking pin access hole.

3. Rotate the ignition key through all lock cylinder positions to check for correct operation.

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Ignition Lock Cylinder - Non Functional

Removal

1. Remove the Passive Anti-Theft System (PATS) transceiver. For additional information, refer to Section 419-01 .

2. Remove the ignition lock cylinder.
   - Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.
   - Use a 3/8-inch diameter drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.
   - Remove and discard the ignition lock cylinder and drill shavings from the steering column.

3. Remove the bearing retainer.

4. Remove the steering column lock housing bearing and steering column lock gear.

Installation

1. Thoroughly clean all drill shavings from the steering column and inspect it for damage.

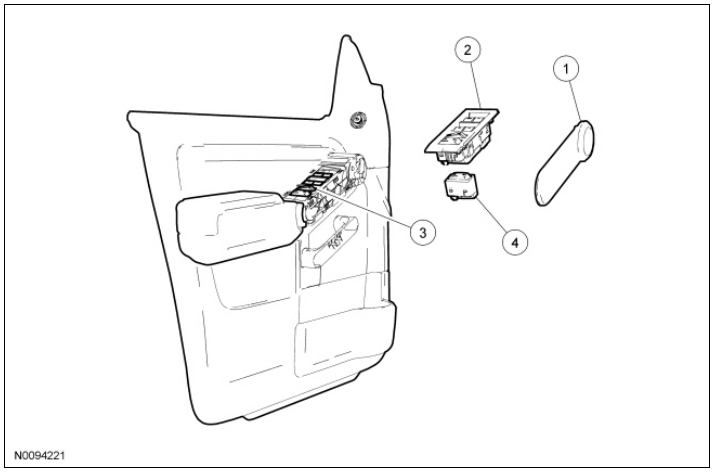
2. Install a new ignition lock cylinder.
   - Verify the ignition lock cylinder operation.

3. Program the new PATS keys. For additional information, refer to Key Programming Using Diagnostic Equipment in Section 419-01 .

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Door Lock Control Switch

NOTE: The LH side is shown, the RH side is similar.



Item	Part Number	Description
1	14A563/ 14A564	Interior door handle cover (RH/LH)
2	78224A34	Door lock control switch bezel (RH/LH)
3	14524/14525	Door lock control switch electrical connectors (RH/LH)
4	14028	Door lock control switch

Removal and Installation

1. Remove the interior door handle cover.

2. Remove the front door switch bezel.
   - Release the 4 retaining tabs.

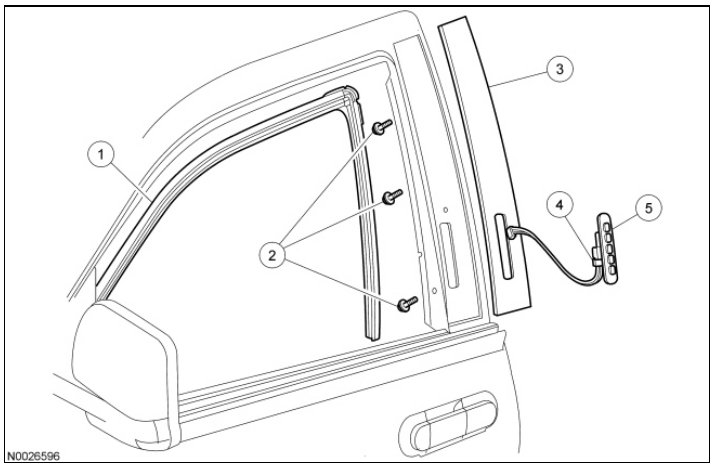
3. Disconnect the door lock control switch and window control switch electrical connectors.

4. Remove the door lock control switch.
   - Release the 4 retaining tabs.

5. To install, reverse the removal procedure.

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Keyless Entry Keypad



Item	Part Number	Description
1	7821547	Door glass top run
2	-	Door pillar trim panel screws (3 required) (part of 14K138)
3	7820555	Door pillar trim panel
4	-	Keyless entry keypad electrical connector (part of 14K138)
5	14A626	Keyless entry keypad

Removal and Installation

1. Position the front window glass to the full down position.
2. Position the door glass top run aside to access the door pillar trim panel screws.
3. Remove the 3 door pillar trim panel screws and the door pillar trim panel.
4. Disconnect the electrical connector and remove the keyless entry keypad from the door pillar trim panel.
5. To install, reverse the removal procedure.

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Material

Item	Specification	Fill Capacity
Motorcraft® Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, D, and F) (Canada)	-	-
Motorcraft® Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2	-

General Specifications

Item	Specification
LH windshield wiper blade and bottom of windshield glass	61 mm (2.401 in)
RH windshield wiper blade and bottom of windshield glass	74 mm (2.913 in)

Torque Specifications

Description	Nm	lb-in
Pivot arm nut	17	150
Pivot shaft nut	10	89
Rear wiper motor grommet nut	10	89
Rear wiper motor nuts	6	53
Windshield washer reservoir bolts	5	44
Windshield wiper assembly mounting bolts	15	133
Windshield wiper motor mounting bolts	15	133
Wiper motor cover-to-glass mounting screws	1	9

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Wipers and Washers

The wipers and washers system consists of the following components:

- Windshield wiper blades
- Windshield wiper pivot arms
- Windshield wiper motor assembly
- Windshield wiper motor
- Windshield washer pump
- Windshield washer reservoir
- Rear window wiper blade
- Rear window wiper pivot arm
- Rear window wiper motor assembly

The wiper system is activated by the multifunction switch. The multifunction switch provides input to the front wiper motor module to activate wash, low, high and intermittent modes. On Explorer, the multifunction switch also provides input to the rear wiper module to activate wash, INT 1 and INT 2 modes. The relays are all integral to the wiper motor module assemblies and are not serviceable separately.

On Explorer, the front and rear washer system share the same washer reservoir and washer pump. The front and rear wiper motor module integral electronics control the direction of the washer pump to direct washer fluid to the windshield or rear window.

On Explorer Sport Trac, the washer system consists of the washer reservoir and pump. When the multifunction switch is placed into the wash mode, the windshield wiper motor integral electronics activate the washer pump to direct washer fluid to the windshield.

When the wiper control is set on any intermittent setting except INT 1, the speed dependent wipers will automatically adjust with the vehicle speed. This feature decreases the time between wipes when the vehicle speed increases.

NOTE: The Smart Junction Box (SJB) may also be identified as the Generic Electronic Module (GEM).

If equipped with automatic headlamps, the SJB will illuminate the exterior lamps within 10 seconds, when the front wipers are activated and the headlamp control switch is in the AUTOLAMP position. When the wipers are turned off, the exterior lamps will remain on for 30 seconds before turning off.

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Wipers and Washers

Special Tool(s)

 ST1138-A	Flex Probe Kit 105-R025D or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST3094-A	Test Light SGT27000 or equivalent 250-350 mA incandescent bulb test lamp SGT27000

Principles of Operation

If equipped with automatic headlamps, the Smart Junction Box (SJB) will illuminate the exterior lamps, including the parking lamps, when the front wipers are on for more than 10 seconds and the headlamp control is in the AUTOLAMP position. When the wipers are turned off, the exterior lamps will remain on for 30 seconds before turning off.

High-Speed Windshield Wipers

When the multifunction switch is set to the HIGH-speed position, it supplies ground to the high/low-speed relay coil and the run/park relay coil, which causes the windshield wiper motor to operate at high speed. During HIGH-speed operation only, both the high/low-speed relay coil ground and the run/park relay coil ground are controlled directly by the multifunction switch. This differs from LOW-speed or INTERMITTENT operation when the run/park relay coil is controlled by the microprocessor. When the switch is placed in the OFF position, the motor continues to operate until the motor returns to the PARK position and the internal Hall-effect sensor senses the motor magnet. The output to the run/park relay deactivates the relay and disconnects the voltage to the motor.

Since the high/low relay coil and the run/park relay coil are both controlled by a hard-wired circuit to the multifunction switch, the windshield wipers will still operate in high-speed mode if the internal windshield wiper module fails, but will not automatically park when the multifunction switch is turned to the OFF position.

Low-Speed Windshield Wipers

When the multifunction switch is set to the LOW-speed position, it supplies ground to the internal windshield wiper motor module low-speed input and the windshield wiper motor operates at low speed. During LOW-speed operation, the internal run/park relay is activated by the microprocessor and supplies 12 volts to the low-speed brush of the windshield wiper motor. The run/park relay coil ground is controlled by the

internal windshield wiper motor module based on inputs received from the multifunction switch. When the switch is placed in the OFF position, the motor continues to operate until the motor returns to the PARK position and the internal Hall-effect sensor senses the motor magnet. The output to the run/park relay deactivates the relay and disconnects the voltage to the motor.

Since the run/park relay is controlled by the internal windshield wiper motor microprocessor, the wipers will only operate in high-speed mode if the internal windshield wiper motor module fails, and will not automatically park when the multifunction switch is turned to the OFF position. This is due to the run/park and high/low relay coils being directly hard-wired to the switch in high speed. The diode prevents current flow through the high/low relay coil so the relay remains in the normally closed LOW-speed position.

Intermittent Speed Windshield Wipers

When the multifunction switch is set to the INTERMITTENT position(s), it supplies ground to the windshield wiper motor module inputs and the windshield wiper motor operates in intermittent mode. During INTERMITTENT operation, the windshield wiper motor activates the run/park relay coil which sends voltage through the high/low relay. The high/low relay remains deactivated, supplying the voltage to the low-speed brush of the windshield wiper motor. The windshield motor continues to operate until the internal Hall-effect sensor senses the magnet (PARK position) and deactivates the run/park relay, which disconnects voltage from the wiper motor. The windshield wipers remain parked until the windshield wiper motor module completes a time-out and then repeats the intermittent windshield wiper cycle.

Wiper Activated Headlamps (If Equipped with Autolamp System)

If equipped with automatic headlamps, the SJB will illuminate the exterior lamps within 10 seconds, when the wipers are on and the headlamp control switch is in the AUTOLAMP position. When the wipers are turned off, the exterior lamps will remain on for 30 seconds before turning off.

Speed Dependent Windshield Wipers

The speed-dependent feature increases the frequency of wiping to compensate for the extra moisture that accumulates on the windshield as the vehicle speed increases, when the multifunction switch is in any intermittent setting except the INT 1 position. The windshield wiper module receives Vehicle Speed Sensor (VSS) information directly from the PCM. As vehicle speed increases, the speed-dependent feature gradually shortens the delay between wipes.

The speed-dependent feature is easiest to verify in the INT 2 position. With the vehicle at a standstill and the multifunction switch in the INT 2 position, the wipers should operate once every 10 seconds. As vehicle speed increases, the delay between wipes will gradually shorten. For example, by the time the vehicle reaches 100 km/h (62 mph), the wipers should operate every 5 seconds. Speed dependent operation is similar in INT 3, INT 4 and INT 5 modes.

Intermittent Rear Window Wiper System

When the multifunction switch is set to the rear INTERMITTENT position(s), it supplies ground to the rear window wiper motor module input and the wiper operates in intermittent mode. During INTERMITTENT operation, the rear wiper motor momentarily activates the rear window wiper relay (internal), which sends voltage to the motor. Once the rear window wiper motor is activated, the internal run/park switch connects voltage to the motor, keeping it operating. When the rear window wiper motor returns to the PARK position, the run/park switch disconnects voltage internally from the wiper motor input, reconnecting it to the rear window wiper motor module output. The rear window wiper remains parked until the rear window wiper motor module completes a time-out and then repeats the cycle.

Washer System - Explorer Sport Trac

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When windshield WASH is selected on the multifunction switch, the windshield wiper motor module activates its integral washer relay which sends voltage to the washer pump to direct fluid to the windshield.

Washer System - Explorer

The front and rear washer system share the same washer reservoir and washer pump. The front and rear wiper motor modules each contain an integral washer relay that supplies a ground path for the washer pump whenever they are inactive. When windshield WASH is selected on the multifunction switch, the windshield wiper motor module activates its integral washer relay, which sends voltage to the washer pump to direct fluid to the windshield. When rear WASH is selected on the multifunction switch, the rear wiper motor module activates its integral washer relay to send voltage to the washer pump to direct fluid to the rear window.

Software Safe Mode

The windshield wiper motor defaults to software safe mode when the run/park sensor does not sense the Hall-effect magnet inside the wiper motor. This can be caused by an obstruction of the windshield wipers, a binding linkage or loss of the Hall sensor signal. The motor continues to operate in a high/low-speed condition, and when turned off, the wipers immediately park on the windshield. If necessary, the wipers can be turned ON and OFF until they return to the PARK position.

Windshield Wiper Circuit Function Table

Multifunction Switch Position	Circuit CRW07 (GY/BN)	Circuit CRW08 (VT/OG)	Circuit CRW19 (BU/OG)	Circuit CRW18 (VT/WH)	Circuit CRW17 (GN/VT)
OFF	OPEN	OPEN	OPEN	OPEN	OPEN
INT 1	OPEN	OPEN	OPEN	OPEN	GROUND
INT 2	OPEN	OPEN	OPEN	GROUND	GROUND
INT 3	OPEN	OPEN	OPEN	GROUND	OPEN
INT 4	OPEN	OPEN	GROUND	GROUND	OPEN
INT 5	OPEN	OPEN	GROUND	OPEN	OPEN
LOW	OPEN	OPEN	GROUND	OPEN	GROUND
HIGH	OPEN	GROUND	GROUND	OPEN	GROUND
WASH	GROUND	OPEN/GROUND	OPEN/GROUND	OPEN/GROUND	OPEN/GROUND

Rear Wiper Circuit Function Table

Multi- Function Switch Position	Circuit CRW21 (YE/VT)	Circuit CRW20 (GY/YE)
OFF	OPEN	OPEN
INT 1	OPEN	GROUND
INT 2	GROUND	GROUND
WASH	GROUND	OPEN

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Windshield washer hoses • Wiper linkage • Multifunction switch	• Battery Junction Box (BJB) fuses: ♦ 20 (30A) ♦ 30 (25A) • Smart Junction Box (SJB) fuses: ♦ 10 (5A) ♦ 12 (5A) • Circuitry • Windshield wiper motor • Rear wiper motor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** The Smart Junction Box (SJB) may also be identified as the Generic Electronic Module (GEM).

   NOTE: The windshield wiper motor does not communicate on the network. The windshield wiper motor provides wiper on/off status directly to the SJB .

   NOTE: Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the VCM .

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the SJB .

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7. Carry out the network test.
    - If the scan tool responds with no communication from one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB and PCM.
9. If the DTCs retrieved are related to the concern, go to the Smart Junction Box (SJB) DTC Chart or the Powertrain Control/Emissions Diagnosis (PC/ED) manual for PCM related DTCs. For all other DTCs, refer to Section 419-10 .
10. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Wipers and Washers .

DTC Charts

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B2008	Wipers On Signal Circuit Short to Ground	GO to Pinpoint Test J .

For a complete list of SJB DTCs, refer to Section 419-10 .

Symptom Chart - Wipers and Washers

Symptom Chart - Wipers and Washers

Pinpoint Tests

Pinpoint Test A: The Wipers are Inoperative - Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

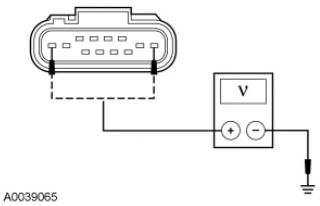
Under normal operation, the windshield wiper relay receives power at all times through circuit SBB20 (GN/RD). When the key is in the RUN or ACC position, the windshield wiper relay receives power from the Smart Junction Box (SJB) through circuit CBP10 (YE/OG). The windshield wiper relay is grounded at all times through circuit GD120 (BK/GN). When the windshield wiper relay is activated, the front windshield wiper motor receives power through circuit CRW03 (VT/WH). The front windshield wiper motor is grounded through circuits GD108 (BK/VT) and GD120 (BK/GN). The multifunction switch is grounded through circuit GD145 (BK/BU). The front windshield wiper motor receives open and ground inputs from the multifunction switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate modes.

This pinpoint test is intended to diagnose the following:

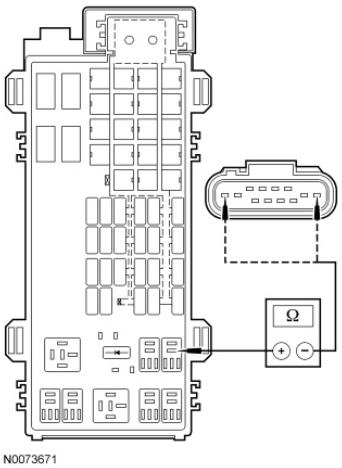
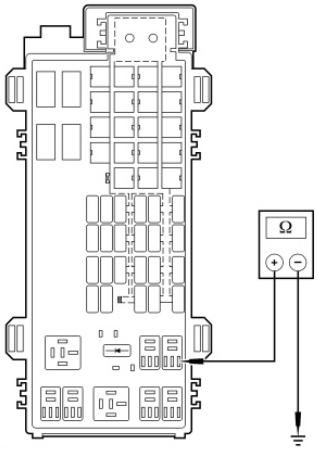
- Fuse(s)
- Windshield wiper relay

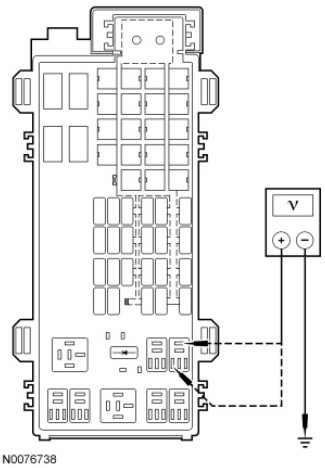
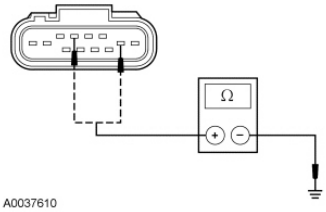
- Wiring, terminals or connectors
- Multifunction switch
- Windshield wiper motor

PINPOINT TEST A: THE WIPERS ARE INOPERATIVE - WINDSHIELD

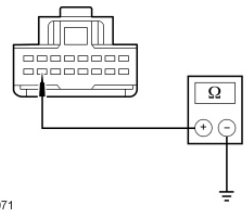
Test Step	Result / Action to Take
A1 CHECK CIRCUIT CRW03 (VT/WH) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Ignition ON. • Measure the voltage between windshield wiper motor C125-5, circuit CRW03 (VT/WH), harness side and ground; and between windshield wiper motor C125-8, circuit CRW03 (VT/WH), harness side and ground.  A0039065 • **Are the voltages greater than 10 volts?**	**Yes** GO to A5 . **No** GO to A2 .
A2 CHECK CIRCUIT CRW03 (VT/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: Windshield Wiper Relay. • Measure the resistance between windshield wiper motor C125-5, circuit CRW03 (VT/WH), harness side and windshield wiper relay pin 5, circuit CRW03 (VT/WH), harness side; and between windshield wiper motor C125-8, circuit CRW03 (VT/WH), harness side and windshield wiper relay pin 5, circuit CRW03 (VT/WH), harness side.	**Yes** GO to A3 . **No** REPAIR the circuit. TEST the system for normal operation.

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 N0073671 • **Are the resistances less than 5 ohms?**	
A3 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Measure the resistance between windshield wiper relay pin 2, circuit GD120 (BK/GN), harness side and ground.  N0076737 • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK CIRCUITS SBB20 (GN/RD) AND CBP10 (YE/OG) FOR VOLTAGE	
• Ignition ON. • Measure the voltage between windshield wiper relay pin 1, circuit CBP10 (YE/OG), harness side and ground; and between windshield wiper relay pin 3, circuit SBB20 (GN/RD), harness side and ground.	**Yes** INSTALL a new windshield wiper relay. TEST the system for normal operation. **No** VERIFY Battery Junction Box (BJB) fuse 20 (30A) and SJB fuse 10 (5A) are OK. If OK, REPAIR the circuit(s) in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible cause of the circuit short. TEST the system for normal operation.

 • **Are the voltages greater than 10 volts?**	
A5 CHECK CIRCUITS GD120 (BK/GN) AND GD108 (BK/VT) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between windshield wiper motor C125-6, circuit GD120 (BK/GN), harness side and ground; and between windshield wiper motor C125-3, circuit GD108 (BK/VT), harness side and ground.  • **Are the resistances less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
A6 CHECK THE MULTIFUNCTION SWITCH	
• Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to A7 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 .
A7 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Measure the resistance between multifunction switch C202-15, circuit GD145 (BK/BU), harness side and ground.	**Yes** GO to A8 . **No** REPAIR the circuit. TEST the system for normal operation.

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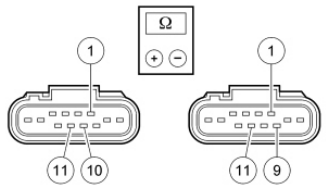
N0037071

- **Is the resistance less than 5 ohms?**

A8 CHECK FOR SHORTS IN THE WINDSHIELD WIPER MOTOR HARNESS

- Measure the resistance at windshield wiper motor C125, harness side, between the circuits shown in the following chart.

Windshield Wiper Motor	Circuits	Windshield Wiper Motor
C125-10	CRW19 (BU/OG)/CRW08 (VT/OG)	C125-1
C125-10	CRW19 (BU/OG)/CRW17 (GN/VT)	C125-9
C125-10	CRW19 (BU/OG)/CRW18 (VT/WH)	C125-11
C125-11	CRW18 (VT/WH)/CRW08 (VT/OG)	C125-1
C125-11	CRW18 (VT/WH)/CRW17 (GN/VT)	C125-9
C125-1	CRW08 (VT/OG)/CRW17 (GN/VT)	C125-9



N0091498

- **Is the resistance greater than 10,000 ohms for all measurements?**

Yes
GO to A9 .

No
REPAIR the circuit. TEST the system for normal operation.

A9 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION

• Disconnect all windshield wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all the windshield wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test B: The Wipers are Inoperative - Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

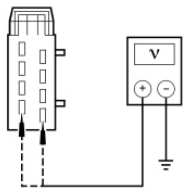
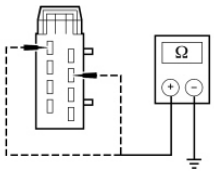
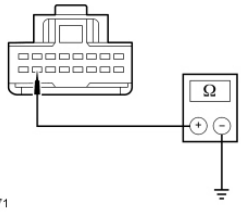
Under normal operation, the rear window wiper motor receives power through circuit SBB30 (BN/RD) and circuit CBP12 (GN/WH). The rear window wiper motor is grounded through circuit GD150 (BK/WH). The rear window wiper motor receives open and ground inputs from the multifunction switch through circuits CRW20 (GY/YE) and CRW21 (YE/VT) to activate the wiper to the appropriate speeds. The rear window wiper motor monitors the liftgate glass ajar switch through circuit CPL58 (GY/OG). When the liftgate glass is closed, this circuit is grounded. If ground is not detected on this circuit by the rear window wiper motor, rear window wiper operation is disabled.

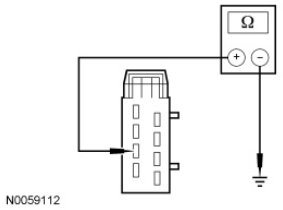
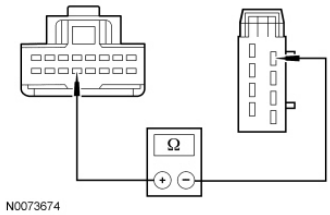
This pinpoint test is intended to diagnose the following:
- Fuse(s)
- Wiring, terminals or connectors
- Rear window wiper motor
- Multifunction switch

PINPOINT TEST B: THE WIPERS ARE INOPERATIVE - REAR WINDOW

Test Step	Result / Action to Take
B1 CHECK CIRCUITS CBP12 (GN/WH) AND SBB30 (BN/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Rear Window Wiper Motor C4323. • Ignition ON. • Measure the voltage between rear window wiper motor C4323-7, circuit CBP12 (GN/WH), harness side and ground; and between rear window wiper motor C4323-8, circuit SBB30 (BN/RD), harness side and ground.	**Yes** GO to B2 . **No** VERIFY Battery Junction Box (BJB) fuse 30 (25A) and Smart Junction Box (SJB) fuse 12 (5A) are OK. If OK, REPAIR the circuit(s) in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible cause of the circuit short. TEST the system for normal operation.

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 N0037073 • **Are the voltages greater than 10 volts?**	
B2 CHECK CIRCUIT GD150 (BK/WH) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between rear window wiper C4323-2, circuit GD150 (BK/WH), harness side and ground; and between rear window wiper C4323-3, circuit GD150 (BK/WH), harness side and ground.  N0037074 • **Is the resistance less than 5 ohms?**	**Yes** GO to B3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
B3 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to B4 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 .
B4 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Measure the resistance between multifunction switch C202-15, circuit GD145 (BK/BU), harness side and ground.  N0037071 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR the circuit. TEST the system for normal operation.

B5 CHECK CIRCUIT CPL58 (GY/OG) FOR AN OPEN	
• The liftgate must be closed. • Measure the resistance between rear wiper motor C4323-6, circuit CPL58 (GY/OG) harness side and ground.  N0059112 • **Is the resistance less than 5 ohms?**	**Yes** GO to B6 . **No** REPAIR the circuit. TEST the system for normal operation.
B6 CHECK CIRCUIT CRW21 (YE/VT) FOR AN OPEN	
• Measure the resistance between multifunction switch C202-13, circuit CRW21 (YE/VT), harness side and rear window wiper C4323-1, circuit CRW21 (YE/VT), harness side.  N0073674 • **Is the resistance less than 5 ohms?**	**Yes** GO to B7 . **No** REPAIR the circuit. TEST the system for normal operation.
B7 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ liftgate glass open. ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new rear window wiper motor. REFER to Wiper Motor - Rear Window in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test C: The Wipers Stay On Continuously - Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

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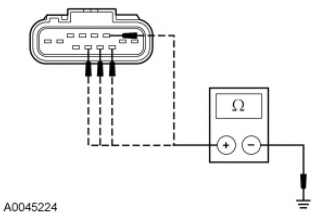
Normal Operation

Under normal operation, the windshield wiper motor receives open and ground inputs from the multifunction switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate modes.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- Multifunction switch

PINPOINT TEST C: THE WIPERS STAY ON CONTINUOUSLY - WINDSHIELD

Test Step	Result / Action to Take
C1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to C2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 .
C2 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH), CRW08 (VT/OG) AND CRW17 (GN/VT) FOR A SHORT TO GROUND	
• Disconnect: Windshield Wiper Motor C125. • Measure the resistance between ground and windshield wiper motor: ♦ C125-1, circuit CRW08 (VT/OG), harness side. ♦ C125-9, circuit CRW17 (GN/VT), harness side. ♦ C125-10, circuit CRW19 (BU/OG), harness side. ♦ C125-11, circuit CRW18 (VT/WH), harness side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
C3 CHECK FOR CORRECT WIPER MOTOR OPERATION	

• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test D: The Wipers Stay On Continuously - Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

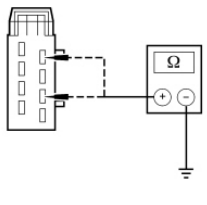
Under normal operation, the rear window wiper motor receives open and ground inputs from the multifunction switch through circuits CRW20 (GY/YE) and CRW21 (YE/VT) to activate the wiper to the appropriate modes. The multifunction switch supplies a ground input to the rear wiper motor on CRW21 (YE/VT) when INT 1 is selected. The multifunction switch supplies ground to the rear wiper motor on CRW21 (YE/VT) and CRW20 (GY/YE) when INT 2 is selected.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Rear window wiper motor
- Multifunction switch

PINPOINT TEST D: THE WIPERS STAY ON CONTINUOUSLY - REAR WINDOW

Test Step	Result / Action to Take
D1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to D2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 .
D2 CHECK CIRCUITS CRW20 (GY/YE) AND CRW21 (YE/VT) FOR A SHORT TO GROUND	
• Disconnect: Rear Window Wiper Motor C4323. • Measure the resistance between rear window wiper motor C4323-5, circuit CRW20 (GY/YE), harness side and ground; and between rear window wiper motor C4323-1, circuit CRW21 (YE/VT), harness side and ground.	**Yes** GO to D3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

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 • **Are the resistances greater than 10,000 ohms?**	
D3 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new rear window wiper motor. REFER to Wiper Motor - Rear Window in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test E: The High/Low Wiper Speeds Do Not Operate Correctly - Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

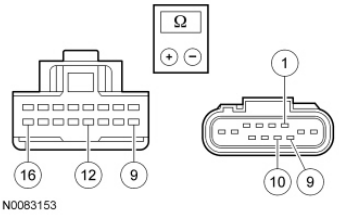
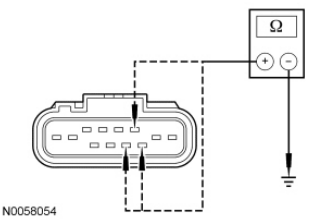
Under normal operation, the windshield wiper motor receives open and ground inputs from the multifunction switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate modes.

This pinpoint test is intended to diagnose the following:

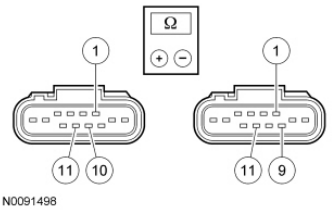
- Wiring, terminals or connectors
- Windshield wiper motor
- Multifunction switch

PINPOINT TEST E: THE HIGH/LOW WIPER SPEEDS DO NOT OPERATE CORRECTLY - WINDSHIELD

Test Step	Result / Action to Take
E1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to E2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.

E2 CHECK CIRCUITS CRW19 (BU/OG), CRW08 (VT/OG) AND CRW17 (GN/VT) FOR AN OPEN	
• Disconnect: Windshield Wiper Motor C125. • Measure the resistance between multifunction switch C202, harness side and windshield wiper motor C125, harness side using the following chart: **Multifunction Switch** / **Circuit** / **Windshield Wiper Motor** C202-9 / CRW08 (VT/OG) / C125-1 C202-12 / CRW17 (GN/VT) / C125-9 C202-16 / CRW19 (BU/OG) / C125-10  N0083153 • **Is the resistance less than 5 ohms?**	**Yes** GO to E3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
E3 CHECK CIRCUITS CRW19 (BU/OG), CRW08 (VT/OG) AND CRW17 (GN/VT) FOR A SHORT TO GROUND	
• Measure the resistance between ground and windshield wiper motor: ♦ C125-1, circuit CRW08 (VT/OG), harness side. ♦ C125-9, circuit CRW17 (GN/VT), harness side. ♦ C125-10, circuit CRW19 (BU/OG), harness side.  N0058054 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E4 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

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E4 CHECK FOR SHORTS IN THE WINDSHIELD WIPER MOTOR HARNESS	
• Measure the resistance at windshield wiper motor C125, harness side, between the circuits shown in the following chart: **Windshield Wiper Motor** / **Circuits** / **Windshield Wiper Motor** C125-10 / CRW19 (BU/OG)/CRW08 (VT/OG) / C125-1 C125-10 / CRW19 (BU/OG)/CRW17 (GN/VT) / C125-9 C125-10 / CRW19 (BU/OG)/CRW18 (VT/WH) / C125-11 C125-11 / CRW18 (VT/WH)/CRW08 (VT/OG) / C125-1 C125-11 / CRW18 (VT/WH)/CRW17 (GN/VT) / C125-9 C125-1 / CRW08 (VT/OG)/CRW17 (GN/VT) / C125-9  N0091498 • **Is the resistance greater than 10,000 ohms for all measurements?**	**Yes** GO to E5 . **No** REPAIR the circuit. TEST the system for normal operation.
E5 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly.	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. **No** The system is operating correctly at this time. Concern may have been caused by a

• Operate the system and verify the concern is still present. • **Is the concern still present?**	loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Intermittent Wiper Speed Does Not Operate Correctly - Rear Window

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

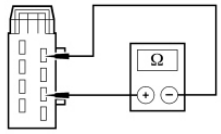
Under normal operation, the rear window wiper motor receives open and ground inputs from the multifunction switch through circuits CRW20 (GY/YE) and CRW21 (YE/VT) to activate the wiper to the appropriate modes. The multifunction switch supplies a ground input to the rear wiper motor on CRW21 (YE/VT) when INT 1 is selected. The multifunction switch supplies ground to the rear wiper motor on CRW21 (YE/VT) and CRW20 (GY/YE) when INT 2 is selected.

This pinpoint test is intended to diagnose the following:
- Rear window wiper motor
- Multifunction switch

PINPOINT TEST F: THE INTERMITTENT WIPER SPEED DOES NOT OPERATE CORRECTLY - REAR WINDOW

Test Step	Result / Action to Take
F1 VERIFY REAR WASHER PUMP OPERATION	
• Ignition ON. • Activate the rear washer pump. • **Does the rear washer pump activate?**	**Yes** GO to F2 . **No** GO to Pinpoint Test H .
F2 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to F3 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 .
F3 CHECK FOR A SHORT BETWEEN CIRCUITS CRW20 (GY/YE) AND CRW21 (YE/VT)	
• Measure the resistance between rear window wiper C4323-5, circuit CRW20 (GY/YE), harness side and rear window wiper C4323-1, circuit CRW21 (YE/VT), harness side.	**Yes** GO to F4 . **No** REPAIR the circuit. TEST the system for normal operation.

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 N0073675 • **Is the resistance greater than 10,000 ohms?**	
F4 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new rear window wiper motor. REFER to Wiper Motor - Rear Window in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test G: The Intermittent Wiper Speed Does Not Operate Correctly - Windshield

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

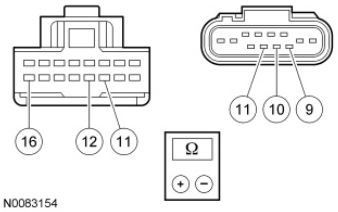
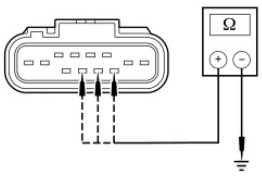
Normal Operation

Under normal operation, the windshield wiper motor receives open and ground inputs from the multifunction switch through circuits CRW17 (GN/VT), CRW18 (VT/WH), CRW19 (BU/OG) and CRW08 (VT/OG) to activate the wipers to the appropriate speeds.

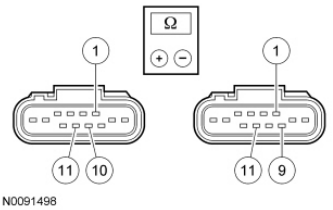
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Windshield wiper motor
- Multifunction switch

PINPOINT TEST G: THE INTERMITTENT WIPER SPEED DOES NOT OPERATE CORRECTLY - WINDSHIELD

Test Step	Result / Action to Take
G1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to G2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
G2 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH) AND CRW17 (GN/VT) FOR AN OPEN	

• Disconnect: Windshield Wiper Motor C125. • Measure the resistance between multifunction switch C202, harness side and windshield wiper motor C125, harness side using the following chart: **Multifunction Switch** / **Circuit** / **Windshield Wiper Motor** C202-11 / CRW18 (VT/WH) / C125-11 C202-12 / CRW17 (GN/VT) / C125-9 C202-16 / CRW19 (BU/OG) / C125-10  N0083154 • **Is the resistance less than 5 ohms?**	**Yes** GO to G3 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
G3 CHECK CIRCUITS CRW19 (BU/OG), CRW18 (VT/WH) AND CRW17 (GN/VT) FOR A SHORT TO GROUND	
• Measure the resistance between ground and windshield wiper motor: ♦ C125-9, circuit CRW17 (GN/VT), harness side. ♦ C125-10, circuit CRW19 (BU/OG), harness side. ♦ C125-11, circuit CRW18 (VT/WH), harness side.  N0058187 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G4 . **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
G4 CHECK FOR SHORTS IN THE WINDSHIELD WIPER MOTOR HARNESS	

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• Measure the resistance at windshield wiper motor C125 between the circuits shown in the following chart. **Windshield Wiper Motor** / **Circuits** / **Windshield Wiper Motor** C125-10 / CRW19 (BU/OG)/CRW08 (VT/OG) / C125-1 C125-10 / CRW19 (BU/OG)/CRW17 (GN/VT) / C125-9 C125-10 / CRW19 (BU/OG)/CRW18 (VT/WH) / C125-11 C125-11 / CRW18 (VT/WH)/CRW08 (VT/OG) / C125-1 C125-11 / CRW18 (VT/WH)/CRW17 (GN/VT) / C125-9 C125-1 / CRW08 (VT/OG)/CRW17 (GN/VT) / C125-9  N0091498 • **Is the resistance greater than 10,000 ohms for all measurements?**	**Yes** GO to G5 . **No** REPAIR the circuit. TEST the system for normal operation.
G5 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test H: The Washer Pump is Inoperative - Explorer

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

The front and rear washer systems share the same washer pump motor. The washer pump motor is controlled by two relays; one relay is integral to the front windshield wiper motor and the other relay is integral to the rear wiper motor. Each relay output is connected to one of the washer pump motor's two inputs and when the washer pump motor is not in use, the relay outputs are both in a state of ground. When the rear window WASH function has been selected, the rear wiper motor's integral relay supplies power to one of the washer pump motor inputs causing it to rotate and deliver washer solvent to the rear window. When the front windshield WASH function has been selected, the front windshield wiper motor's integral relay supplies power to the other washer pump motor input causing it to rotate in the opposite direction and deliver washer solvent to the front windshield. The multifunction switch is connected directly to the front windshield wiper motor and also the rear wiper motor.

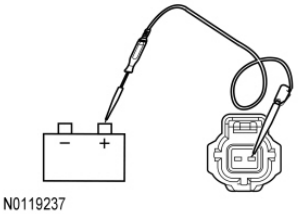
This pinpoint test is intended to diagnose the following:

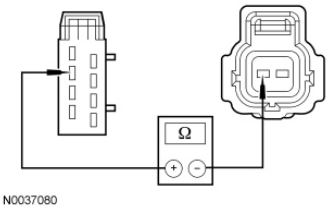
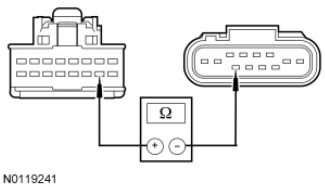
- Wiring, terminals or connectors
- Multifunction switch
- Washer pump motor
- Windshield wiper motor
- Rear window wiper motor

PINPOINT TEST H: THE WASHER PUMP IS INOPERATIVE - EXPLORER

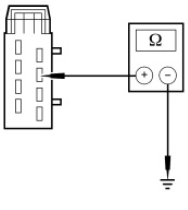
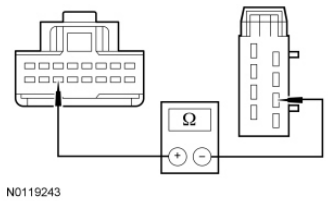
Test Step	Result / Action to Take
H1 CHECK THE OPERATION OF THE FRONT AND REAR WIPERS	
• Ignition ON. • Operate the front and rear wipers in all modes. • **Do the front and/or rear wipers operate in all modes other than front and/or rear wash?**	**Yes** GO to H2 . **No** If the front and/or rear wipers are inoperative or display any other faults (other than front or rear wash), GO to Symptom Chart - Wipers and Washers .
H2 CHECK THE OPERATION OF THE FRONT AND REAR WASH FUNCTIONS	
• Operate the front and rear wash function. • **Is the front and rear wash function inoperative?**	**Yes** If the front and rear wash function is inoperative, GO to H3 . **No** If the front wash is inoperative, GO to H7 . If the rear wash is inoperative, GO to H10 .

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H3 CHECK THE WASHER PUMP MOTOR BY USING A TEST LIGHT	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** • Disconnect: Washer Pump Motor C1397. • Connect a test light between the washer pump motor C1397-1, circuit CRW12 (GY/WH), harness side and the washer pump motor C1397-2, circuit CRW14 (BU/WH), harness side.  N0119238 • Operate the front and rear wash function. • **Does the test light illuminate?**	**Yes** INSTALL A new washer pump motor. TEST the system for normal operation. **No** GO to H4 .
H4 CHECK CIRCUIT CRW14 FOR GROUND	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** • Connect a test light between the washer pump motor C1397-2, circuit CRW14 (BU/WH), harness side and the battery positive post.  N0119237 • **Does the test light illuminate?**	**Yes** GO to H5 . **No** GO to H6 .
H5 CHECK THE REAR WASHER SWITCH CIRCUIT FOR AN OPEN	

• Disconnect: Rear Wiper Motor C4323. • Measure the resistance between the rear wiper motor C4323-4, circuit CRW12 (GY/OG), harness side and the washer pump C1397-1, circuit CRW12 (GY/OG), harness side.  N0037080 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new rear wiper motor. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
H6 CHECK THE FRONT WASHER CONTROL CIRCUIT FOR AN OPEN	
• Disconnect: Windshield Wiper Motor C125. • Measure the resistance between the windshield wiper motor C125-7, circuit CRW14 (BU/WH), harness side and the washer pump C1397-2, CRW14 (BU/WH), harness side. • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new windshield wiper motor. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
H7 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to H8 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
H8 CHECK THE FRONT WASHER SWITCH CIRCUIT FOR AN OPEN	
• Disconnect: Windshield Wiper Motor C125. • Measure the resistance between the multifunction switch C202-10, circuit CRW07 (GY/BN), harness side and the windshield wiper motor C125-12, circuit CRW07 (GY/BN), harness side.  N0119241 • **Is the resistance less than 5 ohms?**	**Yes** GO to H9 . **No** REPAIR the circuit. TEST the system for normal operation.

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H9 CHECK THE REAR WASHER GROUND CIRCUIT FOR AN OPEN	
• Disconnect: Rear Wiper Motor C4323. • Measure the resistance between the rear wiper motor C4323-3, circuit GD150 (BK/WH), harness side and ground.  N0059129 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new windshield wiper motor. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
H10 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to H11 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
H11 CHECK THE REAR WASHER SWITCH CIRCUIT FOR AN OPEN	
• Disconnect: Rear Wiper Motor C4323. • Measure the resistance between the multifunction switch C202-14, circuit CRW20 (GY/YE), harness side and the rear wiper motor C4323-5, circuit CRW20 (GY/YE), harness side.  N0119243 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new rear wiper motor. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test I: The Washer Pump is Inoperative - Explorer Sport Trac

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

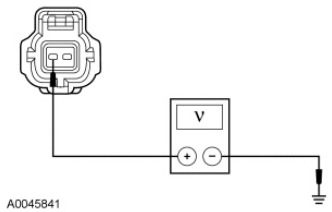
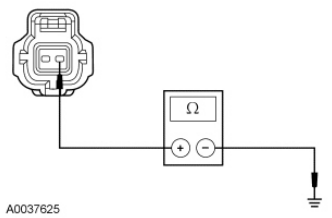
During normal operation, the washer pump motor is powered through an internal relay in the wiper motor using circuit CRW14 (BU/WH). The multifunction switch provides input to the windshield wiper motor

through circuit CRW07 (GY/BN) to activate the washer. The washer pump motor is grounded at all times through circuit GD120 (BK/GN).

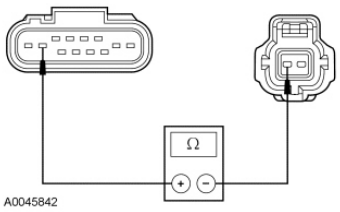
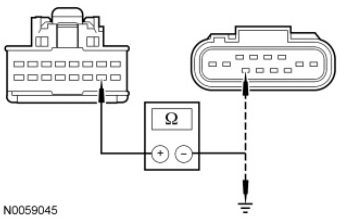
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Washer pump motor
- Multifunction switch

PINPOINT TEST I: THE WASHER PUMP IS INOPERATIVE - EXPLORER SPORT TRAC

Test Step	Result / Action to Take
I1 CHECK THE WASHER PUMP MOTOR FOR VOLTAGE	
• Ignition OFF. • Disconnect: Washer Pump Motor C137. • Ignition ON. • Measure the voltage between washer pump motor C137-1, circuit CRW14 (BU/WH) harness side and ground while depressing the multifunction switch to the WASH position.  A0045841 • **Is the voltage greater than 10 volts?**	**Yes** GO to I2 . **No** GO to I3 .
I2 CHECK CIRCUIT GD120 (BK/GN) FOR GROUND	
• Ignition OFF. • Measure the resistance between washer pump motor C137-2, circuit GD120 (BK/GN), harness side and ground.  A0037625 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new washer pump. REFER to Washer Pump in this section. **No** REPAIR the circuit. TEST the system for normal operation.
I3 CHECK CIRCUIT CRW14 (BU/WH) FOR AN OPEN	

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• Ignition OFF. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between windshield wiper motor C125-7, circuit CRW14 (BU/WH), harness side and washer pump motor C137-1, circuit CRW14 (BU/WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to I4 . **No** REPAIR the circuit. TEST the system for normal operation.
I4 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the Multifunction Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Did the multifunction switch pass the component test?**	**Yes** GO to I5 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 .
I5 CHECK CIRCUIT CRW07 (GY/BN) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between windshield wiper motor C125-12, circuit CRW07 (GY/BN), harness side and multifunction switch C202-10, circuit CRW07 (GY/BN), harness side; and between multifunction switch C202-10, circuit CRW07 (GY/BN), harness side and ground.  • **Is the resistance less than 5 ohms between multifunction switch and wiper motor; and greater than 10,000 ohms between multifunction switch and ground?**	**Yes** GO to I6 . **No** REPAIR the circuit. TEST the system for normal operation.
I6 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly.	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. **No** The system is operating correctly at

• Operate the system and verify the concern is still present. • **Is the concern still present?**	this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test J: The Headlamps Do Not Illuminate When the Wipers are On

Refer to Wiring Diagrams Cell 81 , Front Wipers and Washers for schematic and connector information.

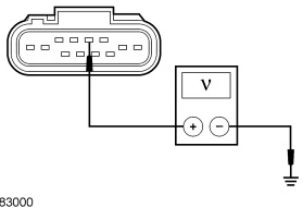
Normal Operation

If equipped with automatic headlamps, the Smart Junction Box (SJB) will illuminate the exterior lamps within 10 seconds when the front wipers are on and the headlamp control switch is in the AUTOLAMP position. The SJB monitors the front wiper motor on circuit CRW22 (WH/BU).

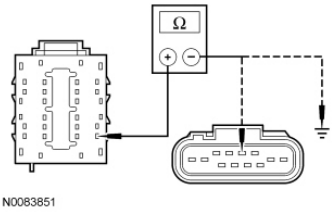
- DTC B2008 Wipers On Signal Circuit Short to Ground - Short to ground on wiper motor on input circuit.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Windshield wiper motor
- SJB

PINPOINT TEST J: THE HEADLAMPS DO NOT ILLUMINATE WHEN THE WIPERS ARE ON

Test Step	Result / Action to Take
J1 CHECK CIRCUIT CRW22 (WH/BU) FOR VOLTAGE	
• Disconnect: Windshield Wiper Motor C125. • Ignition ON. • Measure the voltage between windshield wiper motor C125-2 circuit CRW22 (WH/BU), harness side and ground.  A0083000 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. TEST the system for normal operation. **No** GO to J2 .
J2 CHECK CIRCUIT CRW22 (WH/BU) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280E. • Measure the resistance between SJB C2280E-8 circuit CRW22 (WH/BU), harness side and windshield wiper motor C125-2 circuit CRW22 (WH/BU); then between SJB C2280E-8 circuit	**Yes** GO to J3 . **No** REPAIR the circuit. TEST the system for normal operation.

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CRW22 (WH/BU), harness side and ground.  N0083851 • **Is the resistance less than 5 ohms between the SJB and windshield wiper motor and greater than 10,000 ohms between the SJB and ground?**	
J3 CHECK FOR CORRECT MODULE OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all the SJB connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CLEAR the DTCs. REPEAT the SJB self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Speed Dependent Interval Mode Does Not Operate Correctly

Refer to Wiring Diagrams Cell 81 , Wipers and Washers for schematic and connector information.

Normal Operation

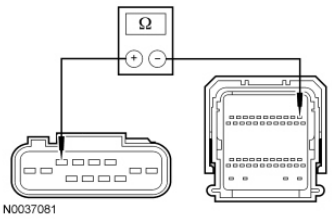
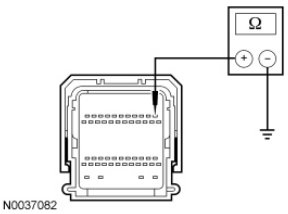
Under normal operation, the windshield wiper motor receives vehicle speed information from the PCM through circuit VMC05 (VT/OG). The speed dependent wipers function in all INT modes except INT 1.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- PCM

PINPOINT TEST K: THE SPEED DEPENDENT INTERVAL MODE DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
K1 REVIEW THE DTCs	
• Review the DTCs from the PCM self-test. • **Are any Vehicle Speed Sensor (VSS) related DTCs present?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the fault.

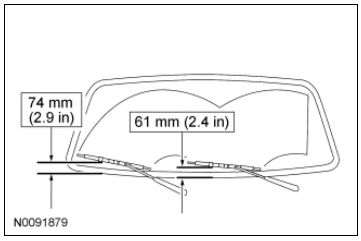
	No GO to K2 .
K2 CHECK CIRCUIT VMC05 (VT/OG) FOR AN OPEN	
• Disconnect: PCM C175b. • Disconnect: Windshield Wiper Motor C125. • Measure the resistance between PCM C175b-1, circuit VMC05 (VT/OG), harness side and windshield wiper motor C125-4, circuit VMC05 (VT/OG), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to K3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
K3 CHECK CIRCUIT VMC05 (VT/OG) FOR A SHORT TO GROUND	
• Measure the resistance between PCM C175b-1, circuit VMC05 (VT/OG), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to K4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
K4 CHECK FOR CORRECT WIPER MOTOR OPERATION	
• Disconnect all wiper motor connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. • Connect all wiper motor connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new windshield wiper motor. REFER to Wiper Motor - Windshield in this section. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

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Wiper Blade and Pivot Arm Adjustment - Windshield

1. Cycle and park the windshield wipers.

2. Verify that the RH and LH wiper blades are located at the specified position.



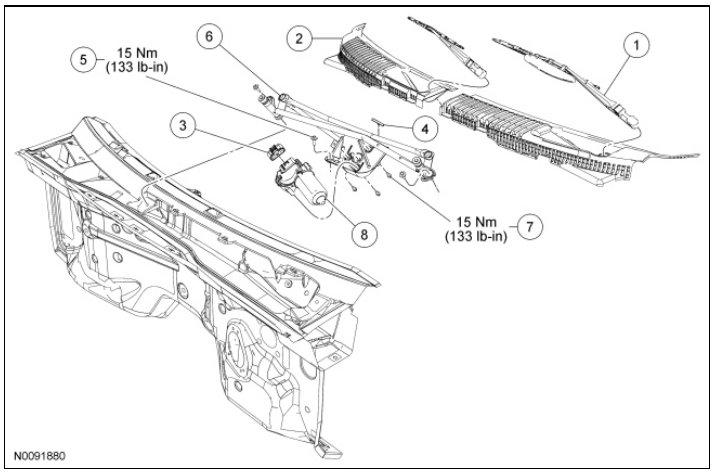
3. **NOTE:** Make sure there is no mechanical binding in the linkage preventing the wiper arms from returning to the fully parked position.

   If the distance is not within specification, remove the windshield wiper pivot arm and reposition to specification.

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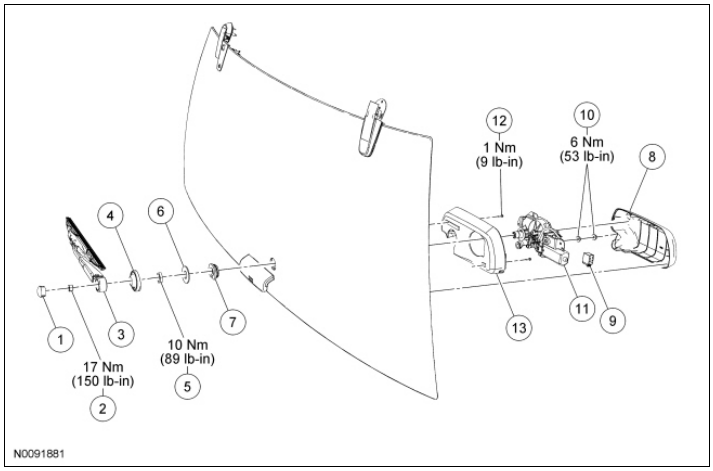
Wiper and Washer System - Exploded View

Windshield Wipers



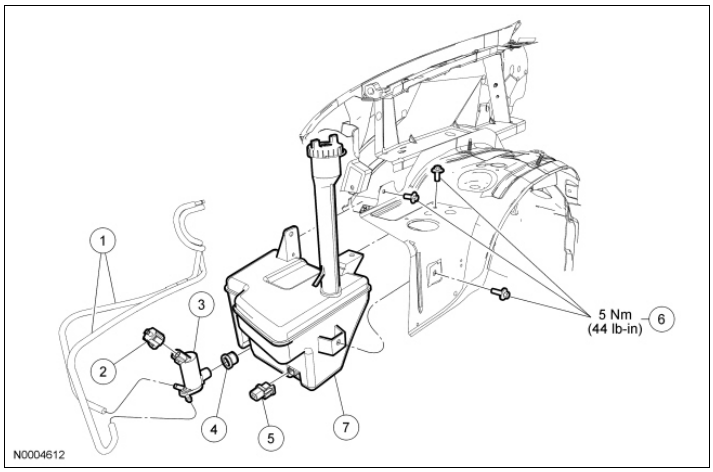
Item	Part Number	Description
1	17526 RH/ 17527 LH	Windshield wiper pivot arm (2 required)
2	02223 RH/ 02222 LH	Cowl panel grille
3	14A464	Windshield wiper motor electrical connector
4	13A506	Wiper motor electrical harness retainer clip
5	17500A	Windshield wiper assembly mounting bolt (3 required)
6	17A535A	Windshield wiper motor assembly
7	W503875S	Windshield wiper motor mounting bolt (3 required)
8	17A535	Windshield wiper motor

Rear Wiper



Item	Part Number	Description
1	17C526	Wiper pivot arm cover
2	W708312	Wiper pivot arm nut
3	17526	Wiper pivot arm (wiper blade assembly serviced by 17528)
4	17C526	Wiper pivot arm shaft cover
5	17481	Pivot shaft nut
6	17C405	Pivot shaft washer
7	17C582	Pivot shaft seal
8	17C412	Rear window wiper motor cover
9	-	Rear window wiper motor electrical connector
10	W704521	Rear window wiper motor nuts (2 required)
11	17508	Rear window wiper motor assembly
12	W505812	Wiper motor cover-to-glass mounting screw (2 required)
13	17C412	Rear window wiper motor cover

Washer Pump and Reservoir



Item	Part Number	Description

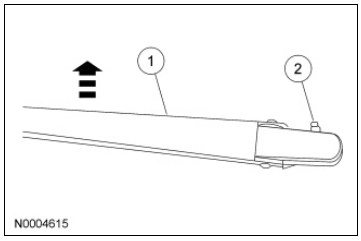
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1	17K605	Windshield washer reservoir hoses
2	14398	Washer pump electrical connector
3	17664B	Windshield washer pump
4	17B618	Windshield washer pump seal
5	14A464	Windshield washer solvent level electrical connector
6	N800947	Windshield washer reservoir bolts (3 required)
7	17B613	Windshield washer reservoir

1. For additional information, refer to the procedures in this section.

Wiper Pivot Arm - Front

1. Remove the wiper pivot arm.
    1. Pull up on the pivot arm.
    2. Pull out on the retaining tab and remove the pivot arm.



2. **NOTE:** The windshield wiper motor must be cycled to make sure that it is in the park position. If necessary, adjust the wiper pivot arms. For additional information, refer to Wiper Blade and Pivot Arm Adjustment - Windshield in this section.

   To install, reverse the removal procedure.

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Wiper Motor - Windshield

Removal and Installation

NOTE: A new wiper motor assembly comes with the linkage arm installed.

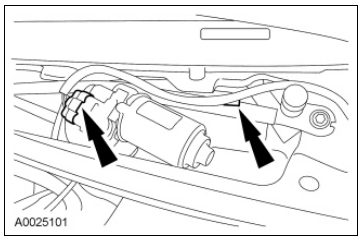
1. Remove the front wiper pivot arms. For additional information, refer to Wiper Pivot Arm - Front in this section.

2. ***NOTICE:*** **To avoid breaking the retaining clips on the cowl panel, do not pull up on the rear of the cowl panel.**

   Pry up on the front of the cowl panels to release it from the retaining clips.

3. Remove the cowl panel grilles.

4. Disconnect the windshield wiper motor electrical connector.
   - Unclip the wiring harness from the wiper arm.
   - Position the wiring harness aside.



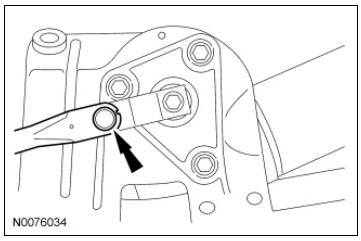
5. Remove the 3 windshield wiper assembly mounting bolts.
   - To install, tighten to 15 Nm (133 lb-in).

6. Remove the windshield wiper assembly and position on a workbench.

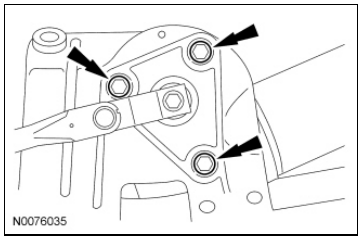
7. ***NOTICE:*** **Do not remove the wiper motor linkage arm from the wiper motor assembly. If the arm is removed, the wiper arms may not park in the correct location.**

   Separate the wiper motor linkage arm from the wiper mounting arm and pivot shaft assembly.

   - Use a suitable tool at the location shown to separate the wiper linkage arm from the wiper mounting arm and pivot shaft assembly.



8. Remove the 3 windshield wiper motor mounting bolts.
   - To install, tighten to 15 Nm (133 lb-in).



9. Remove the windshield wiper motor.

10. **NOTE:** The windshield wiper motor must be cycled to make sure it is in the park position before installing the wiper pivot arms.

    To install, reverse the removal procedure.

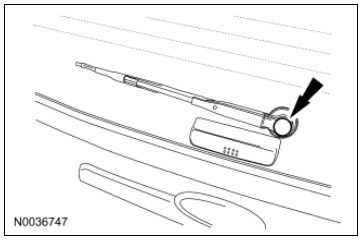
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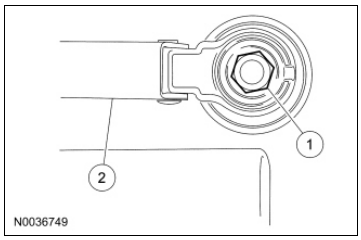
Wiper Pivot Arm - Rear

Removal

1. Remove the wiper pivot arm cover.



2. Remove the wiper pivot arm.
    1. Remove the pivot arm nut.
    2. Remove the wiper pivot arm.



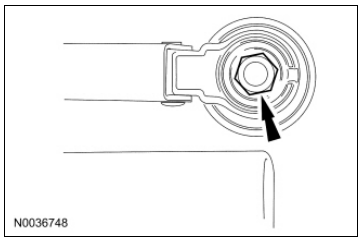
Installation

1. **NOTE:** Before installation, be sure that the rear window wiper motor is in the park position.

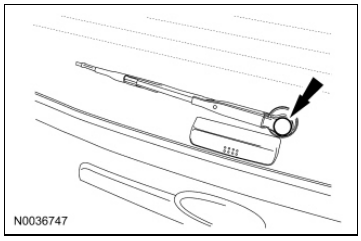
   Turn the wiper switch ON and OFF to allow the rear window wiper motor to cycle and stop in the park position.

2. Position the wiper pivot arm.

3. Install the pivot arm nut.
    - Tighten to 17 Nm (150 lb-in).



4. Install the wiper pivot arm cover.



5. Operate the rear window wiper for one cycle to be sure that the pivot arm is in the correct position when the rear window wiper motor is in the park position.
   If the pivot arm is not in the correct position, remove the pivot arm and repeat Steps 1 through 4.

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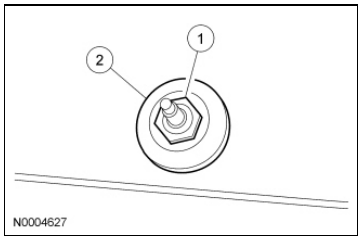
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Wiper Motor - Rear Window

Removal and Installation

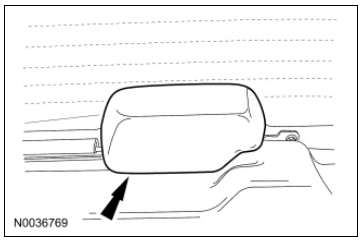
1. Remove the rear wiper pivot arm. For additional information, refer to Wiper Pivot Arm - Rear in this section.

2. Remove the rear window wiper motor grommet.
    1. Remove the pivot shaft nut.
        - To install, tighten to 10 Nm (89 lb-in).
    2. Remove the grommet.

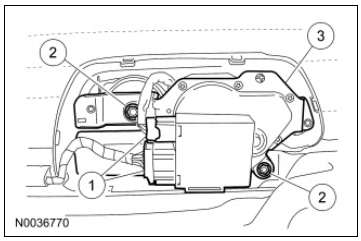


3. Open the liftgate window.

4. Remove the wiper motor cover trim panel.



5. Remove the rear window wiper motor.
    1. Disconnect the electrical connectors.
    2. Remove the 2 rear window wiper motor nuts.
        - To install, tighten to 6 Nm (53 lb-in).
    3. Remove the rear window wiper motor.



6. To install, reverse the removal procedure.

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Washer Pump

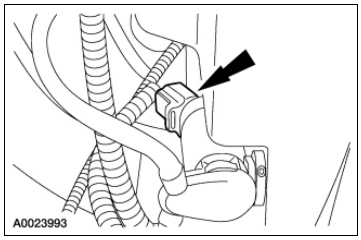
Material

Item	Specification
Motorcraft® Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, D, and F) (Canada)	-
Motorcraft® Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the windshield washer pump electrical connector.



3. ⚠ **WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

   NOTE: To prevent spilling windshield washer fluid, drain the windshield washer reservoir before washer pump removal.

   Disconnect the windshield washer reservoir hoses.

4. **NOTE:** When servicing the windshield washer pump, be careful not to damage the windshield washer pump seal.

   Remove the windshield washer pump.

5. ***NOTICE:*** **Do not operate the windshield washer pump before filling the windshield washer reservoir. Failure to do so could result in premature pump failure.**

   To install, reverse the removal procedure.

   - Fill the windshield washer reservoir with windshield washer fluid.

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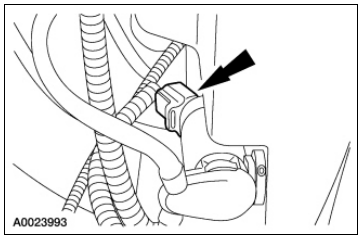
Washer Reservoir

Material

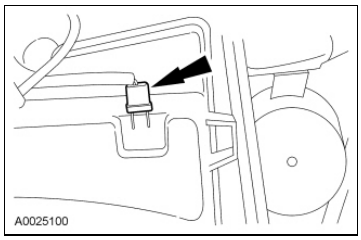
Item	Specification
Motorcraft® Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, D, and F) (Canada)	-
Motorcraft® Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the Air Cleaner (ACL) assembly. For additional information, refer to Section 303-12 .
3. Remove the RH front fender splash shield. For additional information, refer to Section 501-02 .
4. Disconnect the windshield washer pump electrical connector.



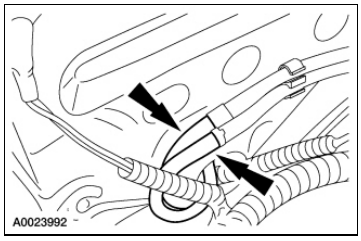
5. Disconnect the windshield washer solvent level electrical connector.



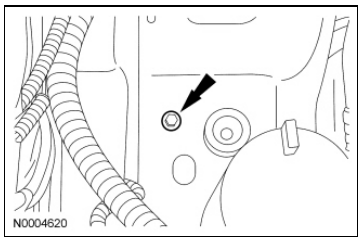
⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTE: If necessary, drain the windshield washer reservoir after removal.

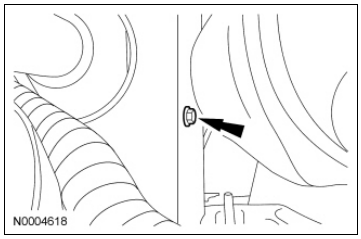
6. Disconnect the windshield washer reservoir hoses.



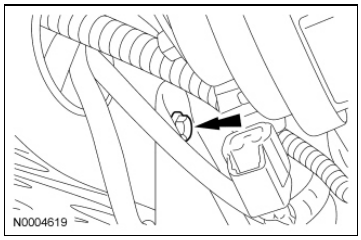
7. Remove the top bolt.
    - To install, tighten to 5 Nm (44 lb-in).



8. Remove the side bolt.
    - To install, tighten to 5 Nm (44 lb-in).



9. Remove the bolt.
    - To install, tighten to 5 Nm (44 lb-in).



10. Remove the windshield washer pump reservoir.

11. ***NOTICE:*** **When servicing the windshield washer pump, be careful not to damage the windshield washer pump seal.**

    Transfer components as necessary.

12. ***NOTICE:*** **Do not operate the washer pump prior to filling the windshield washer reservoir. Failure to follow these instructions may result in premature pump failure.**

    To install, reverse the removal procedure.

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General Specifications

Item	Specification
Roof Opening Panel Alignment	
Roof opening panel glass clearance: roof to the front of the roof opening panel	-3 to 1 mm (-0.12 to 0.04 in) flush front to rear
Roof opening panel glass clearance: rear of the roof opening panel to the roof	3 to -1 mm (0.12 to -0.04 in) flush front to rear

Torque Specifications

Description	Nm	lb-in
Air deflector screws	1	9
Roof opening panel frame bolts	6	53
Roof opening panel glass screws	4	35
Roof opening panel motor mounting screws	3	27

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Roof Opening Panel

The roof opening panel consists of the following:

- Air deflector
- Roof opening panel drain hose
- Roof opening panel frame
- Roof opening panel glass
- Roof opening panel glass seal
- Roof opening panel motor and module assembly
- Roof opening panel shield (sun shade)
- Roof opening panel shield guide feet
- Roof opening panel switch
- Roof opening panel trough
- Roof opening panel trough guides
- Skid plates
- Trim lace

Roof Opening Panel Operation

The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel. The roof opening panel is an electronically operated glass panel that has one-touch open, one-touch close and one-touch vent features.

To vent the roof opening panel, the roof opening panel must first be in the CLOSED position. Press and release the TILT control switch. The roof opening panel will move to the VENT position automatically. To close the roof opening panel from the VENT position, pull and hold the TILT control switch until the glass panel stops moving.

To open the roof opening panel, press and release the SLIDE control switch. The roof opening panel will open automatically. The roof opening panel movement can be stopped at any time by pressing the switch again.

To close the roof opening panel, pull and release the SLIDE or TILT control switch. The roof opening panel will close automatically. The roof opening panel movement can be stopped at any time by pressing the switch again.

Bounce-Back

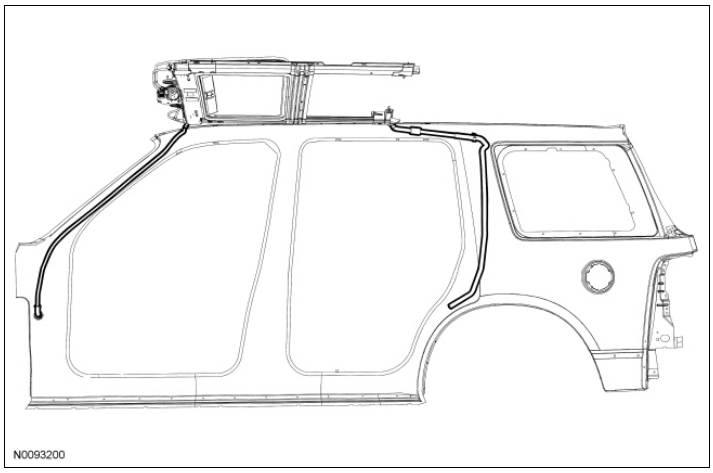
The roof opening panel has a bounce-back feature. If an obstacle has been detected in the roof opening panel as the sliding glass is closing, the roof opening panel will automatically open and stop at a predetermined position.

Security Override

To override a bounce-back condition (to overcome the resistance of ice on the roof opening panel seal for example), within 2 seconds of a bounce-back event, pull and hold the SLIDE or TILT control switch. The closing force will begin to increase each time the roof opening panel is closed for the first 3 closing cycles (bounce-back will still be enabled).

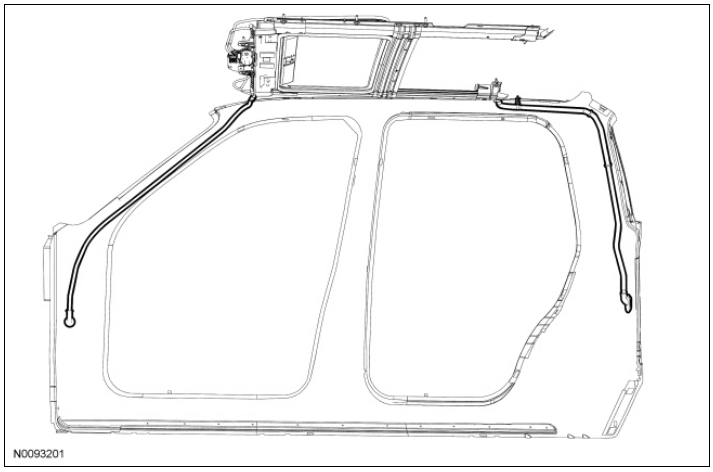
Roof Opening Panel Drain Hose Routing - Explorer

NOTE: RH side shown, LH side similar.



Roof Opening Panel Drain Hose Routing - Explorer Sport Trac

NOTE: RH side shown, LH side similar.



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Roof Opening Panel

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Principles of Operation

Roof Opening Panel

The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel. The roof opening panel motor and module are installed new as an assembly. The roof opening panel is an electronically operated glass panel that can be opened, closed or vented by the roof opening panel switch.

The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Roof opening panel • Roof opening panel shield • Roof panel frame • Opening shield guide feet	• Smart Junction Box (SJB) fuse(s): ♦ 1 (20A) ♦ 5 (5A) • Circuitry • Accessory delay relay • Roof opening panel control switch • Roof opening panel motor

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3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern is not visually evident, determine the symptom. GO to Symptom Chart - Roof Opening Panel or GO to Symptom Chart - NVH .

Symptom Chart - Roof Opening Panel

Symptom Chart - Roof Opening Panel

Symptom Chart - NVH

Symptom Chart- NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- The roof opening panel has excessive wind noise

- Glass panel not fully closed
- Incorrect alignment
- Roof opening panel seals damaged

- GO to Pinpoint Test A .

- The roof opening panel rattles

- Roof opening panel
- Roof opening panel rail or guide
- Roof opening panel lifter assemblies
- Loose roof opening panel fasteners
- Roof opening panel shield
- DVD entertainment system

- GO to Pinpoint Test C .

- The roof opening panel is noisy during operation

- Roof opening panel
- Roof opening panel rail or guide
- Roof opening panel lifter assemblies
- Roof opening panel alignment
- Roof opening panel motor

- GO to Pinpoint Test D .

Pinpoint Tests

Pinpoint Test A: The Roof Opening Panel Has Excessive Wind Noise

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel.

This pinpoint test is intended to diagnose the following:

- Incorrect roof opening panel alignment
- Poorly fitting roof opening panel seal/weatherstrip
- Incorrect installation of the roof opening panel and motor/module
- Incorrect curvature of the air deflector

PINPOINT TEST A: THE ROOF OPENING PANEL HAS EXCESSIVE WIND NOISE

Test Step	Result / Action to Take
A1 VERIFY THE ROOF OPENING PANEL NOISE	
• Road test the vehicle with the roof opening panel in the CLOSED and OPEN positions. • **Is the wind noise present only in the OPEN position?**	**Yes** GO to A4 . **No** GO to A2 .
A2 CHECK THE ROOF OPENING PANEL WEATHERSTRIP	
NOTE: Make sure the weatherstrip is secured to the glass, not cut, cracked, pinched, loose or obstructed in CLOSED, VENT and OPEN positions. • Check the roof opening panel weatherstrip. • **Is the roof opening panel weatherstrip OK?**	**Yes** GO to A3 . **No** INSTALL a new roof opening panel weatherstrip. REFER to Roof Opening Panel - Exploded View in this section. TEST the system for normal operation.
A3 CHECK THE ROOF OPENING PANEL ALIGNMENT	
• Check the roof opening panel alignment. • **Is the alignment OK?**	**Yes** REFER to Section 501-00 to diagnose other possible sources of the excessive wind noise. **No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. TEST the system for normal operation.

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A4 CHECK THE AIR DEFLECTOR	
• Make sure the air deflector is securely attached and check for damaged or unsecured springs. • **Is the air deflector OK?**	**Yes** PARTIALLY close the roof opening panel until the noise is eliminated. If the noise is eliminated, INFORM the customer that changing glass location will eliminate the wind noise. If the wind noise is not eliminated, INSTALL a new air deflector. TEST the system for normal operation. **No** INSTALL new air deflector assembly. REFER to Air Deflector in this section. TEST the system for normal operation.

Pinpoint Test B: The Roof Opening Panel Leaks

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel.

This pinpoint test is intended to diagnose the following:
- Incorrect roof opening panel alignment
- Damaged, clogged or obstructed roof opening panel drain hoses
- Damaged roof opening panel seal/weatherstrip
- Incorrect position of the roof opening panel glass

PINPOINT TEST B: THE ROOF OPENING PANEL LEAKS

Test Step	Result / Action to Take
B1 VERIFY CUSTOMER OPERATION OF ROOF OPENING PANEL WHEN PARKED	
• Make sure customer is parking with the roof opening panel correctly in the CLOSED position. • **Is the customer parking with the roof opening panel in the CLOSED position?**	**Yes** GO to B2 . **No** INSTRUCT the customer to refer to the Owner's Literature for correct operation of the roof opening panel.
B2 CHECK THE ALIGNMENT OF THE ROOF OPENING PANEL	
• Make sure the roof opening panel glass is centered and flush with roof line. • **Is the roof opening panel alignment correctly?**	**Yes** GO to B3 . **No** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. TEST the system for normal operation.
B3 CHECK THE WEATHERSTRIP CONDITION	
	Yes GO to B4 .

• **NOTE:** The seal has a bonded joint located on the passenger side or rear edge. This is not a defect. • Make sure the roof opening panel seal is not cracked, torn or loose. • Check the roof opening panel seal. • **Is the roof opening panel seal in good condition and free from damage?**	**No** INSTALL a new roof opening panel seal. TEST the system for normal operation.
B4 CHECK THE WATER TROUGH CONDITION	
• Check the water trough and guides for damage and/or correct attachment and function. • **Is the water trough OK?**	**Yes** GO to B5 . **No** REPAIR the water trough or replace as necessary. TEST the system for normal operation.
B5 CHECK THE DRAIN HOSES	
NOTE: Drain hoses can be viewed with a flashlight by removing the headliner lace around the inside opening and gently pulling down on the headliner. (On some vehicles, the trim lace has been replaced by Velcro® style attachments.) • Make sure the drain hoses are all connected and not cracked, slit, pinched or obstructed. • **Are all the drain hoses present and attached correctly?**	**Yes** GO to B6 . **No** REPAIR or INSTALL a new drain hose(s). TEST the system for normal operation.
B6 CHECK THE DRAIN HOSES FOR CORRECT FLOW	
NOTE: Drain hoses must flow downhill and can not be pinched or restricted by headliner or any other trim components. • With the panel open, slowly pour water into the water trough area and make sure that the same amount of water exits the vehicle at the bottom of the A- and C-pillars. • Check the drain hoses for obstructions by blowing compressed air through the drain spouts in the water trough area, then retest with water. • **Are the drain hoses operating correctly?**	**Yes** INSPECT other areas of the vehicle that may cause water to enter the roof area such as the windshield or luggage rack, if equipped. If no problem is found, GO to B7 . **No** LOWER the headliner and INSPECT drain hoses for correct routing. REPAIR or INSTALL a new drain hose(s). TEST the system for normal operation.
B7 CHECK THE CONDITION OF THE ROOF OPENING PANEL FRAME	
• Check the roof opening panel frame for damage that may cause the roof opening panel seal to seat incorrectly. • **Is the roof opening panel frame OK?**	**Yes** INSTALL a new roof opening panel. REFER to Roof Opening Panel in this section. TEST the system for normal operation. **No** REPAIR roof opening panel frame as necessary. TEST the system for normal operation.

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Pinpoint Test C: The Roof Opening Panel Rattles

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel. All components should be secured correctly.

This pinpoint test is intended to diagnose the following:

- Roof opening panel
- Roof opening panel air deflector assembly
- Roof opening panel water trough
- Roof opening panel lifter assemblies
- Headliner
- Roof opening panel motor/module pad
- Roof opening panel frame
- Loose fasteners
- DVD entertainment system

PINPOINT TEST C: THE ROOF OPENING PANEL RATTLES

Test Step	Result / Action to Take
C1 CHECK THE ROOF OPENING PANEL WEATHERSTRIP	
• **NOTE:** Make sure the weatherstrip is secured to the glass, not cut, cracked, pinched, loose or obstructed in CLOSED, VENT and OPEN positions. • Check the roof opening panel weatherstrip. • **Is the roof opening panel weatherstrip OK?**	**Yes** GO to C2 . **No** INSTALL a new roof opening panel weatherstrip. REFER to Roof Opening Panel - Exploded View in this section. TEST the system for normal operation.
C2 CHECK THE ROOF OPENING PANEL TIGHTNESS	
• Manually push the roof opening glass panel up and fore/aft. • **Is the roof opening panel glass loose?**	**Yes** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. TEST the system for normal operation. **No** GO to C3 .
C3 CHECK THE ROOF OPENING PANEL TRACKS	
• Open the roof opening panel. • Check the roof opening panel tracks for obstructions and damage.	**Yes** GO to C4 . **No** REMOVE all the roof opening panel track obstructions

• **Are the roof opening panel tracks OK?**	and REPAIR the roof opening panel tracks. If the roof opening panel tracks cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.
C4 CHECK THE ROOF OPENING PANEL WATER TROUGH AND TROUGH GUIDES	
• Check the roof opening panel water trough and trough guides for any loose obstructions. • **Are the roof opening panel water trough and trough guides installed securely and free from obstructions?**	**Yes** GO to C5 . **No** REMOVE all obstructions from the roof opening panel water trough guides and install securely. INSTALL a new roof opening panel frame if the water trough guides are damaged. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation.
C5 CHECK THE ROOF OPENING PANEL SHIELD (SUNSHADE)	
• Check the roof opening panel shield for correct installation. • **Is the roof opening panel shield installed correctly?**	**Yes** GO to C6 . **No** INSTALL the roof opening panel shield correctly. REFER to Roof Opening Panel Shield . TEST the system for normal operation.
C6 CHECK THE ROOF OPENING PANEL AIR DEFLECTOR ASSEMBLY	
• Check the roof opening panel air deflector assembly for obstructions and damage. • **Is the roof opening panel air deflector assembly OK?**	**Yes** GO to C7 . **No** REMOVE all obstructions and REPAIR or INSTALL a new roof opening panel air deflector assembly. REFER to Air Deflector in this section. TEST the system for normal operation.
C7 CHECK THE ROOF OPENING PANEL GLASS	
• Verify the roof opening panel glass is free from obstructions and damage, and is securely fastened. • **Is the roof opening panel glass OK?**	**Yes** GO to C8 . **No** REPAIR or INSTALL a new roof opening panel glass. REFER to Roof Opening Panel Glass in this section. TEST the system for normal operation.
C8 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES	
• Verify the roof opening panel lifter assemblies are free from obstructions and damage.	**Yes** GO to C9 . **No**

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• **Are the roof opening panel lifter assemblies OK?**	REMOVE all obstructions from the roof opening panel lifter assemblies and REPAIR any damage. If the roof opening panel lifter assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation.
C9 CHECK ROOF OPENING PANEL FRAME INSTALLATION	
• Check all roof opening fasteners for correct torque and verify correct installation of the roof opening panel frame. Refer to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. • **Is the roof opening panel correctly installed and tightened to specification?**	**Yes** GO to C10 . **No** TIGHTEN the loose fasteners or REINSTALL the roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation.
C10 CHECK THE ROOF OPENING PANEL FRAME FOR RATTLES	
• Check the roof opening panel frame assembly for any loose parts or for any condition that will cause rattles. • **Is there a condition that will cause rattles?**	**Yes** INSTALL a suitable sound damper material to correct the condition. If the rattle still persists, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation. **No** If equipped with a DVD entertainment system, GO to C11 . INSTALL a new roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation.
C11 CHECK THE DVD ENTERTAINMENT SYSTEM FOR RATTLES	
• Check all DVD entertainment system fasteners for correct torque and verify correct installation. Refer to Section 415-00 . • **Is the DVD entertainment system correctly installed and tightened to specification?**	**Yes** INSTALL a new roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation. **No** TIGHTEN the loose fasteners or REINSTALL the DVD entertainment system. REFER to Section 415-00 . TEST the system for normal operation.

Pinpoint Test D: The Roof Opening Panel is Noisy During Operation

Normal Operation

The roof opening panel operates smoothly while opening and closing.

This pinpoint test is intended to diagnose the following:

- Obstructed or damaged roof opening panel
- Obstructed or damaged roof opening panel lifter assemblies
- Incorrect roof opening panel alignment
- Noisy roof opening panel motor/module assembly

PINPOINT TEST D: THE ROOF OPENING PANEL IS NOISY DURING OPERATION

Test Step	Result / Action to Take
D1 CHECK THE ROOF OPENING PANEL FOR OBSTRUCTIONS OR DAMAGE	
• Check the roof opening panel for any obstructions and damage. • **Are there any obstructions and/or damage?**	**Yes** REMOVE all obstructions. REPAIR any damage. If the damage cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation. **No** GO to D2 .
D2 CHECK THE ROOF OPENING PANEL OPERATION	
• Check the roof opening panel during operation. • **Is the roof opening panel loose or incorrectly adjusted?**	**Yes** ALIGN the roof opening panel. REFER to Roof Opening Panel Alignment in this section. TEST the system for normal operation. **No** GO to D3 .
D3 CHECK THE ROOF OPENING PANEL TRACKS	
• Open the roof. • Check the roof opening panel tracks for obstructions and damage. • **Are the roof opening panel tracks OK?**	**Yes** GO to D4 . **No** REMOVE all obstructions and REPAIR any damage. If the roof opening panel tracks cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel Frame in this section. TEST the system for normal operation.
D4 CHECK THE ROOF OPENING PANEL SHIELD	
• Check the roof opening panel shield for correct movement. • **Is the roof opening panel shield moving correctly?**	**Yes** GO to D5 . **No** REMOVE and REINSTALL the roof opening panel shield. REFER to Roof Opening Panel Shield in this section. TEST the

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	system for normal operation.
D5 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES	
• Check the roof opening panel lifter assemblies for obstructions and damage. • **Are the roof opening panel lifter assemblies OK?**	**Yes** GO to D6 . **No** REMOVE all obstructions and REPAIR any damage. If the roof opening panel lifter assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. TEST the system for normal operation.
D6 CHECK THE ROOF OPENING PANEL MOTOR/MODULE	
• Remove the roof opening panel motor/module and leave the electrical connector connected. • Operate the roof opening panel to the full OPEN and CLOSED positions. • **Does the motor/module make excessive noise?**	**Yes** INSTALL a new roof opening panel motor/module. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Motor in this section. TEST the system for normal operation. **No** REINSTALL the roof opening panel motor/module. TEST the system for normal operation. If the roof opening panel is still noisy, INSTALL a new roof opening panel frame. REFER to Roof Opening Panel - Exploded View and Roof Opening Panel Frame in this section. If the roof opening panel is no longer noisy, the system is operating correctly. The concern may have been caused by an incorrectly installed roof opening panel motor.

Pinpoint Test E: The Roof Opening Panel Does Not Open or Close

Refer to Wiring Diagrams Cell 101 , Roof Opening Panel for schematic and connector information.

The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed. Refer to Roof Opening Panel Motor Initialization in this section.

Normal Operation

The roof opening panel uses an integrated motor and module to operate the roof opening panel. A new roof opening panel motor/module is installed as an assembly.

The roof opening panel motor/module receives voltage from the accessory delay relay through circuit CBP05 (YE) when the key is in the ACC or RUN position and voltage at all times through circuit SBP01 (RD). Ground is supplied to the roof opening panel motor/module and the roof opening panel control switch through circuit GD133 (BK). When the roof opening panel SLIDE or TILT switch is pulled, a ground signal is sent to the roof opening panel motor/module through circuit CPR40 (YE/OG), which causes the roof opening panel

to close. When the roof opening panel SLIDE switch is pressed, a ground signal is sent to the roof opening panel motor/module through circuit CPR31 (VT/BN), which causes the roof opening panel to open.

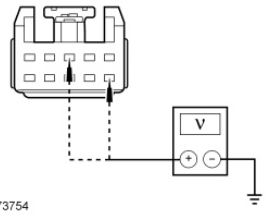
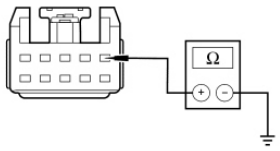
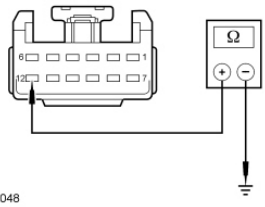
This pinpoint test is intended to diagnose the following:

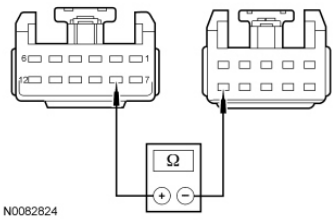
- Fuse(s)
- Wiring, terminals or connectors
- Inoperative roof opening panel switch
- Inoperative roof opening panel motor/module assembly
- Roof opening panel motor not initialized

PINPOINT TEST E: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

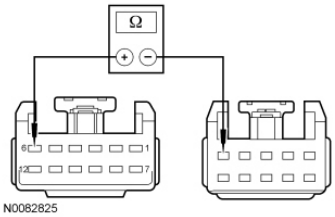
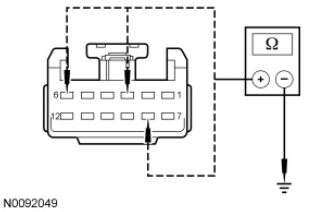
Test Step	Result / Action to Take
E1 CHECK THE POWER WINDOWS	
• Ignition ON. • Verify the power windows operate. • **Do the power windows operate?**	**Yes** GO to E2 . **No** REFER to Section 501-11 to diagnose the accessory delay relay circuit.
E2 CHECK THE MOTOR/MODULE FOR INITIALIZATION	
• Attempt to carry out the roof opening panel motor initialization procedure. Refer to Roof Opening Panel Motor Initialization in this section. • **Is the concern still present, or does the roof opening panel motor fail to initialize?**	**Yes** GO to E3 . **No** The system is operating normally at this time. The roof opening panel motor was not initialized.
E3 CHECK THE ROOF OPENING PANEL SWITCH	
• Ignition OFF. • Disconnect: Roof Opening Panel Switch C912. • Carry out the roof opening panel switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the roof opening panel switch OK?**	**Yes** GO to E4 . **No** INSTALL a new roof opening panel switch. TEST the system for normal operation.
E4 CHECK VOLTAGE TO THE ROOF OPENING PANEL MOTOR/MODULE	
• Ignition OFF. • Disconnect: Roof Opening Panel Motor/Module C921. • Ignition ON. • Measure the voltage between roof opening panel motor/module C921-3, circuit CBP05 (YE), harness side and roof opening panel motor/module C921-6, circuit SBP01 (RD), harness side and ground.	**Yes** GO to E5 . **No** VERIFY Smart Junction Box (SJB) fuse 1 (20A) and circuit fuse 5 (5A) are OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring

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 A0073754 • **Is the voltage greater than 10 volts for both measurements?**	Diagrams Manual to identify the possible causes of the circuit short. TEST the system for normal operation.
E5 CHECK THE ROOF OPENING PANEL MOTOR/MODULE GROUND	
• Ignition OFF. • Measure the resistance between roof opening panel motor/module C921-1, circuit GD133 (BK), harness side and ground.  A0073757 • **Is the resistance less than 5 ohms?**	**Yes** GO to E6 . **No** REPAIR the circuit. TEST the system for normal operation.
E6 CHECK THE ROOF OPENING PANEL CONTROL SWITCH GROUND	
• Measure the resistance between roof opening panel switch C912-12, circuit GD133 (BK), harness side and ground.  N0092048 • **Is the resistance less than 5 ohms?**	**Yes** GO to E7 . **No** REPAIR the circuit. TEST the system for normal operation.
E7 CHECK CIRCUIT CPR40 (YE/OG) FOR AN OPEN	
• Measure the resistance between roof opening panel switch C912-8, circuit CPR40 (YE/OG), harness side and roof opening panel motor/module C921-10, circuit CPR40 (YE/OG), harness side.	**Yes** GO to E8 . **No** REPAIR the circuit. TEST the system for normal operation.



- **Is the resistance less than 5 ohms?**

E8 CHECK CIRCUIT CPR31 (VT/BN) FOR AN OPEN	
• Measure the resistance between roof opening panel switch C912-6, circuit CPR31 (VT/BN), harness side and roof opening panel motor/module C921-5, circuit CPR31 (VT/BN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to E9 . **No** REPAIR the circuit. TEST the system for normal operation.
E9 CHECK CIRCUITS CPR31 (VT/BN), CPR40 (YE/OG) AND CPR38 (WH/BU) FOR A SHORT TO GROUND	
• Measure the resistance between roof opening panel switch C912, harness side and ground using the following chart: **Roof Opening Panel Switch** / **Circuit** C912-6 — CPR31 (VT/BN) C912-3 — CPR38 (WH/BU) C912-8 — CPR40 (YE/OG)  • **Is the resistance greater than 10,000 ohms for all measurements?**	**Yes** GO to E10 . **No** REPAIR the circuit(s). TEST the system for normal operation.

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E10 CHECK THE ROOF OPENING PANEL MOTOR/MODULE FOR CORRECT OPERATION	
• Disconnect all roof opening panel motor/module connectors. • Check for: ♦ corrosion. ♦ bent pins. ♦ pushed-out pins. • Connect all roof opening panel motor/module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new roof opening panel motor/module. REFER to Roof Opening Panel Motor in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Roof Opening Panel Does Not Open or Close in VENT Position

Refer to Wiring Diagrams Cell 101 , Roof Opening Panel for schematic and connector information.

The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed. Refer to Roof Opening Panel Motor Initialization in this section.

Normal Operation

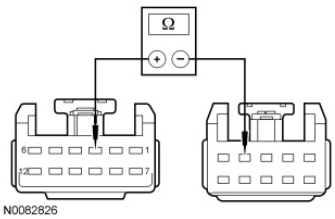
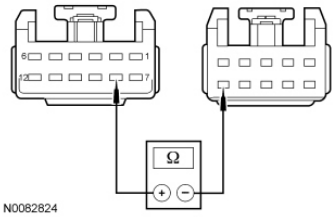
The roof opening panel uses a integrated motor and module to operate the roof opening panel. A new roof opening panel motor/module is installed as an assembly.

The roof opening panel motor/module receives voltage from the accessory delay relay through circuit CBP05 (YE) when the key is in the ACC or RUN position and voltage at all times through circuit SBP01 (RD). Ground is supplied to the roof opening panel motor/module and the roof opening panel control switch through circuit GD133 (BK). When the roof opening panel TILT switch is pressed, a ground signal is sent to the roof opening panel motor/module through circuit CPR38 (WH/BU), which causes the roof opening panel to open to the VENT position. When the roof opening panel SLIDE or TILT switch is pulled, a ground signal is sent to the roof opening panel motor/module through circuit CPR40 (YE/OG), which causes the roof opening panel to close.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Roof opening panel switch
- Roof opening panel motor/module assembly

PINPOINT TEST F: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE IN VENT POSITION

Test Step	Result / Action to Take
F1 CHECK THE MOTOR/MODULE FOR INITIALIZATION	
	Yes GO to F2 .

• Attempt to carry out the roof opening panel motor initialization procedure. Refer to Roof Opening Panel Motor Initialization in this section. • **Is the concern still present, or does the roof opening panel motor fail to initialize?**	**No** The system is operating normally at this time. The roof opening panel motor was not initialized.
F2 CHECK THE ROOF OPENING PANEL SWITCH	
• Ignition OFF. • Disconnect: Roof Opening Panel Switch C912. • Carry out the roof opening panel switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the roof opening panel switch OK?**	**Yes** GO to F3 . **No** INSTALL a new roof opening panel switch. TEST the system for normal operation.
F3 CHECK CIRCUIT CPR38 (WH/BU) FOR AN OPEN	
• Measure the resistance between roof opening panel switch C912-3, circuit CPR38 (WH/BU), harness side and roof opening panel motor/module C921-4, circuit CPR38 (WH/BU), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to F4 . **No** REPAIR the circuit. TEST the system for normal operation.
F4 CHECK CIRCUIT CPR40 (YE/OG) FOR AN OPEN	
• Measure the resistance between roof opening panel switch C912-8, circuit CPR40 (YE/OG), harness side and roof opening panel motor/module C921-10, circuit CPR40 (YE/OG), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to F5 . **No** REPAIR the circuit. TEST the system for normal operation.
F5 CHECK THE ROOF OPENING PANEL MOTOR/MODULE FOR CORRECT OPERATION	
• Disconnect all roof opening panel motor/module connectors. • Check for: ♦ corrosion.	**Yes** INSTALL a new roof opening panel motor/module. REFER to Roof Opening Panel Motor in this

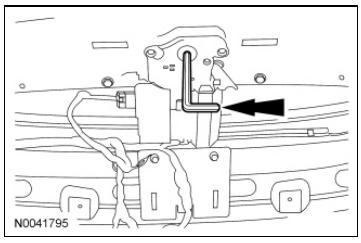
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♦ bent pins. ♦ pushed-out pins. • Connect all roof opening panel motor/module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	section. TEST the system for normal operation. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Roof Opening Panel Manual Operation

1. Remove the overhead console. For additional information, refer to Section 501-12 .

2. Insert an Allen wrench into the center of the manual drive hole of the roof opening panel motor. Rotate the Allen wrench counterclockwise until the roof opening panel is closed.



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Roof Opening Panel Motor Initialization

⚠ WARNING: Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.

NOTE: A new roof opening panel motor will only vent and must be initialized.

NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed.

1. Turn the ignition to the RUN position. For a new roof opening panel motor, skip to Step 3.

2. **For an existing roof opening panel motor,** pull and hold the SLIDE switch until the roof opening panel glass moves to the full VENT position. Release the SLIDE switch.

3. **For a new roof opening panel motor,** pull and hold the SLIDE switch until the roof opening panel glass moves past full VENT and suddenly back to full VENT.
   For an existing motor, pull and hold the SLIDE switch (for approximately 10 seconds) until the roof opening panel glass moves past full VENT and suddenly back to full VENT.

4. Quickly release the SLIDE switch and re-pull and hold the SLIDE switch while the roof opening panel glass moves to full OPEN and back to CLOSED (movement will start approximately 3 seconds after the switch is pulled).

5. Release the SLIDE switch and verify successful initialization by carrying out one-touch open, one-touch close and one-touch vent operations.

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Roof Opening Panel Alignment

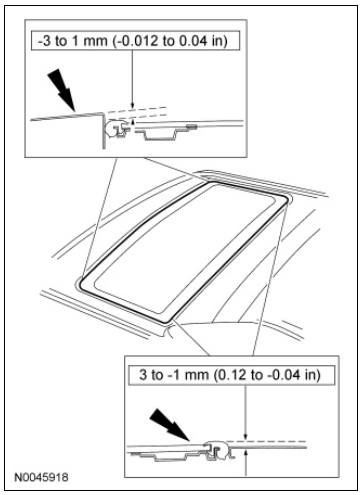
NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Position the roof opening panel in the CLOSED position.

2. Loosen the 4 roof opening panel glass screws.

3. **NOTE:** Make sure the roof opening panel is centered in the roof opening.

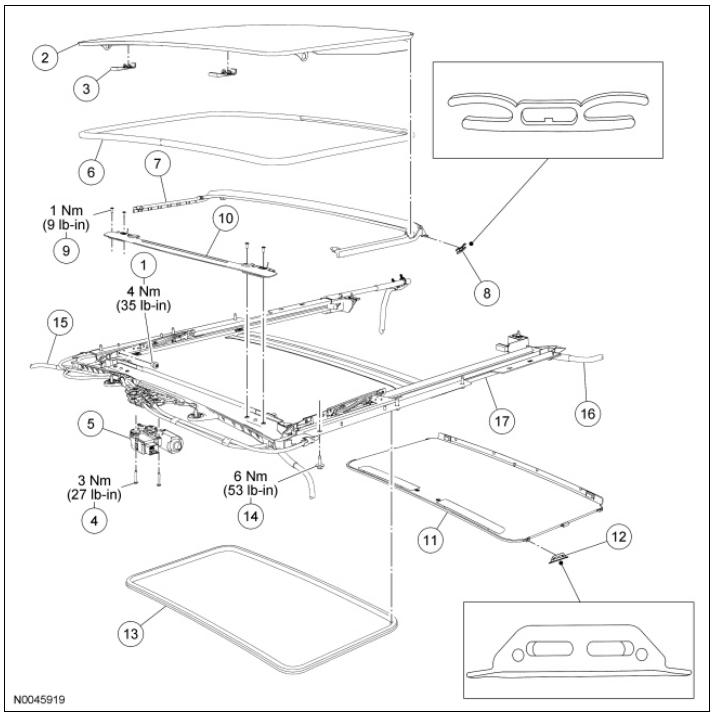
   Adjust the roof opening panel glass height to specification.



4. Maintain horizontal and vertical roof opening panel position while adjusting and tighten the 4 roof opening panel glass screws to 4 Nm (35 lb-in).

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Roof Opening Panel - Exploded View



Item	Part Number	Description
1	78502F90	Roof opening panel glass screw (4 required)
2	78500A18	Roof opening panel glass
3	78502C46	Skid plate (2 required)
4	15C682	Roof opening panel motor screw (3 required)
5	78515B689	Roof opening panel motor
6	7851884	Glass seal
7	7854022	Trough assembly
8	78500A64	Trough guide shoe assembly (2 required)
9	78502F92	Air deflector screw (4 required)
10	78500A26	Air deflector assembly
11	78519A02	Roof opening panel shield
12	7850152	Roof opening panel shield spring-loaded guide feet (4 required)
13	7852124	Headliner trim piece
14	W505179-S424	Roof opening panel frame bolt (10 required)
15	78502C52	Roof opening panel front drain hose (2 required)
16	78502C53	Roof opening panel rear drain hose (2 required)
17	7851070	Roof opening panel frame

1. For additional information, refer to the procedures in this section.

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Roof Opening Panel Glass

Removal and Installation

NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Position the roof opening panel to the VENT position.

2. Remove the 4 roof opening panel glass screws.
   - To install, tighten to 4 Nm (35 lb-in).

3. From the outside of the vehicle, remove the roof opening panel glass assembly.

4. To install, reverse the removal procedure.
   - If installing a new roof opening panel glass seal, use care around the corners to make sure of a correct seal to the roof opening panel glass.
   - Align the roof opening panel. For additional information, refer to Roof Opening Panel Alignment in this section.
   - Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

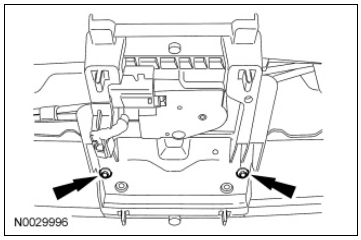
Roof Opening Panel Frame

Removal and Installation

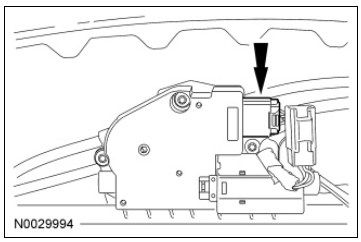
NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the headliner. For additional information, refer to Section 501-05 .

2. Remove the 2 retaining screws and the upper console bracket.

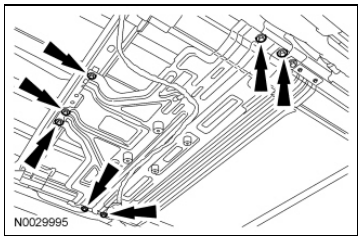


3. Disconnect the roof opening panel motor electrical connector.



4. Disconnect the 4 roof opening panel drain hoses from the corners of the roof opening panel frame.

5. Remove the entertainment center support bracket (if equipped).
   - Remove the 7 bolts.
   - Remove the support bracket.



NOTICE: **To avoid damage to the roof opening panel frame, be sure to support the roof opening panel frame when removing the frame bolts.**

6. Remove the 10 roof opening panel frame bolts.

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- To install, tighten to 6 Nm (53 lb-in).

7. Remove the roof opening panel frame.

8. To install, reverse the removal procedure.
   - Align the roof opening panel. For additional information, refer to Roof Opening Panel Alignment in this section.
   - Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Roof Opening Panel Motor

Removal and Installation

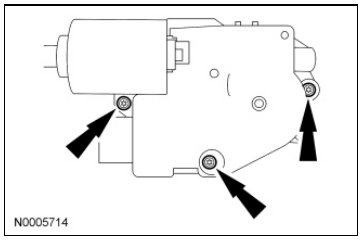
NOTICE: **The roof opening panel motor contains ceramic magnets that may fail at any time if cracked. Any roof opening panel motor that has been dropped onto a hard surface during removal or installation should be replaced with a new motor.**

NOTE: The roof opening panel motor must be initialized when repairs are carried out on any part of the roof opening panel system, including: whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel glass has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed, a new roof opening panel glass has been installed or a new roof opening panel assembly has been installed. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

1. Remove the overhead console. For additional information, refer to Section 501-12 .

2. Disconnect the roof opening panel electrical connectors.

3. Remove the 3 roof opening panel motor screws.
   - To install, tighten to 3 Nm (27 lb-in).



4. **NOTE:** When installing the roof opening panel motor, it may be necessary to turn the roof opening panel motor slightly to engage the drive splines.

   NOTE: Anytime a roof opening panel motor is removed, the cables/mechanisms can experience free-play movement. It is important that the cables/mechanisms do not move. They are timed to be parallel with each other.

   Remove the roof opening panel motor.

5. To install, reverse the removal procedure.
   - Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

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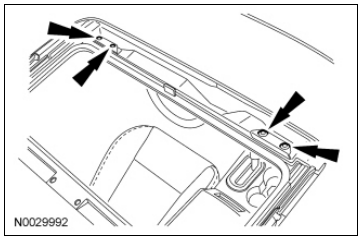
Roof Opening Panel Shield

Removal and Installation

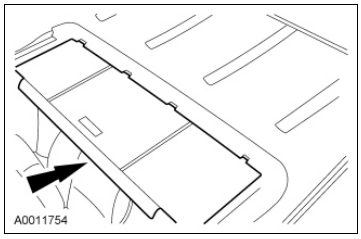
1. Remove the roof opening panel glass. For additional information, refer to Roof Opening Panel Glass in this section.

2. Remove the trough.
   - Pull the trough assembly arms outward to release the trough assembly guide arm pins from the roof opening panel frame to remove.

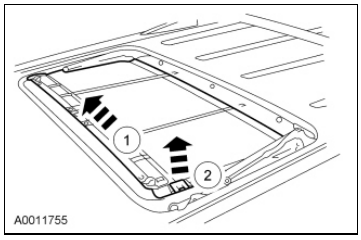
3. Remove the air deflector.
   - Remove the 4 screws.
     - ♦ To install, tighten to 1 Nm (9 lb-in).
   - Remove the air deflector.



4. Slide the roof opening panel shield forward halfway.

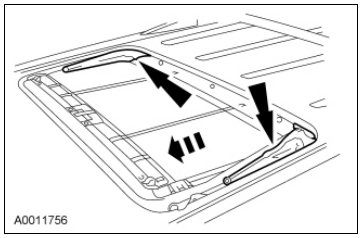


5. Disengage the roof opening panel shield guide feet.
   1. Push the roof opening panel shield toward one side of the vehicle.
   2. Lift the front portion of the roof opening panel shield upward to disengage the guide feet.



6. Slide the roof opening panel shield forward and release the rear guide feet.

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7. **NOTE:** The roof opening panel shield guide feet can be serviced separately from the roof opening panel shield.

   If necessary, new roof opening panel shield guide feet may be installed at this time.

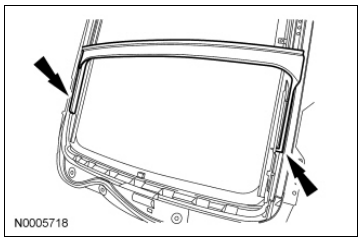
8. To install, reverse the removal procedure.
   - Align the roof opening panel. For additional information, refer to Roof Opening Panel Alignment in this section.
   - Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

Trough Assembly

Removal and Installation

1. Remove the roof opening panel glass. For additional information, refer to Roof Opening Panel Glass in this section.

2. Remove the trough assembly.
   - Pull the trough assembly arms outward to release the trough assembly guide arm pins from the roof opening panel frame to remove.



3. To install, reverse the removal procedure.
   - Align the roof opening panel. For additional information, refer to Roof Opening Panel Alignment in this section.
   - Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

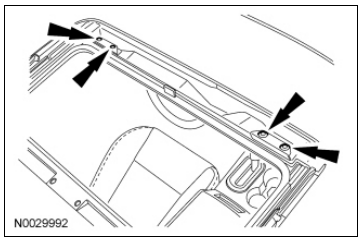
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Air Deflector

Removal and Installation

1. Move the roof opening panel to full OPEN position.

2. Remove the air deflector.
   - Remove the 4 screws.
     - ♦ To install, tighten to 1 Nm (9 lb-in).
   - Remove the air deflector from the roof opening panel frame.



3. To install, reverse the removal procedure.
   - Initialize the roof opening panel motor. For additional information, refer to Roof Opening Panel Motor Initialization in this section.

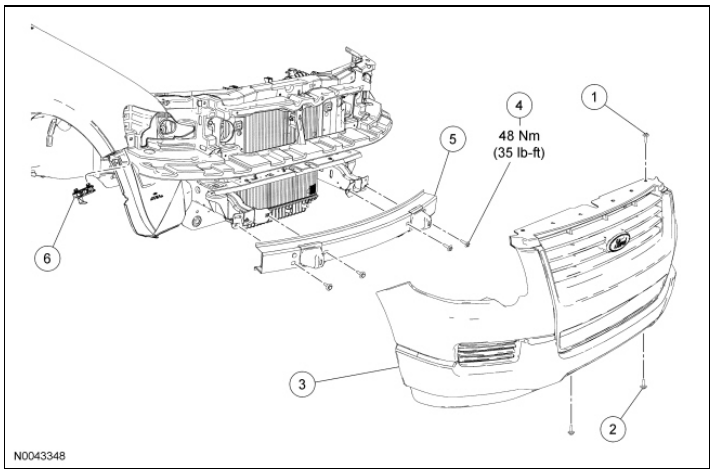
Torque Specifications

Description	Nm	lb-ft	lb-in
Front bumper mounting bolts	48	35	-
Rear bumper cover bracket bolts - Explorer	11	-	97
Rear bumper cover bracket bolts - Explorer Sport Trac	6	-	53
Rear bumper cover screws	6	-	53

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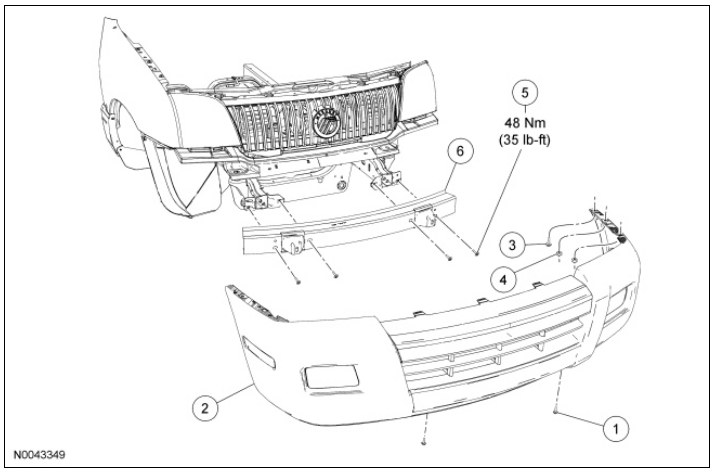
Bumper - Exploded View, Front

Explorer/Explorer Sport Trac



Item	Part Number	Description
1	W711666	Radiator grille scrivet (6 required)
2	W712584	Bumper cover lower bolt (2 required)
3	17D957	Bumper cover
4	W505444	Front bumper mounting bolt (4 required)
5	17K820	Front bumper
6	17E814	Front bumper cover retaining clip (LH/RH)

Mountaineer



Item	Part Number	Description
1	W712584	Bumper cover lower bolt (2 required)
2	17D957	Bumper cover

3	W505427	Bumper cover upper bolt (2 required)
4	W701014	Bumper cover upper nut (4 required)
5	W505444	Front bumper cover mounting bolt (4 required)
6	17K820	Front bumper

1. For additional information, refer to the procedures in this section.

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Bumper Cover - Front

Removal and Installation

Explorer/Explorer Sport Trac

1. Remove the headlamp assemblies. For additional information, refer to Section 417-01 .

All vehicles

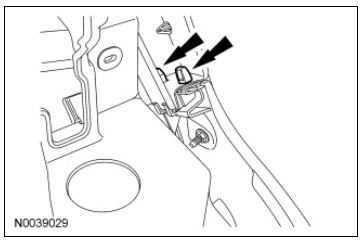
2. Disconnect the fog lamp electrical connectors, if equipped.
3. Disconnect the side turn signal lamp electrical connectors, if equipped.
4. Remove the front fender inner splash shield screws.
5. Remove the front fender inner splash shield pin-type retainers.
6. Remove the front fender inner splash shields.
7. Remove the 2 bolts from the bottom of the bumper cover.

Explorer/Explorer Sport Trac

8. Remove the 6 grille-to-grille opening panel scrivets.

NOTE: The fender clips are removed with the front fender. Use a flat-blade screwdriver to release the locking tabs from the front bumper cover.

9. Release the bumper cover-to-fender clips.



Mountaineer

10. Remove the bumper cover upper screws.
11. Rotate the bottom of the front bumper cover upward.
12. Apply downward pressure to the top of the front bumper cover to release the 3 locking tabs.

All vehicles

13. Remove the front bumper cover.

14. To install, reverse the removal procedure.

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Bumper - Front

Removal and Installation

1. Remove the front bumper cover. For additional information, refer to Bumper Cover - Front in this section.

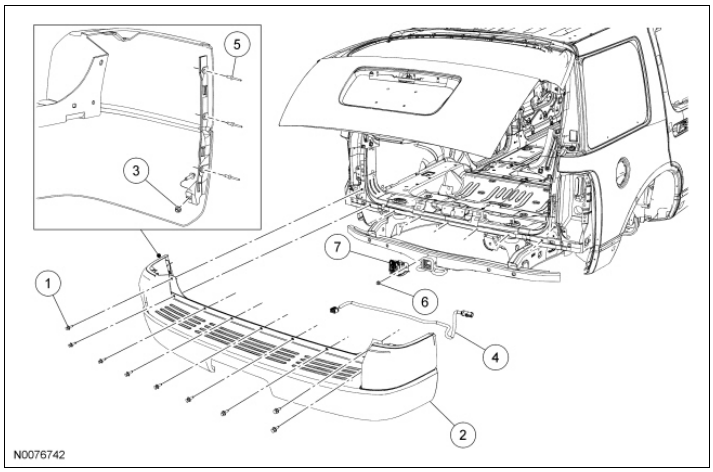
2. Remove the 4 front bumper bolts.
   - To install, tighten to 48 Nm (35 lb-ft).

3. Remove the front bumper.

4. To install, reverse the removal procedure.

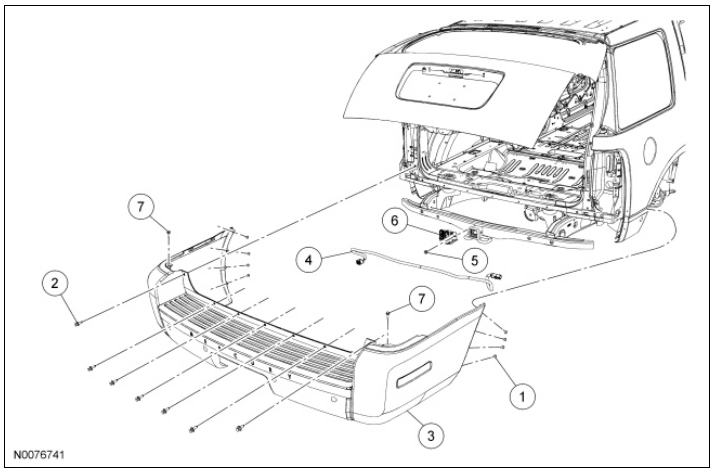
Bumper - Exploded View, Rear

Explorer



Item	Part Number	Description
1	W708530	Bumper cover pin-type retainer (9 required)
2	17D781	Rear bumper cover
3	W505153	Rear bumper cover bracket bolt (4 required)
4	14A464	Parking aid sensor wiring assembly
5	N811487	Rear bumper cover bracket rivet (6 required)
6	605872S	Trailer hitch light plug bolt
7	14A464	Trailer hitch light plug

Mountaineer

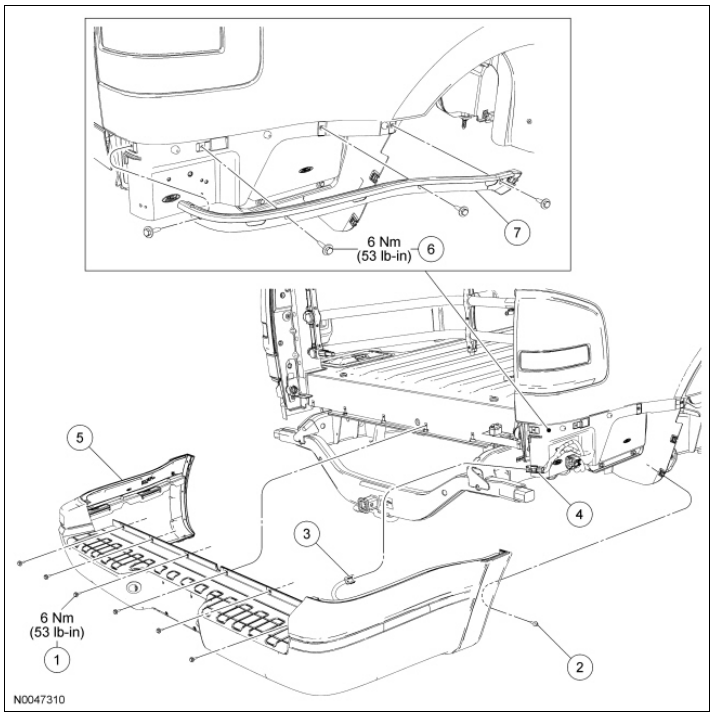


Item		Description

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	Part Number	
1	W708530	Bumper cover-to-splash shield pin-type retainer (8 required)
2	W708530	Bumper cover pin-type retainer (7 required)
3	17K835	Rear bumper cover
4	14A464	Rear parking aid sensor wiring assembly
5	605872S	Trailer hitch light plug bolt
6	14A464	Trailer hitch light plug
7	W705549	Bumper cover bracket bolts

Explorer Sport Trac



Item	Part Number	Description
1	W712247	Rear bumper cover screw (6 required)
2	W711414	Rear bumper cover splash shield screw (6 required)
3	13412	Rear bumper cover wiring harness
4	180103-13A409	Rear license plate wiring harness connector
5	17K835	Rear bumper cover
6	W505424	Rear bumper cover bracket bolt and washer (4 required)
7	17E850	Rear bumper cover mounting bracket

1. For additional information, refer to the procedures in this section.

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Bumper Cover - Rear, Explorer

Removal and Installation

1. Remove the tail lamp assemblies.

2. Remove the 2 rear bumper cover bracket bolts.
   - To install, tighten to 11 Nm (97 lb-in).

3. Remove the 9 bumper cover pin-type retainers.

4. Disconnect the rear parking aid sensor electrical connector, if equipped.

5. ***NOTICE:*** **To avoid damaging the rear bumper cover, do not twist the cover when removing.**

   Remove the bumper cover.

   - Lift the outer corners upward and pull the bumper cover straight up and out.

6. Transfer components as necessary.

7. To install, reverse the removal procedure.

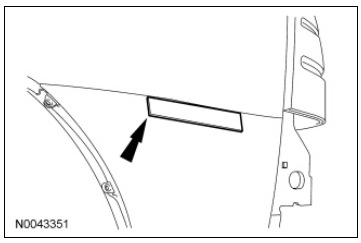
Bumper Cover - Rear, Mountaineer

Removal and Installation

1. Remove the taillamp assemblies.
2. Remove the 2 rear bumper bracket bolts.
3. Remove the bumper cover pin-type retainers.
4. Disconnect the rear parking aid sensor electrical connector, if equipped.
5. Remove the side marker lamp electrical connector, if equipped.
6. Remove the 8 bumper cover-to-splash shield pin-type retainers.
7. **NOTE:** The rear bumper cover has a bracket located at the upper edge of the moulding that attaches to the sheet metal.

   Remove the rear bumper cover.

   - Lift the front corner of the rear bumper cover straight up and pull away.
   - Repeat on the opposite side.



8. Transfer components as necessary.
9. To install, reverse the removal procedure.

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Bumper Cover - Rear, Sport Trac

1. Remove the 6 rear bumper cover screws.
   - To install, tighten to 6 Nm (53 lb-in).
2. Remove the 6 rear bumper cover splash shield screws (3 each side).
3. Disconnect the license plate electrical connector.
4. ***NOTICE:*** **To avoid damaging the rear bumper cover, do not twist the cover when removing.**

   Remove the bumper cover.

   - Pull the outer corners outward and pull the bumper cover rearward to disengage the cover from the retaining clips.
5. Transfer the components as necessary.
6. To install, reverse the removal procedure.

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Material

Item	Specification	Fill Capacity
Clear Silicone Rubber TA-32	ESB-M4G92-A	-

Torque Specifications

Description	Nm	lb-ft
60 percent bench safety belt anchor bolt (early production with Torx head)	76	56
60 percent bench safety belt anchor bolt (late production with hex head)	121	89
Center and RH safety belt buckle bolts (Second row 60/40 bench and 60/40 with E-Z entry)	40	30
Center safety belt retractor anchor bolt (Second row 60/40 E-Z entry)	55	41
Center safety belt retractor bolt (Second row 60/40 bench and 60/40 with E-Z entry)	75	55
Child safety seat tether anchor bolt	40	30
Front row D-ring bolt	48	35
LH safety belt buckle bolt (Second row 60/40 bench and 60/40 with E-Z entry)	55	41
Safety belt buckle and pretensioner nuts	36	27
Safety belt buckle bolt (Second row bucket)	47	35
Safety belt retractor anchor bolts (except center safety belt retractor)	40	30
Safety belt retractor bolts (except center safety belt retractor)	40	30
Safety belt shoulder height adjuster bolt	40	30
Safety belt shoulder height adjuster D-ring bolt	48	35
Second row outboard D-ring bolt	40	30
Third row D-ring bolt	40	30
Third row safety belt buckle nut	75	55

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Safety Belt System

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

When replacing any active occupant restraint components, use only the replacement parts specified in the Ford Customer Service Division Master Parts and Accessories Catalog.

The active restraint system serviceable components consist of the following:

- Front row safety belt buckles and pretensioners
- Front row adaptive load limiting retractors
- Second row outboard safety belt retractors
- Second row 60 percent bench or E-Z entry seat center safety belt retractor
- Second row 60 percent bench seat dual safety belt buckle assembly (Explorer/Mountaineer with 5-passenger seating and Explorer Sport Trac)
- Second row 60 percent E-Z entry seat dual safety belt buckle assembly (Explorer/Mountaineer with 7-passenger seating)
- Second row 40 percent bench seat safety belt buckle assembly (Explorer/Mountaineer with 5-passenger seating and Explorer Sport Trac)
- Second row 40 percent E-Z entry seat safety belt buckle assembly (Explorer/Mountaineer with 7-passenger seating)
- Second row bucket seat safety belt buckle assembly (Explorer/Mountaineer with 6-passenger seating)
- Second row child safety seat tether anchors
- Second row lower anchors and tethers for children
- Third row safety belt retractors
- Third row dual safety belt buckle assembly
- Third row child safety seat tether anchors

Safety Belt Retractors

- Adaptive load limiting retractor (front only)
- Dual locking mode
    - ♦ Emergency Locking Retractor (ELR)
    - ♦ Automatic Locking Retractor (ALR) (all except driver seat)

Adaptive load limiting

Adaptive load limiting safety belt retractors are pyrotechnic devices integrated with the driver and front passenger safety belt retractor assemblies. Adaptive load limiting safety belt retractors work in conjunction with the safety belt buckle pretensioners to control the tension of the driver and front passenger safety belts. The Restraints Control Module (RCM) monitors the readiness of the adaptive load limiting safety belt retractor. The RCM uses this information and all other information provided by the restraints system to determine what action is to be taken.

For adaptive load limiting safety belt retractor diagnostic information, refer to Diagnosis and Testing in Section 501-20B .

Automatic Locking Retractor (ALR)

The ALR mode is used when locking a child seat in an outboard seating position. The ALR mode is automatically activated when the safety belt webbing is fully extracted from the retractor and then allowed to retract. As the safety belt webbing is retracted back onto the spool, an audible clicking sound is made indicating the safety belt retractor is in ALR mode and the safety belt webbing will not pull back out of the safety belt retractor. To disengage the ALR mode, allow the safety belt webbing to fully retract back onto the spool. The ALR mode is disengaged when the webbing is free to extract and retract back into the retractor. For testing, refer to the appropriate Functional Test procedure Diagnosis and Testing in Safety Belt System in this section.

Emergency Locking Retractor (ELR)

The ELR is a vehicle-sensitive feature designed to activate and lock the safety belt webbing during hard braking, hard cornering or in an impact of approximately 24 km/h (15 mph). The ELR feature helps to reduce the forward movement of the driver and passengers. For testing, refer to the appropriate Functional Test procedure Diagnosis and Testing in Safety Belt System in this section.

Safety Belt Buckles

Safety belt buckle and pretensioner

The safety belt buckle and pretensioners are located on the inboard side of the seat track and is for front seat occupants.

The safety belt buckle and pretensioner is a pyrotechnic device that removes excess webbing from the safety belt system when deployed. When the pretensioner deploys, the buckle moves downward, removing excess webbing from the lap and shoulder safety belts.

If the vehicle is involved in a crash that results in pretensioner deployment, a new safety belt buckle pretensioner must be installed.

For safety belt buckle pretensioner diagnosis and disposal information, refer to Diagnosis and Testing or General Procedures in Section 501-20B .

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Second and third row safety belt buckles

The second and third row safety belt buckles are attached to the seat cushion frames or floor and can be serviced separately.

Child Safety Seat Restraints

Lower anchors and tethers for children and child safety seat tether anchors are provided. Check all attachment points after a collision.

Lower Anchors and Tethers for Children

This system will be referred to as lower anchors. The lower anchor system is a standardized and uniform attachment system for installing child safety seats in passenger vehicles. Lower anchor-equipped child safety seats have 2 lower attachments that connect to the vehicle portion of the system.

The vehicle portion of the system consists of 2 attachment points (6-mm wires) welded to the seat cushion frame. The attachment points protrude from between where the backrest and cushion of the seat meet, only at the second row outboard seating positions.

If a child safety seat was in use during a collision, inspect the vehicle portion of the system for damage. If any of the attachment points (6-mm wires) are damaged, install a new seat cushion frame.

Child Safety Seat Tether Anchors

Child safety seat tether anchors are attachment points located in the back panel of the sheet metal (Sport Trac) or bolted into the floor (Explorer/Mountaineer).

If a child safety seat was in use during a collision, inspect the vehicle portion of the system for damage. If any of the attachment points are damaged, install new ones.

Explorer, Mountaineer and Sport Trac Front Row

Child safety seat tether anchors are not available in the front row for any of the vehicles.

Explorer, Mountaineer - 5 and 6 Passenger, Second Row

The 2 second row outboard child safety seat tether anchors are located directly behind the seat, attached to the floor pan protruding from the carpet. For 5 passenger center seat, either tether anchor located near the back hatch door can be used.

Explorer, Mountaineer - 7 passenger, Second Row

The 3 second row child safety seat tether anchors are located directly behind the seat, attached to the floor pan protruding from the carpet.

Sport Trac - Second Row

Child safety seat tether anchors are located at all 3 seating positions. They are part of the back panel sheet metal.

The 2 third row child safety seat tether anchors are located directly behind the seat near the back hatch door.

Safety Belt Warning System

The safety belt warning system is a reminder to fasten the driver safety belt. Refer to Diagnosis and Testing, Safety Belt System in this section.

Belt-Minder®

The Belt-Minder® feature is a supplemental warning to the safety belt warning function. This feature provides additional reminders to the driver that the driver safety belt is unbuckled. Refer to Diagnosis and Testing, Safety Belt System in this section.

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Safety Belt System

Principles of Operation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

Safety Belt Warning System

The conditions of operation for the driver and/or passenger safety belt warning indicator and chime operate as follows:

- If the driver and/or passenger safety belt is not buckled with the ignition ON, then the safety belt warning indicator illuminates for 1 to 2 minutes and the warning chime sounds for 4 to 8 seconds
- If the driver and/or passenger safety belt is buckled while the warning indicator is illuminated and the warning chime is sounding, then the indicator and chime will turn off
- If the driver and/or passenger safety belt is buckled before the ignition is in the ON position, the safety belt warning indicator and chime will remain off

Belt-Minder®

The Belt-Minder® feature is a supplemental warning to the safety belt warning function. This feature provides an additional reminder that the driver and/or front passenger safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning indicator in the Instrument Cluster (IC) module.

Either the driver or front passenger safety belt systems may activate the Belt-Minder®. If the Belt-Minder® warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger),

the other occupant can still activate the Belt-Minder® feature.

The passenger Belt-Minder® feature is activated only when the Occupant Classification Sensor (OCS) system detects a passenger in the right front seat and the passenger weight exceeds a programmed limit. For information on the OCS system, refer to Diagnosis and Testing in Section 501-20B .

To activate or deactivate the Belt-Minder® feature, refer to General Procedures in Section 413-01 or the Owner's Literature.

If...	Then...
the driver and/or passenger safety belt is buckled before the ignition is in the ON position or less than 1-2 minutes have elapsed since the ignition has been turned ON...	the Belt-Minder® feature will not activate.
the driver and/or front passenger safety belt is not buckled before the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition has been turned ON...	the Belt-Minder® feature is activated - the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belt(s) is buckled.
the driver or front passenger safety belt becomes unbuckled for approximately one minute while the vehicle is traveling at least 5 km/h (3 mph) and more than 1-2 minutes have elapsed since the ignition has been ON...	the Belt-Minder® feature is activated - the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belt(s) is buckled.

Inspection and Verification

1. Verify the customer concern by operating the active restraint system to duplicate the condition.

2. Inspect to determine if any of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
• Safety belt webbing integrity (torn, frayed, cut or stretched) • Safety belt buckle and tongue assembly • Safety belt retractor	• Bare, broken or disconnected wire • Connector not tightly engaged • Safety belt warning indicator burned out or broken

3. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. With the exception of removing a twist from the safety belt webbing, do not attempt to repair a component of the safety belt system; new components must be installed.

4. If the concern remains after the inspection, determine the symptom. GO to Symptom Chart .

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5. To check the active restraint system for correct operation, carry out the appropriate Functional Test(s).

Symptom Chart

Symptom Chart

Component Test

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

Carry out the appropriate Functional Test(s) as determined in Inspection and Verification.

Functional Test - Safety Belt Buckle and Tongue

The safety belt buckle and tongue assembly must operate freely during the latching and unlatching function. Fasten the safety belt by inserting the tongue (male portion) into the buckle (female portion).

1. Verify the following during the latching sequence:
   - Tongue insertion is not hindered by excessive effort.
   - A click is heard when the safety belt buckle latches the tongue.

2. Verify the system integrity by forcefully pulling on the safety belt webbing.

3. Unlatch the safety belt by fully depressing the safety belt buckle release button and allowing the safety belt to release and retract.

4. Verify the following during the unlatching process:
   - Push-button depression does not require excessive effort.
   - The tongue can be removed easily from the buckle.

5. Repeat the above steps 3 times.

6. If the functional test reveals a concern(s), install a new safety belt buckle or safety belt retractor as required.

Functional Test - Safety Belt Retractor

The safety belt retractor must be freely operational for extraction and retraction of the safety belt webbing between full extension and in-vehicle stowed positions.

1. Extract and retract the safety belt between the full extension and stowed positions.

2. Verify the safety belt retractor operates without excessive effort or binding.

3. Install a new safety belt retractor if any concern is found or the complaint has been verified.

Functional Test - Safety Belt Retractor, Automatic Locking Retractor (ALR) Mode

1. Position the seat backrest fully upright (if adjustable).

2. Position the safety belt shoulder height adjuster (if equipped) in the full down or up position.

3. Fasten the safety belt.

4. Pull out the safety belt webbing until the Automatic Locking Retractor (ALR) feature is activated.

5. Allow the safety belt webbing to retract until it stops.

6. Pull on the safety belt webbing to check that the safety belt retractor has remained in the ALR mode. If the safety belt retractor is not locked, install a new safety belt retractor.

7. Unfasten the safety belt and allow the safety belt webbing to retract to its stowed position.

8. Pull out and retract the safety belt webbing to verify the safety belt retractor has converted automatically out of ALR mode. If the safety belt retractor remains locked in the ALR mode, install a new safety belt retractor.

Functional Test - Safety Belt Retractor, Road Test Inspection

⚠ WARNING: The driver and passenger must be prepared to brace themselves in the event the safety belt retractor does not lock. Failure to follow this instruction may result in serious personal injury.

NOTE: Make sure there is no excessive slack in the safety belt webbing across the torso during testing.

NOTE: Do not jerk on the safety belt webbing when carrying out this test.

1. Test the safety belts in the following sequence:
    1. Fasten the safety belts and proceed to a safe area.
    2. Attain a speed of 24 km/h (15 mph).
    3. **⚠ WARNING: Apply maximum brake force only on dry concrete or equivalent hard surface, NEVER on wet pavement or gravel. Failure to follow this instruction may**

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result in serious personal injury.

Grasp the shoulder harness, lean forward and apply the brakes, making a maximum braking application without a skid.

4. The safety belts should lock up with minimum webbing extension.
5. If there is a lockup of all safety belt retractors being tested, the safety belt retractors are functioning correctly. If any safety belt retractor fails to lock up, install a new safety belt retractor(s).

Safety Belt Cleaning

1. ⚠ **WARNING: Do not bleach or re-dye the safety belt webbing, as the webbing may weaken. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.**

   Clean the safety belt webbing only with a mild soap solution recommended for cleaning upholstery or carpets. Follow the instructions provided with the soap.

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Safety Belt Maintenance

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. The safety belt assemblies should be periodically inspected to make sure that they have not become damaged and that they remain in correct operating condition, particularly if they have been subjected to severe stress.

2. Before installing the new safety belt assembly, the safety belt retaining areas must be inspected for damage and distortion. If the retaining points are damaged and distorted, the sheet metal must be reworked back to its original shape and structural integrity.

3. Install the new safety belt(s) using the appropriate instructions. Carry out the appropriate Functional Test Procedure. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Procedure After a Collision

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

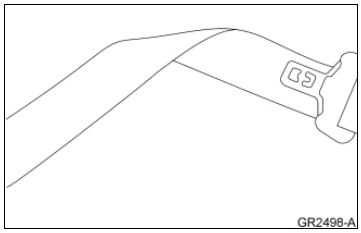
1. Before installing a new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be worked back to its original shape and structural integrity.

2. Install the new safety belt(s). For additional information, refer to the appropriate procedure in this section. Carry out all applicable Functional Tests for the component(s). For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

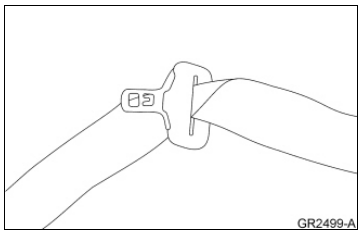
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Safety Belt Tongue Rotated on Belt

1. Fold the safety belt as indicated.



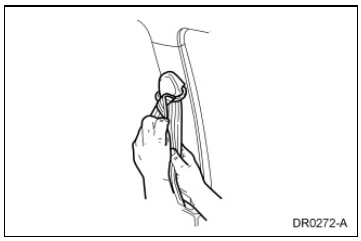
2. Pull the safety belt tongue over the fold in the safety belt.



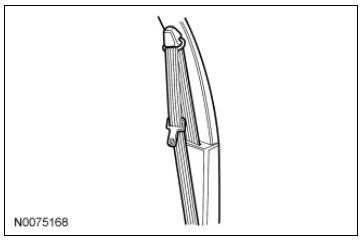
Safety Belt Twisted at the Safety Belt Guide

NOTE: These procedures apply to both wire-formed and stamped D-ring designs.

1. Grasp the safety belt webbing at the D-ring and fold the twisted portion of the belt webbing over itself.



2. Feed the folded portion of the safety belt webbing through the safety belt guide (D-ring) to remove the twist from the belt webbing.

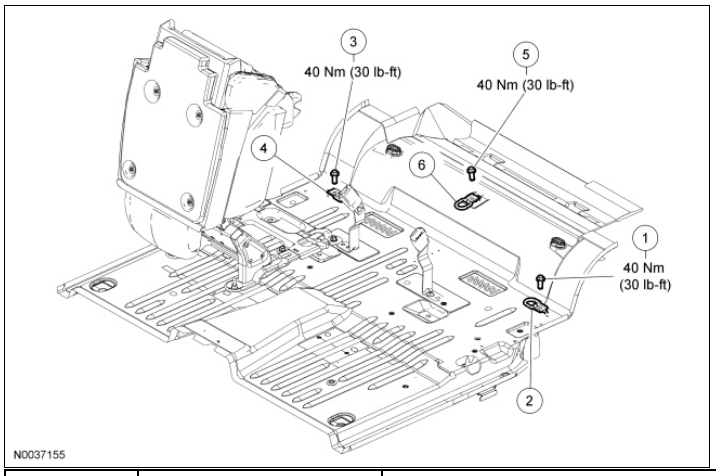


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Child Safety Seat Tether Anchor - Second Row

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A



Item	Part Number	Description
1	-	Tether anchor bolt
2	-	Tether anchor
3	-	Tether anchor bolt
4	-	Tether anchor
5	-	Tether anchor bolt (part of 613D76A)
6	613D76A	Tether anchor

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in

a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: Second row bucket seats shown, others similar.

NOTE: Carpet removed for clarity.

1. Remove the bolt(s) and tether anchor(s).
    - To install, apply clear silicone rubber and tighten to 40 Nm (30 lb-ft).

2. To install, reverse the removal procedure.

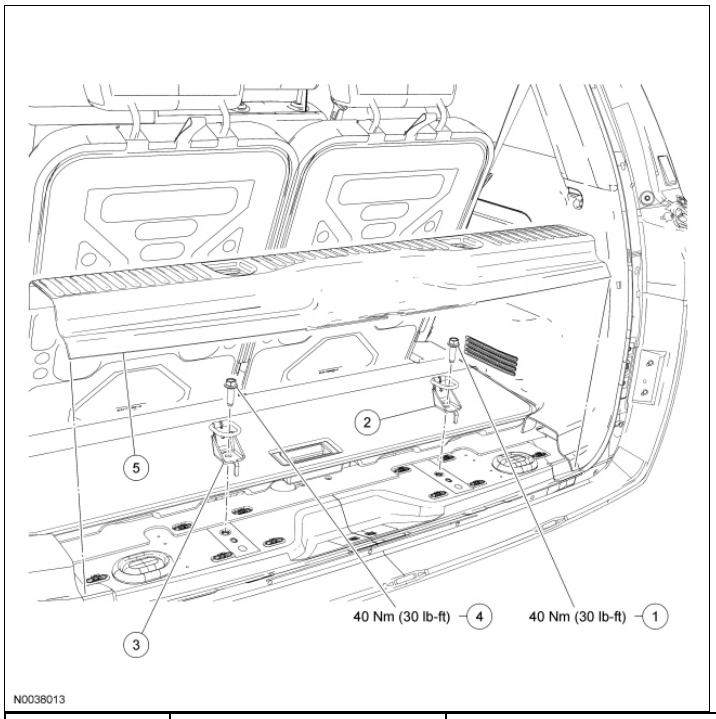
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Child Safety Seat Tether Anchor - Third Row

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A



Item	Part Number	Description
1	-	Tether anchor bolt
2	613F10B	Tether anchor
3	613F10B	Tether anchor
4	-	Tether anchor bolt
5	42624	Liftgate scuff plate trim panel

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the liftgate scuff plate trim panel. For additional information, refer to Section 501-05 .

2. Remove the tether anchor bolt(s) and tether anchor(s).
    - To install, apply clear silicone rubber and tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure.

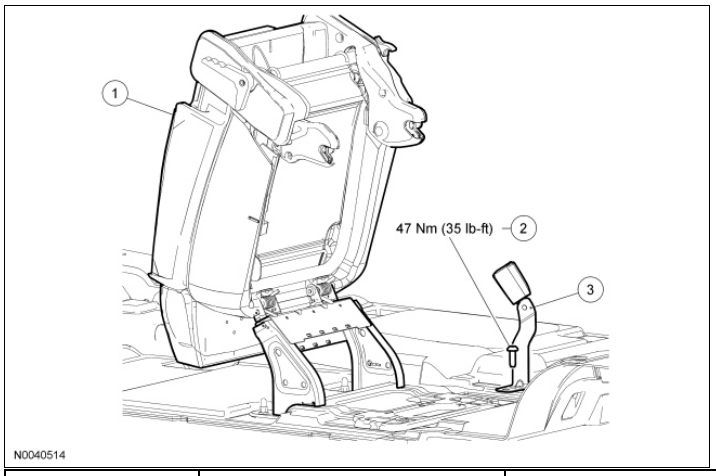
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Safety Belt Buckle - Second Row, Bucket

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A



Item	Part Number	Description
1	60026	Seat assembly
2	N807750	Safety belt buckle bolt
3	60044	Safety belt buckle

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt

pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Tilt the second row seat forward.

2. Remove the seat base cover.

3. Remove the bolt and safety belt buckle.
   - To install, apply clear silicone rubber and tighten to 47 Nm (35 lb-ft).

4. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

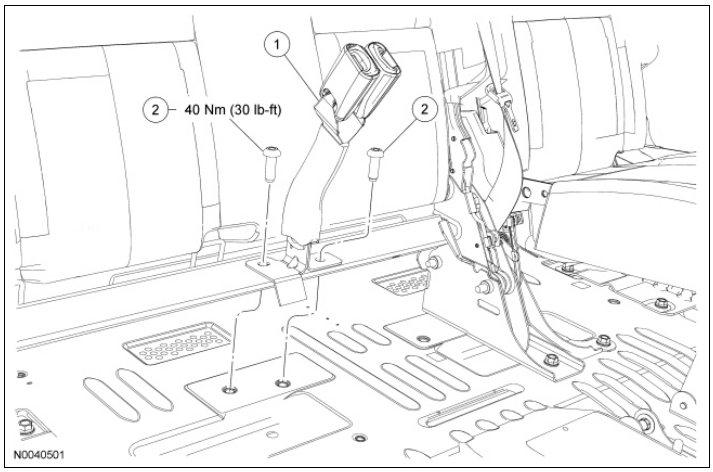
   To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Buckle - Second Row, Center and RH, 60/40, Bench



Item	Part Number	Description
1	611C72C	Dual safety belt buckle
2	N807750	Safety belt buckle bolts (2 required)

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: Seat cushion removed for clarity.

1. Remove the 2 bolts and dual safety belt buckle.
   - To install, tighten to 40 Nm (30 lb-ft).

2. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

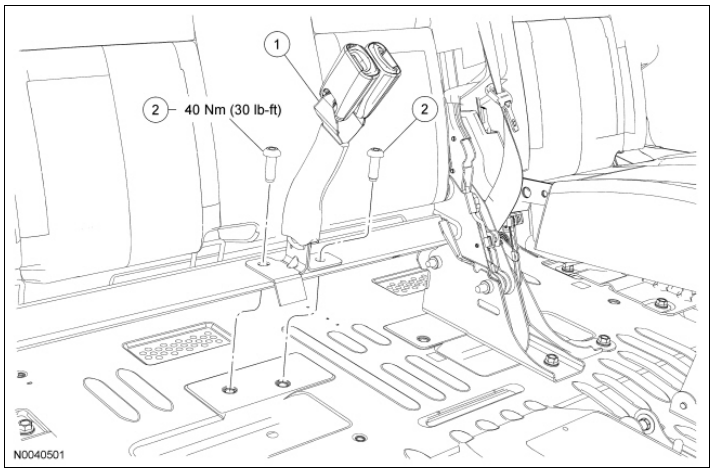
   To install, reverse the removal procedure.

3. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Buckle - Second Row, Center and RH, 60/40, E-Z Entry



Item	Part Number	Description
1	611C72C	Dual safety belt buckle assembly
2	N807750	Safety belt buckle bolts (2 required)

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: Seat is removed from the vehicle for clarity.

1. Remove the 2 bolts and dual safety belt buckle assembly.
   - To install, tighten to 40 Nm (30 lb-ft).

2. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

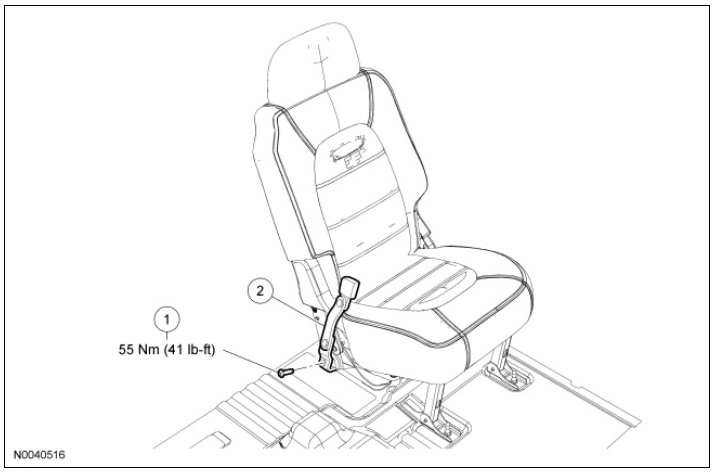
   To install, reverse the removal procedure.

3. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Buckle - Second Row, LH, 60/40, Bench



Item	Part Number	Description
1	W708473	Safety belt buckle bolt
2	-	Safety belt buckle

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the 40 percent seat. For additional information, refer to Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench in Section 501-10 .

2. Remove the bolt and safety belt buckle.
   - To install, tighten to 55 Nm (41 lb-ft).

3. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

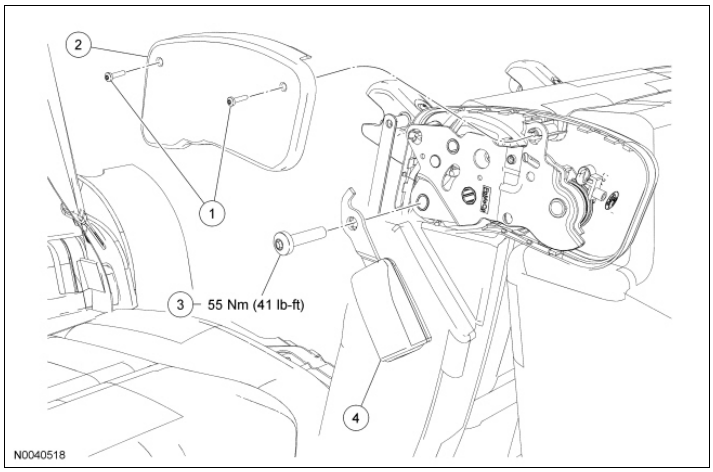
   To install, reverse the removal procedure.

4. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Buckle - Second Row, LH, 60/40, E-Z Entry



Item	Part Number	Description
1	-	Inboard side shield screws (2 required)
2	61348	Side shield
3	W702441	Safety belt buckle bolt
4	60044 LH/ 60045 RH	Safety belt buckle

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Tilt the seat forward.

2. Remove the 2 screws and inboard side shield.

3. Remove the bolt and safety belt buckle.
    - To install, tighten to 55 Nm (41 lb-ft).

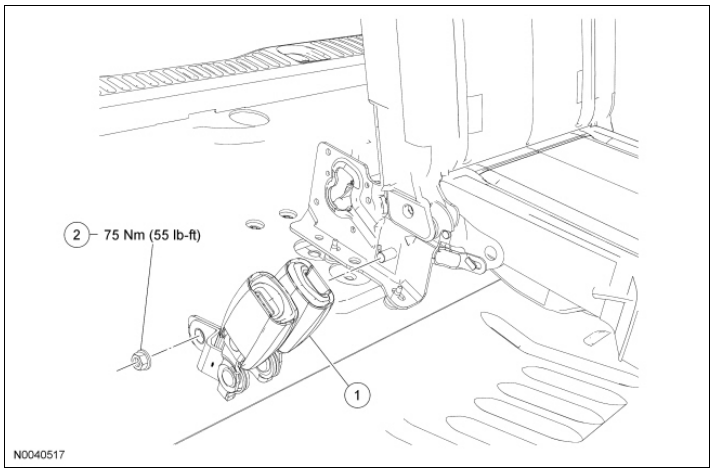
4. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Buckle - Third Row



Item	Part Number	Description
1	613048	Dual safety belt buckle
2	-	Safety belt buckle nut

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: Power seat shown, manual seat similar.

1. Remove the RH third row seat. For additional information, refer to Seat - Third Row Section 501-10 .

2. Remove the nut and dual safety belt buckle assembly.

- To install, tighten to 75 Nm (55 lb-ft).

3. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   To install, reverse the removal procedure.

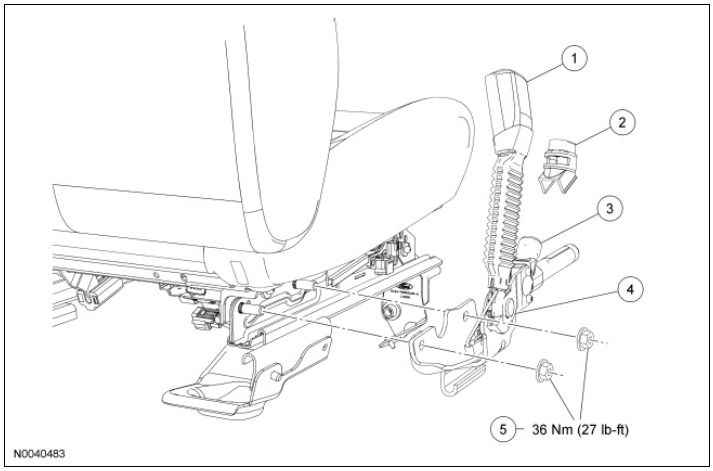
4. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Buckle and Pretensioner

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	61202 RH/ 61203 LH	Safety belt buckle pretensioner
2	-	Safety belt buckle pretensioner electrical connector cover
3	-	Safety belt buckle pretensioner electrical connector
4	-	Safety belt buckle switch electrical connector
5	-	Safety belt buckle pretensioner nuts (2 required)

Removal and Installation

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

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in

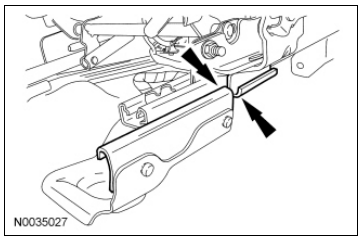
a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the seat so it does not engage the safety belt buckle and pretensioner bracket and allows access to all 4 seat mounting fasteners.
    - If equipped with power seats, position the passenger seat track downward to access the safety belt retractor anchor bolt.



2. Remove the seat and depower the SRS . For additional information, refer to Seat - Front in Section 501-10 .

3. Remove the safety belt buckle pretensioner electrical connector cover.

4. Disconnect the safety belt buckle electrical connectors.

5. Remove the 2 nuts and safety belt buckle pretensioner.
    - To install, tighten to 36 Nm (27 lb-ft).

6. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

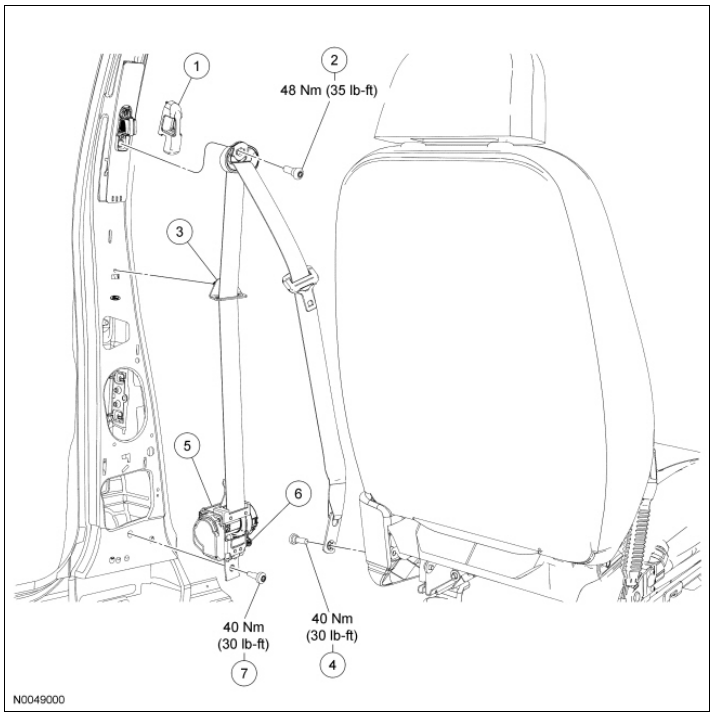
   To install, reverse the removal procedure.

7. Install the seat and repower the SRS . **If the passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Front Seat in Section 501-10 .

8. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Retractor - Front



Item	Part Number	Description
1	-	D-ring cover
2	W710896	D-ring bolt
3	354161	Secondary safety belt guide
4	W708473	Safety belt retractor anchor bolt
5	611B08 RH/ 611B09 LH	Safety belt retractor
6	-	Adaptive load limiting electrical connector
7	W700883	Safety belt retractor bolt

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install

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new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

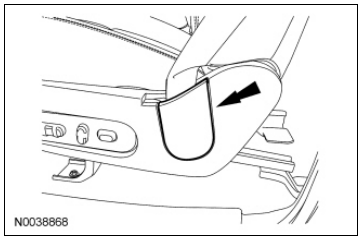
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: LH shown, RH similar.

1. If equipped with power seats, position the passenger seat track downward to access the safety belt retractor anchor bolt.

2. Depower the Supplemental Restraint System (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

3. Remove the safety belt anchor cover.



4. Remove the bolt and safety belt anchor.
   - To install, tighten to 40 Nm (30 lb-ft).

5. **NOTE:** If the D-ring cover is damaged or does not remain attached, install a new D-ring cover.

   Remove the D-ring cover.

6. Remove the bolt and D-ring.
   - To install, tighten to 48 Nm (35 lb-ft).

7. Remove the lower B-pillar trim panel. For additional information, refer to B-Pillar Lower Trim Panel in Section 501-05 .

8. Remove the secondary safety belt guide.

9. Disconnect the electrical connector.

10. Remove the bolt and safety belt retractor.
    - To install, tighten to 40 Nm (30 lb-ft).

11. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

To install, reverse the removal procedure.

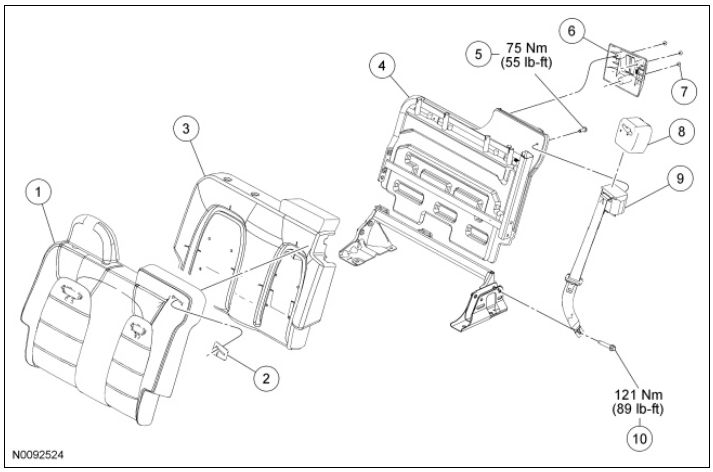
12. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of Section 501-20B .

13. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Retractor - Second Row, Center, 60/40, Bench



Item	Part Number	Description
1	66601	Backrest trim cover
2	610D72	Safety belt guide cover
3	66800	Backrest foam pad
4	613A38	Backrest frame
5	N807750	Safety belt retractor bolt
6	638A74	Upper latch cover (Sport Trac only)
7	-	Upper latch cover screw (3 required) (part of 605C10)
8	613C46	Safety belt retractor cover
9	611B64	Safety belt retractor
10	-	Safety belt anchor bolt (part of 611B64)

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

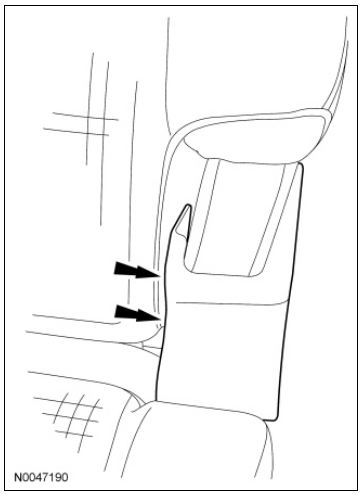
After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the second row, 40 percent seat. For additional information, refer to Section 501-10 .

2. Remove the bolt and safety belt anchor.
   - To install tighten to 121 Nm (89 lb-ft).

3. **NOTE:** LH shown, RH similar.

   Remove the 4 screws and position aside the latch covers.

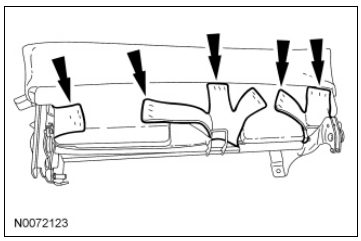


4. Remove the safety belt guide cover.

5. If equipped, remove the 3 screws and the upper latch cover.

6. Release the J-clip at the bottom of the seat backrest.

7. Remove all the staples in the backrest support panel.



8. ***NOTICE:*** **Use care when separating the seat upholstery from the hook-and-loop strip, or the hook-and-loop strip can be torn from the seat backrest foam pad.**

   Separate the hook-and-loop fasteners. Invert the seat backrest trim cover and position aside.

9. Position aside the backrest foam pad.

10. Remove the safety belt retractor cover.

11. Remove the bolt and safety belt retractor.

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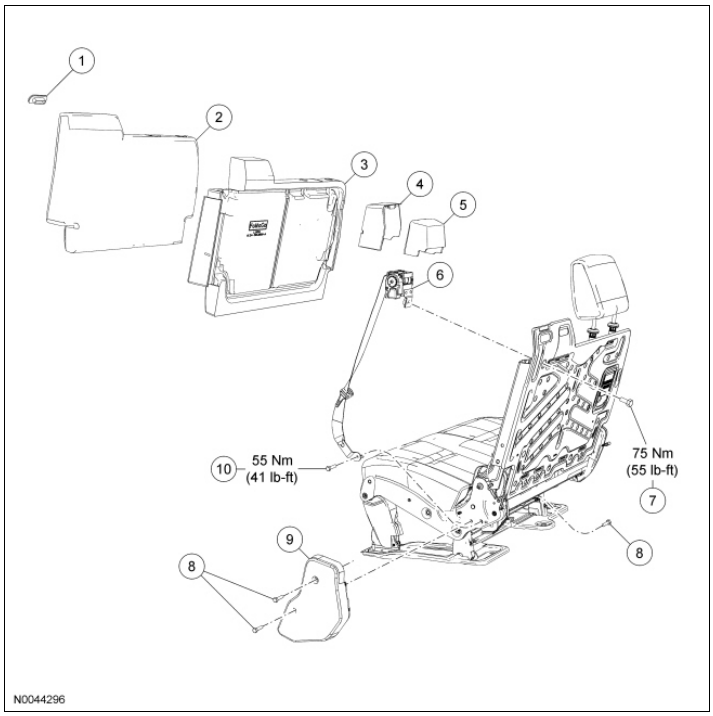
- To install, tighten to 75 Nm (55 lb-ft).

12. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

    To install, reverse the removal procedure.

13. Check the active restraint system for correct operation. For additional information, refer to Safety Belt System in this section.

Safety Belt Retractor - Second Row, Center, 60/40, E-Z Entry



Item	Part Number	Description
1	610D72	Safety belt bezel
2	66600	Seat backrest trim cover
3	66800	Seat backrest foam pad
4	613D46	Safety belt retractor cover
5	611D52	Safety belt retractor insulator
6	611B64	Safety belt retractor
7	-	Safety belt retractor bolt
8	-	Latch cover screws (3 required)
9	61349	Recliner latch cover
10	-	Safety belt retractor anchor bolt

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

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If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: Seat is removed and exploded for clarity.

1. Fold the seat and tilt to the E-Z entry position.

2. Remove the 3 screws and inboard recliner outer cover side shield.

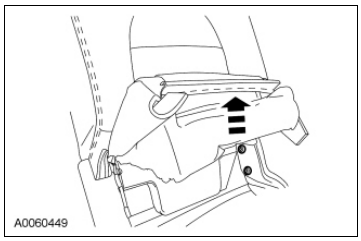
3. Remove the bolt and safety belt anchor.
   - To install, tighten to 55 Nm (41 lb-ft).

4. Release the backrest trim cover retainers.

5. Remove the safety belt bezel.

6. ***NOTICE:*** **Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.**

   Invert the backrest trim cover.



7. Release the hook-and-loop strips.

8. Remove the pin-type retainer and safety belt retractor cover and insulator.

9. Remove the bolt and safety belt retractor.
   - To install, tighten to 75 Nm (55 lb-ft).

10. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

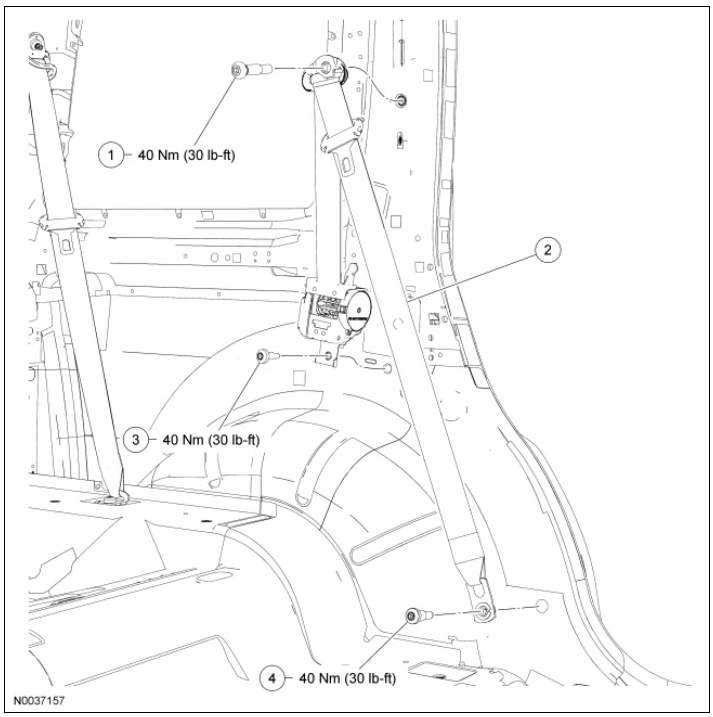
    To install, reverse the removal procedure.

11. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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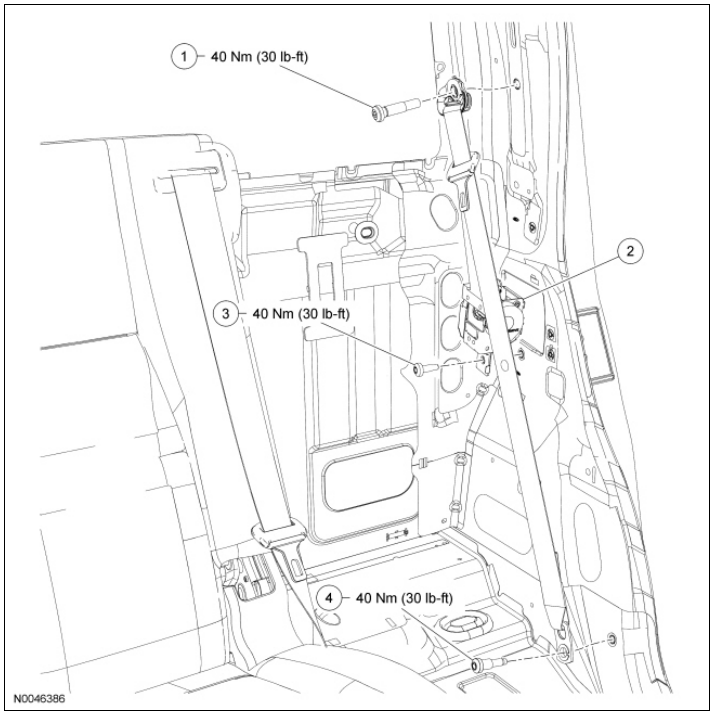
Safety Belt Retractor - Second Row, Outboard

Explorer/Mountaineer



Item	Part Number	Description
1	N808651	D-ring bolt
2	611B68 RH/ 611B69 LH	Safety belt retractor
3	-	Safety belt retractor bolt (part of 611B68 RH/ 611B69 LH)
4	-	Safety belt retractor anchor bolt (part of 611B68 RH/ 611B69 LH)

Explorer Sport Trac



Item	Part Number	Description
1	N808651	D-ring bolt
2	611B68 RH/ 611B69 LH	Safety belt retractor
3	-	Safety belt retractor bolt (part of 611B68 RH/ 611B69 LH)
4	-	Safety belt retractor anchor bolt (part of 611B68 RH/ 611B69 LH)

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

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Explorer/Mountainer and Explorer Sport Trac with 60/40 bench seat

1. Remove the seat. For additional information, refer to Seat - Second Row, 60/40, E-Z Entry or Seat - Second Row, Sport Trac or Seat - Second Row, Explorer, 60/40 Bench or Seat - Second Row, Bucket in Section 501-10 .

Explorer Sport Trac

2. Remove the trim panels. For additional information, refer to Cab Rear Trim Panel in Section 501-05 .

Explorer/Mountaineer with 60/40 E-Z entry seat

3. Tilt the headrest to the E-Z entry position.

4. Fold the appropriate seat and tilt forward to the E-Z entry position.

Explorer/Mountaineer with 60/40 E-Z entry and bench seat

5. Remove the upper C-trim pillar panel. For additional information, refer to C-Pillar Trim Panel - Explorer, Mountaineer in Section 501-05 .

6. Position the rear quarter trim panel aside to access the safety belt retractor.

All vehicles

7. Remove the bolt and safety belt retractor anchor.
   - To install, tighten to 40 Nm (30 lb-ft).

8. Remove the bolt and D-ring.
   - To install, tighten to 40 Nm (30 lb-ft).

9. Remove the bolt and safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).

10. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

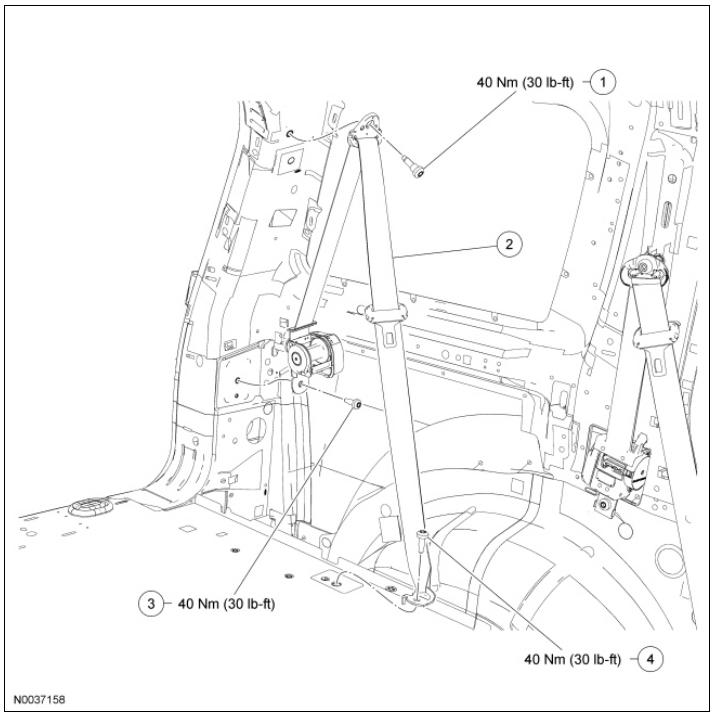
    To install, reverse the removal procedure.

11. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Retractor - Third Row



Item	Part Number	Description
1	W704703	D-ring bolt
2	611B50 RH/ 611B51 LH	Safety belt retractor
3	W700883	Safety belt retractor bolt (part of 611B50 RH/ 611B51 LH)
4	W700883	Safety belt retractor anchor bolt (part of 611B50 RH/ 611B51 LH)

Removal and Installation

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in

a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the quarter trim panel. For additional information, refer to Quarter Trim Panel in Section 501-05 .

2. Remove the bolt and D-ring.
   - To install, tighten to 40 Nm (30 lb-ft).

3. Remove the bolt and safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).

4. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

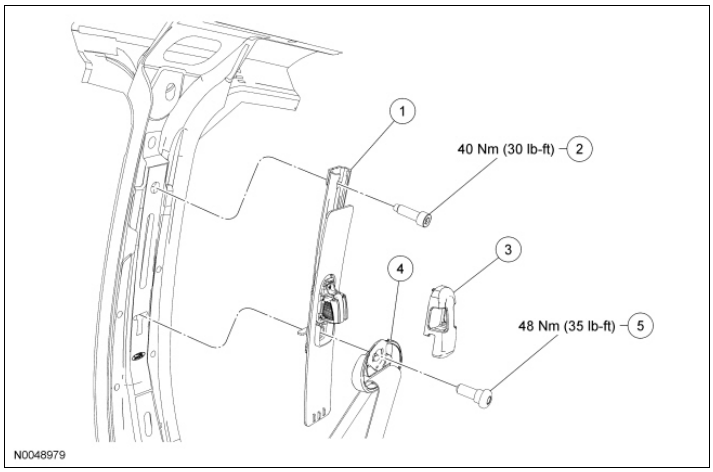
   To install, reverse the removal procedure.

5. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Safety Belt Shoulder Height Adjuster



Item	Part Number	Description
1	602B82	Safety belt shoulder height adjuster
2	-	Safety belt shoulder height adjuster bolt (part of 602B82)
3	-	D-ring cover
4	611B08 RH/ 611B09 LH	Safety belt retractor
5	W710896	D-ring bolt (part of 611B08 RH/ 611B09 LH)

⚠ WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors
- Buckles
- Belt tension sensor (BTS) (if equipped)
- Front safety belt buckle support assemblies (slide bar) (if equipped)
- Safety belt shoulder belt height adjusters (if equipped)
- Child safety seat tether bracket assemblies
- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. **NOTE:** Inspect the D-ring cover for damage. If the cover is damage or does not remain attached,

install a new D-ring cover.

Remove the D-ring cover.

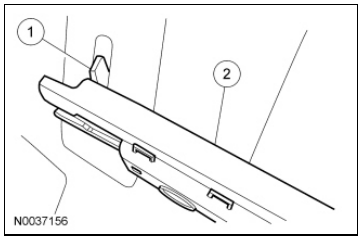
2. Remove the bolt and D-ring.
   - To install, tighten to 48 Nm (35 lb-ft).

3. Remove the upper B-pillar trim panel. For additional information, refer to B-Pillar Upper Trim Panel in Section 501-05 .

4. Lower the shoulder safety belt shoulder height adjuster to the most downward position.

5. Remove the bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

6. Remove the safety belt shoulder height adjuster.
   1. Rotate the safety belt shoulder height adjuster downward to release the lower tab.
   2. Remove the safety belt shoulder height adjuster.



7. **NOTE:** Before installation, make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

   To install, reverse the removal procedure.

8. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in Safety Belt System in this section.

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Torque Specifications

Description	Nm	lb-ft	lb-in
C-pillar side impact sensor bolts	12	-	106
Driver air bag module bolts	7	-	62
Front door side impact sensor bolt	9	-	80
Front impact severity sensor (pressure sensor) bolt	12	-	106
Occupant Classification System Module (OCSM) screws	2	-	18
Occupant Classification System (OCS) rail bolts	25	18	-
Passenger air bag module nuts	9	-	80
Restraints Control Module (RCM) bracket-to-center tunnel bolts	27	20	-
RCM nuts	12	-	106
Safety belt anchor bolt	40	30	-
Safety Canopy® module bolts	8	-	71
Safety Canopy® module C-pillar tether bracket bolts	12	-	106
Safety Canopy® module front tether bracket bolt	8	-	71
Seat position sensor bolt	6	-	53
Seat side air bag module bolts	10	-	89

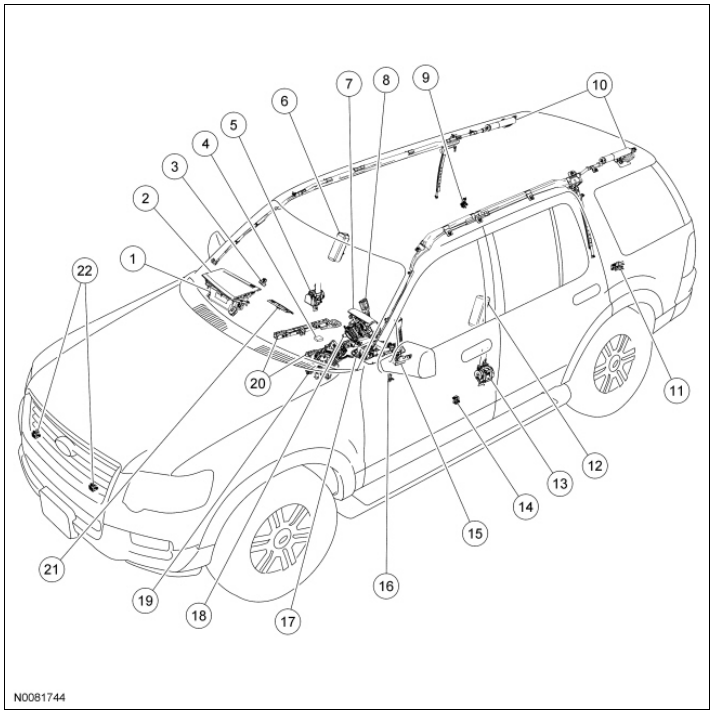
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Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

The Supplemental Restraint System (SRS) is designed to provide increased collision protection for front seat and second row outboard occupants in addition to that provided by the 3-point safety belt system. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantage of the SRS .

The serviceable air bag and safety belt pretensioner SRS components are shown in the following illustrations.

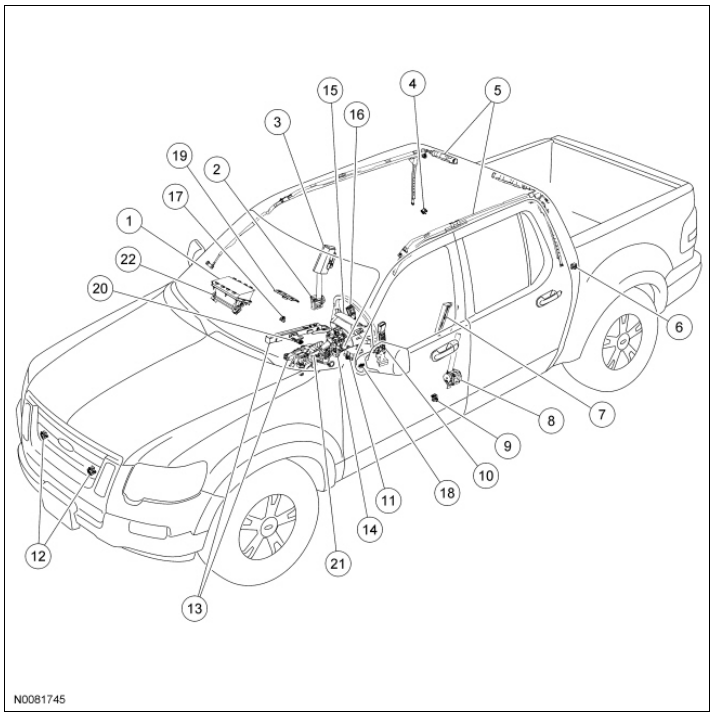
Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Components - Explorer/Mountaineer



Item	Part Number	Description
1	044A74	Passenger air bag module assembly
2	04338	Passenger air bag cover
3	14B345	Passenger first row side impact sensor (pressure sensor, located in passenger front door)
4	14B422	Occupant Classification System Module (OCSM)
5	611B08	Passenger adaptive load limiting safety belt retractor
6	611D11	Passenger seat side air bag module
7	043B13	Driver air bag module
8	61202	Passenger safety belt buckle pretensioner (includes safety belt buckle switch)
9	14B345	Second row, passenger side impact sensor
10	042D94 RH/ 042D95 LH	Safety Canopy® modules
11	14B345	Second row, driver side impact sensor
12	611D10	Driver seat side air bag module

13	611B09	Driver adaptive load limiting safety belt retractor
14	14B345	Driver first row side impact sensor (pressure sensor, located in driver front door)
15	61203	Driver safety belt buckle pretensioner (includes safety belt buckle switch)
16	14B416	Driver seat track position sensor
17	14B321	Restraints Control Module (RCM)
18	14A664	Clockspring
19	3C529	Deployable steering column
20	61708 / 61709	Occupant Classification System (OCS) rails (outboard/inboard)
21	14B418	Passenger Air Bag Deactivation (PAD) indicator
22	14B004	Front impact severity sensors (driver/center front crash sensor and passenger front crash sensor)

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Components - Explorer Sport Trac



Item	Part Number	Description
1	04338	Passenger air bag cover
2	611B08	Passenger adaptive load limiting safety belt retractor
3	611D11	Passenger seat side air bag module
4	14B345	Second row, passenger side impact sensor
5	042D94 RH/ 042D95 LH	Safety Canopy® modules
6	14B345	Second row, driver side impact sensor
7	611D10	Driver seat side air bag module
8	611B09	Driver adaptive load limiting safety belt retractor

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9	14B345	Driver first row side impact sensor (pressure sensor, located in driver front door)
10	61203	Driver safety belt buckle pretensioner (includes safety belt buckle switch)
11	14B321	Restraints Control Module (RCM)
12	14B004	Front impact severity sensors (driver/center front crash sensor and passenger front crash sensor)
13	61708 / 61709	Occupant Classification System (OCS) rails (outboard/inboard)
14	14A664	Clockspring
15	043B13	Driver air bag module
16	61202	Passenger safety belt buckle pretensioner (includes safety belt buckle switch)
17	14B345	Passenger first row side impact sensor (pressure sensor, located in passenger front door)
18	14B416	Driver seat track position sensor
19	14B418	Passenger Air Bag Deactivation (PAD) indicator
20	14B422	Occupant Classification System Module (OCSM)
21	3C529	Deployable steering column
22	044A74	Passenger air bag module assembly

Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

Special Tool(s)

 ST2574-A	Flex Probe Kit 300-NUD105-R025DE or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

A Supplemental Restraint System (SRS) consists of the following:

- Dual stage driver and passenger air bag module
- Safety belt buckle pretensioners
- Adaptive load limiting retractors
- Safety canopies
- Impact sensors (driver\center front crash sensor, passenger front crash sensor first and second row driver and passenger side impact sensors)
- Clockspring
- An air bag warning indicator (located in the Instrument Cluster (IC))
- Restraints Control Module (RCM)
- Occupant Classification System (OCS) system
- Passenger Air Bag Deactivation (PAD) indicator

In addition to dual stage deployment (advanced restraint system) driver and front passenger air bag modules, this vehicle is equipped with a passenger air bag adaptive tether as well as driver and passenger air bag canister vents.

The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the SRS components in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after power and/or ground has been removed from the RCM . The RCM performs an internal, external circuitry and component "self-test" during each startup. If a SRS fault exists, the RCM sends a message to IC module to illuminate the air bag warning indicator. In addition to the self-test at start up, the RCM continuously monitors all of its external and internal circuitry for faults.

In a frontal collision, the impact sensors located in the front of the vehicle detect the sudden deceleration and send an electrical signal to the RCM . The RCM uses the information from the impact sensors and the Occupant Classification System Module (OCSM) in the deployment determination. If the RCM determines that SRS deployment is required, the RCM sends voltage and current to the squib(s) causing the solid

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chemical propellant to undergo a rapid chemical reaction. This controlled reaction produces harmless nitrogen gas that fills the air bag(s)/safety canopies and/or activates the safety belt pretensioners/adaptive load limiting retractor(s) to control the tension of the safety belt(s).

The RCM communicates through the Data Link Connector (DLC) the current and historical DTCs on the High Speed Controller Area Network (HS-CAN). The RCM also communicates over the HS-CAN to the IC module, OCSM and PCM.

Adaptive Load Limiting Safety Belt Retractor

This vehicle is equipped with driver and front passenger adaptive load limiting retractors. Adaptive load limiting retractors are pyrotechnic devices integrated to the driver and front passenger safety belt retractor assemblies. Adaptive load limiting retractors work in conjunction with the safety belt buckle pretensioners and control the tension of the driver and front passenger seat belts in the event of a deployable collision. The RCM monitors the readiness of the adaptive load limiting retractors. The RCM uses this information and all other information provided by the restraints system to determine what action is to be taken.

Air Bag Module Second Stage Deployment Check

Because the driver and passenger front air bags each have 2 deployment stages, it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

- For information on driver air bag module and/or passenger air bag module remote deployment, refer to Pyrotechnic Device Disposal in this section.

Air Bag Warning Indicator

The air bag warning indicator:

- is located in the IC module.
- and circuitry prove out is a function of the IC module. The IC module will prove out the air bag warning indicator by lighting the air bag warning indicator for 6 seconds and then turn off.
- will flash and/or illuminate based on the message the IC module receives from the RCM .
- will illuminate if the IC module does not receive a message from the RCM .

Clockspring

The clockspring:

- is mounted on the steering column, behind the steering wheel.
- allows for continuous electrical connections between the driver air bag module and the RCM when the steering wheel is turned.

Driver Air Bag Module

The driver air bag module:

- contains dual stage deployment (advanced restraint system).
- is equipped with canister vent.

In addition to dual stage deployment (advanced restraint system) driver air bag module, this vehicle is equipped with a driver air bag canister vent. Canister venting is a deployable device integrated to the driver air bag module. Canister venting controls the inflation rate of the driver air bag and the escape rate of gases from the vent.

Deployable Steering Column

This vehicle is equipped with a deployable steering column. The deployable steering column includes a deployable device that, once deployed, reduces the amount of force necessary to collapse the steering column during a crash event. The deployable device is activated by the RCM depending on when the module detects a crash event force exceeding a programmed limit and the position of the driver seat. After deployment, a new steering column **must** be installed.

High Speed Controller Area Network (HS-CAN)

This vehicle utilizes a communication system called a HS-CAN . The HS-CAN consists of a twisted pair of wires connected to the following:

- ABS module
- Accessory Protocol Interface Module (APIM)
- IC module
- OCS system
- PCM
- Transmission Control Module (TCM)
- RCM
- Four-Wheel Drive (4WD) module
- DLC

The HS-CAN circuits use a bias voltage of approximately 2.5 volts, one is a positive 2.5 volts while the other is a negative 2.5 volts. The HS-CAN also uses 2 terminating resistors, one contained within the PCM, the other in the IC module. The terminating resistors are not serviced separately. The terminating resistors have a value of 120 ohms each, for a total normal operating system total of 60 ohms. The HS-CAN may operate with only one terminating resistor and may communicate some messages to some of the control modules with only one circuit functioning. Refer to Section 418-00 .

Impact Sensors

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

For these vehicles, the SRS uses 6 satellite sensors in addition to the RCM . The RCM is mounted to the center tunnel beneath the console. All vehicles will have 2 front impact severity sensors (driver/center front crash sensor and passenger front crash sensor) located in the front-center area of the vehicle, behind the grille mounted on the lower radiator support. The first row impact sensors (pressure sensors) are located in each of the front doors behind the trim panel. The second row impact sensors are located on each C-pillar. Mounting

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orientation and torque is critical for correct operation of all impact and rollover sensors.

Deployment Loop

The deployment loop is made up of the RCM , deployable device (each containing a squib), air bag(s), safety belt pretensioners (safety canopies/side air curtains, deployable steering columns, load limiting retractor, adaptive tether, adaptive vent, if equipped) and associated circuits.

Loops/Squibs

All deployable devices contain an initiating device called a squib. The squib is part of the deployment loop. Air bag/safety canopies modules can contain more than one squib, some vehicles may have up to 4 squibs in one air bag module. Squibs are often referred to as loops during the diagnostic process.

Occupant Classification System (OCS) System

The OCS system is found only on the front passenger seat. The front passenger OCS system is comprised of 2 OCS rails (weight sensors) that are mounted to each side of the seat track and an OCSM which is mounted to the electrical bracket underneath the seat cushion pan. The components that make up the OCS system are serviced separately. The weight of any occupant or object on the front passenger seat is electronically communicated to the OCSM .

The OCS system is also used for operation of the passenger Belt-Minder®. For information on the passenger Belt-Minder® feature, refer to Section 501-20A . To deactivate or reactivate the passenger Belt-Minder® feature, refer to Section 413-01 or the Owner's Literature.

When the front passenger seat is removed for service, the Zero Seat Weight Test must be carried out after the installation of the front passenger seat. When a new OCS system component is installed, the System Reset must be carried out after the installation of the front passenger seat. The Zero Seat Weight Test and/or System Reset must be carried out only as instructed in the Workshop Manual. For information on the Zero Seat Weight Test and/or System Reset, refer to Occupant Classification Sensor (OCS) System Zero Seat Weight Test or Occupant Classification Sensor (OCS) System Reset in this section.

Occupant Classification System Module (OCSM)

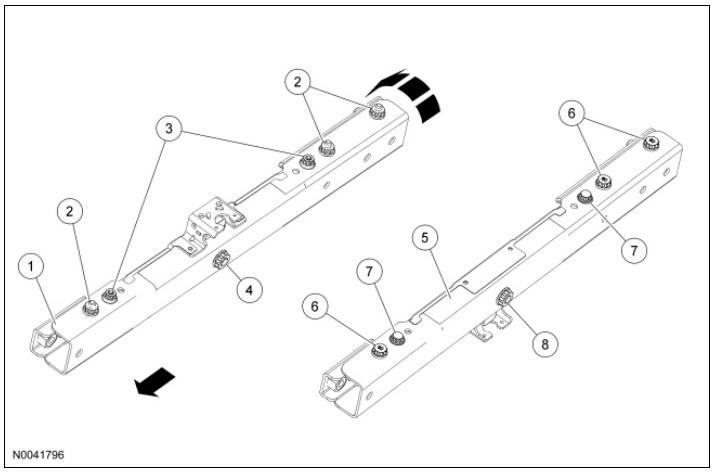
Based on programmed limits, the OCSM will inform the RCM , via a HS-CAN , the weight of any occupant or object on the front passenger seat. The RCM uses this information in determining if the passenger air bag module or passenger seat side air bag module is to be deployed in the event of a deployable collision.

The OCSM monitors the OCS system for faults and communicates on-demand and continuous DTCs via the DLC with the use of a scan tool.

Occupant Classification System (OCS) Rails (Weight Sensors)

⚠ WARNING: Do not disassemble the occupant classification system (OCS) sensor rail or tighten or loosen any of the nuts and bolts installed to the OCS rail body. Only the 8 bolts that attach the 2 OCS sensor rails to the seat track may be removed and installed. Failure to follow these instructions may result in incorrect operation of the OCS and increase the risk of serious personal injury or death in a crash.

NOTE: The illustration below is indicating the fasteners of the OCS rails (weight sensors) that **must not** be tightened or loosened. The OCS rails are installed individually as an assembly and require no adjustment.



Item	Description
1	Occupant Classification System (OCS) rail, outboard side
2	Stopper nut(s) and bolt(s), outboard side
3	Sensor pivot nut(s) and bolt(s), outboard side
4	Sensor nut (under assembly), outboard side
5	OCS rail, inboard side
6	Stopper nut(s) and bolt(s), inboard side
7	Sensor pivot nut(s) and bolt(s), inboard side
8	Sensor nut (under assembly), inboard side

Passenger Air Bag Deactivation (PAD) Indicator

The PAD indicator is a visual indicator used to inform the front seat occupants of the passenger air bag deactivation state. The PAD indicator is a stand-alone lamp installed into the vehicle instrument panel in a position visible to each front seat occupant.

The RCM controls the state of the PAD indicator through a direct hardwire connection, based on information provided by the OCS system. The PAD indicator is lit to indicate the passenger air bag module is disabled. An exception to this is when the front passenger seat is determined to be empty and the passenger safety belt buckle is unbuckled indicating a deactivated passenger air bag module is not necessary. In all other cases, the PAD indicator is unlit when the passenger air bag module is enabled.

When the ignition is in the ON position, the PAD indicator prove-out period is initiated by the RCM . The RCM briefly activates the PAD indicator to prove-out the indicator function and verify correct operation.

For information on the OCS system, refer to Occupant Classification Sensor System in this section.

The following table indicates the passenger air bag status and the PAD indicator status based the size of the front outboard passenger occupant.

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Passenger Air Bag Deactivation (PAD) Indicator Status

Occu- pant Size	Passenger Safety Belt Buckle Status	Pass. Air Bag Status	PAD Ind. Status
None	Unbuckled	Disabled	Unlit
None	Buckled	Disabled	Lit
Infant or Small Child	Buckled/ Unbuckled	Disabled	Lit
Adult Sized	Buckled/ Unbuckled	Enabled	Unlit

Passenger Air Bag Module

The passenger air bag module:

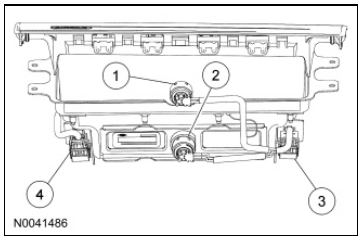
- contains dual stage deployment (advanced restraint system).
- is equipped with canister vent.
- is equipped with adaptive tether.
- is mounted in the passenger side of the instrument panel.

In addition to the dual stage deployment (advanced restraint system) front passenger air bag module, this vehicle is equipped with a passenger air bag adaptive tether, as well as a passenger air bag canister vent. Canister venting is a deployable device integrated to the passenger air bag module. Canister venting controls the inflation rate of the passenger air bag and the escape rate of gases from the vent.

Adaptive tether is a deployable device integrated to the passenger air bag module. Adaptive tether restricts the rearward movement of the passenger air bag.

Passenger Air Bag Module

NOTE: Illustration shown as if looking through the glove compartment opening, rotated slightly for clarity.



Item	Description
1	Passenger air bag adaptive tether
2	Passenger air bag canister vent
3	Adaptive tether and canister vent 4-way connector
4	Passenger air bag squib 1 and squib 2 4-way connector

Restraints Control Module (RCM)

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

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

NOTICE: **Prior to the installation of a new Restraints Control Module (RCM), it is necessary to upload module configuration information to the scan tool. This information needs to be downloaded into the new RCM once installed. Refer to Section 418-01 .**

NOTE: This vehicle may be equipped with the SYNC® V2 feature which contains the 911 assist option. Refer to the Owner's Literature.

NOTE: Carrying out Programmable Module Installation (PMI) will not enable the 911 assist option that is disabled. The RCM and Accessory Protocol Interface Module (APIM) must be configured correctly to fully support 911 assist functionality.

The RCM carries out the following functions:

- deploys the air bag(s) in the event of a deployable crash.
- activates the safety belt buckle pretensioner(s) and safety belt adaptive load limiting retractor(s) to control tension on the safety belt.
- monitors the SRS for faults.
- requests the illumination of the air bag indicator if a fault is detected.
- communicates the on-demand or continuous DTCs through the DLC .

The RCM monitors the SRS for possible faults. If a fault is detected while the ignition switch is in the ON position, the RCM will request illumination of the air bag indicator located in the IC .

When the ignition is cycled (turned OFF and then ON), the IC module will prove out the air bag indicator by lighting the indicator for 6 seconds and then off. If a SRS fault exists, the air bag indicator will illuminate and remain illuminated for the rest of the ignition cycle. The RCM will also communicate the on-demand (current) and continuous (historical) DTCs through the DLC to the scan tool. If the RCM requests illumination of the air bag indicator and the air bag indicator does not function, the IC module will automatically activate an audible chime. The chime is a series of 5 sets of 5 tone bursts. If the chime is heard, the SRS and the air bag indicator require repair.

The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the air bags in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after the battery ground cable is disconnected.

Safety Belt Buckle Pretensioners

The safety belt buckles are equipped with pretensioners. The safety belt buckle pretensioners remove excess slack from the safety belt webbing. The pretensioners are activated by the RCM when the module detects a crash event force exceeding a programmed limit.

Safety Belt Buckle Switches

The front safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the RCM whether the safety belts are buckled or unbuckled.

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The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will set a DTC.

The RCM uses this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. The RCM also communicates the driver safety belt buckle switch status to the IC module, which monitors the information to control the safety belt warning indicator. For information on the safety belt warning indicator, refer to Section 413-01 .

Safety Canopy® Module

⚠ WARNING: Anytime the Safety Canopy® or side air curtain module has deployed, a new headliner and new A-, B-, C- and D-pillar upper trim panels and attaching hardware must be installed. Remove any other damaged components and hardware and install new components and hardware as needed. Failure to follow these instructions may result in the Safety Canopy® or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

The Safety Canopy® module:

- is installed as an assembly.
- is mounted above the headliner.
- attaches from the A-pillar frame to the D-pillar frame on Explorer/Mountaineer and from the A-pillar frame to the C-pillar frame on Explorer Sport Trac.

Seat Side Air Bag Module

NOTE: When servicing a seat equipped with a seat side air bag module, refer to Section 501-10 .

A seat side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a Safety Canopy® module.

The seat side air bag module:

- will deploy upon receiving a flow of current from the RCM initiated by the side impact sensor(s) and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the driver/passenger seat back.
- is used in conjunction with a Safety Canopy® module.

Seat Track Position Sensor

The seat track position sensor is a Hall-effect sensor located on the driver seat track. The seat track position sensor informs the RCM of the driver seat position. The RCM uses this information in determining the deployment rate of the dual-stage driver air bag module.

Secondary Air Bag Warning (Chime)

The secondary air bag warning chime, is an audible chime generated by the IC module. If the IC module has detected a fault with the air bag warning indicator, a DTC will be stored in the memory of the IC module.

Upon receiving the message from the RCM that a SRS fault has been detected, the IC module will sound the secondary air bag warning chime in a pattern of 5 sets of 5 beeps.

Diagnostic Instructions

The symptom chart can be used to help locate SRS concerns if no DTCs are retrieved and the listed symptoms are observed. Whether or not the listed symptoms are observed, always carry out the following:

1. Retrieve all DTCs stored in the RCM memory and OCSM memory. Refer to Retrieve/Clear Continuous DTCs in this section.

2. Run the on-demand Self Test to determine what DTCs are currently being sensed by the RCM and OCSM .

3. If on-demand DTCs are different than CMDTCs , always repair the on-demand DTCs first.

A DTC can indicate several concerns. The DTCs are to assist in system diagnosis and are not to be considered definitive. Always refer to the pinpoint test corresponding to the DTC to determine where the concern lies and to repair the concern correctly.

Self Test/On-Demand

The on-demand Self Test option is used to verify that no electrical concerns exist with the SRS . Upon entering the self-test, the RCM / OCSM will make an electrical check of each electrical component in the system. If a concern is detected, a DTC is displayed on the scan tool with a brief description of the DTC. The self-test should always be run after any repair to verify that the repair was successful.

Self Test/Continuous Memory and Clear DTCs

During vehicle operation, the RCM and OCSM will detect and store both intermittent and hard failure DTCs in non-volatile memory. The DTC strategy employed by the RCM incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern to exist for up to one minute in the system before the RCM will detect it. For the RCM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC. DTCs can be retrieved with a scan tool using the Self Test option. All DTCs stored in the RCM and OCSM will be displayed on the scan tool along with a brief description of the DTC. If no DTCs are present, the scan tool will display a SYSTEM PASSED message. This option can also be used to clear DTCs from the RCM and OCSM memory, as long as the concern no longer exists.

Once 75 hours of operation have been recorded by the RCM since the concern was last detected, all RCM CMDTCs will be automatically removed from memory.

Once 128 ignition cycles have been recorded by the OCSM since the concern was last detected, all OCSM continuous memory DTCs will be automatically removed from memory.

DataLogger PID/Data

The DataLogger PID/Data option allows the scan tool operator to read the state of several PIDs to aid in diagnosing the system. PIDs are real time measurements of parameters, such as voltages and resistances, calculated by the RCM sent to the scan tool for display. Many of the PIDs supported by the modules are

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calculated periodically and are, therefore, not true real time readings.

To retrieve PIDs, follow these steps:

1. Connect the scan tool to the DLC .
2. Turn the ignition to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select DataLogger.
5. Select RCM or OCSM .

Active Commands

Instrument Cluster (IC) module

These commands allow the technician to verify the operation of IC module components and subsystems.

Occupant Classification System (OCS) System Reset

The Occupant Classification System (OCS) System Reset active command sets the zero set point or rezeros the OCS system. Refer to Occupant Classification Sensor (OCS) System Reset in this section.

Lamp Fault Codes (LFCs)

This vehicle supports LFCs **only** when the RCM is in plant mode. A new RCM installed in a vehicle will be in plant mode until:

- Programmable Module Installation (PMI) has been carried out.
- the RCM sees a fault-free SRS (no DTCs present).

If a LFC is present after completing PMI , a fault is present in the SRS and on-demand DTCs must be retrieved and diagnosed.

Diagnosing Customer Concerns With On-Demand DTCs

NOTE: Most SRS diagnostic procedures will require depowering and repowering of the SRS . Depowering and repowering requires disconnecting of the battery and removal of the RCM fuse. This reduces the risk of accidental deployment of SRS components while diagnostic procedures are being carried out.

If the air bag warning indicator is reported ON by the customer when the vehicle comes in for service, connect the scan tool and follow the Diagnostic Instruction procedures in this section to identify the concern.

Once the DTC is known, read the Normal Operation of the pinpoint test for the DTC involved.

Using the scan tool with the use of PIDs and active command(s) may be of assistance in diagnosing the concern.

- Follow the depowering procedure as directed in this section.

- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
    - components.
    - connectors.
    - splices and wiring harnesses.
    - insulation on conductors.

Diagnosing Customer Concerns With Continuous Memory DTCs

If an air bag warning indicator ON is reported by the customer but is not present when the vehicle comes in for service, follow the Diagnostic Instruction procedures in this section to identify the intermittent DTC.

Once the DTC is known, read the Normal Operation section of the pinpoint test for the DTC involved.

- Follow the depowering procedure as directed in this section.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
    - components.
    - connectors.
    - splices and wiring harnesses.
    - insulation on conductors.

Refer to the Normal Operations section of the pinpoint test for the DTC involved, which lists the common concerns that relate to the DTC. Concerns are listed according to priority.

Bit-Mapped DTCs

Many of the continuous memory and on-demand DTCs that can be present in the RCM provide general fault information and require accessing the associated bit-mapped PIDs (fault PIDs) to identify the specific concern. DTCs that use fault PIDs are conceptually different from conventional DTCs.

Conventional DTCs identify a specific concern for a given component and point to a particular diagnostic path. In the diagnostic path, PIDs are sometimes used to determine the root cause.

DTCs that use fault PIDs do not identify the specific concern. The DTC identifies the component(s) or type of components in which the concern exists. The next level, fault PIDs, identifies the specific device and fault condition. Fault PIDs are available for both on-demand (active) and continuous memory (historic) DTCs. Those associated PIDs are an extension of the information provided by the DTC and are identified by the same DTC number. Using both DTC and the fault PID is necessary to define the specific fault present (in the same manner as normal DTCs do).

A scan tool must be used to view DTCs and their fault PIDs. Once a scan tool has retrieved a DTC, use the scan tool to view the fault PIDs. Viewing the fault PIDs must be carried out to identify the specific concern that is present. When the viewing of fault PIDs has been carried out, the scan tool can display the PIDs associated with that DTC, including the status or state that exists (on-demand DTC) or existed (Continuous Memory Diagnostic Trouble Code (CMDTC)). Refer to the manufacturer's instructions for the scan tool being used on how to view fault PIDs.

Prove Out Procedure

Turn the ignition switch from the off to the on position and monitor the air bag indicator with all SRS

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components connected. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag indicator will:

- fail to light.
- remain lit continuously.
- flash at a 5Hz rate RCM not configured).

The air bag indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS . If the air bag indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator will need to be repaired before diagnosis can continue.

Air Bag Reconnect Checklist

The checklist below should be completed following diagnosis or repair of any air bag system concern:

- All in-seat harness connectors connected?
- All OCS system components connected?
- All air bag modules connected?
- Safety Canopy® modules connected?
- Safety belt pretensioner connectors connected?
- Safety belt load limiter connectors connected?
- All sensors (front, side impact sensors and seat track position sensor) connected?
- PAD indicator connected?
- RCM connected?
- RCM fuse installed?
- Battery connected?

Glossary

Secondary Air Bag Warning

The secondary air bag warning is an audible fault format that consists of 5 sets of 5 tone bursts, with each set of 5 tone bursts separated by a 5-second quiet period. One tone burst cycle will consist of 1-second ON and 1-second OFF. This series of 5 activations is repeated every 30 minutes.

Disconnect the Component

Disconnect the component means to disconnect the component vehicle harness connector, not to remove the component. Do not reconnect a disconnected component unless instructed to do so.

Deactivate the Supplemental Restraint System (SRS)

Deactivate the SRS means to carry out a deactivation procedure for the SRS . Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Depower the SRS

Depower the SRS means to disconnect the battery and remove the RCM fuse. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Install a New Component

Install a new component means to remove the existing component and install a new authorized part obtained from Ford Customer Service Division.

Prove Out the SRS

Prove out the SRS means to turn the ignition switch from the OFF to the ON position, and to monitor the air bag indicator with the SRS components connected. Refer to Prove Out Procedure in this section.

Reactivate the SRS

Reactivate the SRS means to carry out the reactivation procedure for the SRS . Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.

Reconnect the System

Reconnect the system means to reconnect all SRS components. Refer to Air Bag System Reconnect Checklist in this section.

Repower the SRS

Repower the SRS means to turn the ignition ON, install the RCM fuse and connect the battery ground cable. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

Inspection and Verification

1. Verify the customer concern.

2. Inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Damaged Restraints Control Module (RCM) or loose mounting • Damaged Occupant Classification System Module (OCSM) or loose mounting • Occupant Classification System (OCS) rail is damaged, has contamination or has an obstruction • Damaged front impact severity sensor(s) or loose mounting • Damaged side impact sensor(s) or loose mounting • Damaged or disconnected Passenger Air Bag Deactivation (PAD) indicator	• Open Smart Junction Box (SJB) fuse 17 (10A) • Damaged wiring harness • Loose, damaged or corroded connectors • Circuitry open/shorted • Damaged shorting bars

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the DLC .

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5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record CMDTCs .

8. Clear the continuous DTCs and carry out the self-test diagnostics for the RCM and OCSM .

9. If the DTCs retrieved are related to the concern, go to the DTC Charts. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

The DTCs can be retrieved from the RCM and the OCSM with a scan tool via the DLC .

Restraints Control Module (RCM) DTC Chart

DTC [a]	Description	Action To Take
Continuous lamp	The Air Bag Indicator is Illuminated Continuously	GO to Pinpoint Test A .
B1085	Restraint System - Seatbelt Load Limiter Status	GO to Pinpoint Test B .
B1118	Passenger Front Crash Sensor Mount/Communication Fault (RH front impact severity sensor)	GO to Pinpoint Test C .
B1135	Passenger Front Crash Sensor Internal Fault (RH front impact severity sensor)	INSTALL a new passenger front crash sensor. REFER to Front Impact Severity Sensor in this section.

B1231	Event Threshold Exceeded	INSTALL a new Restraints Control Module (RCM) and impact sensors. REFER to Inspection and Repair After a Supplemental Restraint System (SRS) Deployment in this section.
B1317	Battery Voltage High	GO to Pinpoint Test AB .
B1318	Battery Voltage Low	GO to Pinpoint Test AB .
B1342	ECU is Faulted	INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section.
B1884	PAD Warning Lamp Circuit Failure	GO to Pinpoint Test D .
B1890	PAD Warning Lamp Circuit Short to Battery	GO to Pinpoint Test E .
B2290	Occupant Classification System Fault	**NOTE:** If no on-demand or continuous DTC is present in the Occupant Classification System Module (OCSM) and DTC B2290 is only present in the RCM as a continuous memory DTC, CLEAR all RCM DTCs, PROVE OUT the SRS and CONFIRM the battery and charging system are OK. The OCSM reported a fault message to the RCM . CARRY OUT on-demand self test of the OCSM and REFER to the OCSM DTC Chart for any OCSM DTCs present. If no OCSM DTCs are present, the DTC may have been set due to a momentary low voltage condition. REFER to Section 414-00 to CONFIRM the battery and charging system are OK as a momentary low voltage condition may have resulted in the OCSM reporting a fault message to the RCM and setting RCM DTC B2290.
B2292	Restraint System - Seatbelt Pretensioner Fault	GO to Pinpoint Test G .
B2293	Restraint System - Air Bag Fault	GO to Pinpoint Test H .
B2294	Restraint System - Curtain Fault	GO to Pinpoint Test I .
B2295	Restraint System - Side Air Bag Fault	GO to Pinpoint Test J .
B2296	Restraint System - Impact Sensor Fault	GO to Pinpoint Test K .
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	GO to Pinpoint Test L .
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	GO to Pinpoint Test M .
B2438	Passengers Seat Belt Buckle Switch Short to Ground	GO to Pinpoint Test N .
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	GO to Pinpoint Test O .
B2477	Module Configuration Failure	**NOTE:** When installing a new RCM , always make sure the correct RCM is being installed. If an incorrect RCM is installed, DTCs will result.

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		CARRY OUT Programmable Module Installation (PMI). REFER to Section 418-01 .
B2607	Harness/Configuration Mismatch	**NOTE:** When installing a new RCM , always make sure the correct RCM is being installed. If an incorrect RCM is installed, DTCs will result. CARRY OUT Programmable Module Installation (PMI). REFER to Section 418-01 .
B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver's Side	GO to Pinpoint Test P .
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	GO to Pinpoint Test Q .
B2792	Cross Link Between Firing Loops	GO to Pinpoint Test R .
B2984	Deployable Steering Column Circuit Open	GO to Pinpoint Test S .
B2985	Deployable Steering Column Circuit Short to Battery	GO to Pinpoint Test T .
B2986	Deployable Steering Column Circuit Short to Ground	GO to Pinpoint Test U .
B2987	Deployable Steering Column Circuit Resistance Low on Squib	GO to Pinpoint Test S .
C1414	Incorrect Module Design Level	GO to Pinpoint Test AC .
C1946	Front Driver's Seat Track Position Switch Circuit Open	GO to Pinpoint Test X .
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	GO to Pinpoint Test Y .
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	GO to Pinpoint Test Z .
C1981	Front Driver's Seat Track Position Switch Circuit Fault	GO to Pinpoint Test AA .
U0300	Internal Control Module Software Incompatibility	**NOTE:** When installing a new RCM , always make sure the correct RCM is being installed. If an incorrect RCM is installed, DTCs will result. CARRY OUT Programmable Module Installation (PMI). REFER to Section 418-01 .
U1900	CAN Communication Bus Fault - Receive Error	**NOTE:** DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new RCM as part of repair for a RCM DTC U1900 fault.

		VIEW and RECORD IC_MSG_ RCM , PCM_MSG_ RCM and OCS _MSG_ RCM fault PIDs to determine the module with the concern. REFER to Section 418-00 to diagnose the High Speed Controller Area Network (HS-CAN)/module concern.
U2050	No Application Present	**NOTE:** When installing a new RCM , always make sure the correct RCM is being installed. If an incorrect RCM is installed, DTCs will result. INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section.
U2051	One or More Calibration Files Missing/Corrupt	**NOTE:** When installing a new RCM , always make sure the correct RCM is being installed. If an incorrect RCM is installed, DTCs will result. CARRY OUT Programmable Module Installation (PMI). REFER to Section 418-01 .

[a] DTC: Retrieved using scan tool.

Occupant Classification System Module (OCSM) DTC Chart

DTC [a]	Description	Action To Take
B229A	Occupant Classification System Contamination	**NOTE:** If no on-demand or continuous DTC is present in the RCM and DTC B229A is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS . GO to Pinpoint Test V .
B229B	Occupant Classification System Obstruction	**NOTE:** If no on-demand or continuous DTC is present in the RCM and DTC B229B is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS . GO to Pinpoint Test W .
B1231	Event Threshold Exceeded (Crash Data Memory Full)	INSTALL new OCS rails and CLEAR all OCSM and RCM DTCs. REFER to Occupant Classification Sensor and Inspection and Repair After a Supplemental Restraint System (SRS) Deployment in this section.
B1317	Battery Voltage High	GO to Pinpoint Test AB .
B1318	Battery Voltage Low	GO to Pinpoint Test AB .
B1342	ECU is Faulted	CARRY OUT Occupant Classification System (OCS) system reset. REFER to Occupant Classification Sensor (OCS) System Reset in this section. DO NOT carry out the Zero Seat Weight Test at this time. CLEAR the DTCs and REPEAT the self-test. If the DTC is no longer present, CARRY OUT the Zero Weight Test to complete the repair. REFER to Occupant Classification Sensor (OCS) System Zero Seat Weight Test in this section. If the DTC is still present, INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section.
B2290	Occupant Classification System Fault	**NOTE:** If no on-demand or continuous DTCs are present in the OCSM and DTC B2290 is only present in the RCM , REFER to

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		DTC B2290 in the RCM DTC chart above. GO to Pinpoint Test F .
B2477	Module Configuration Failure	INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section.
C1941	Zero Seat Weight Test Failure	Can only be reported when carrying out Occupant Classification System (OCS) system Zero Seat Weight Test. REFER to Occupant Classification Sensor (OCS) System Zero Seat Weight Test in this section.
U1900	CAN Communication Bus Fault - Receive Error	**NOTE:** DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new OCSM as part of repair for a OCS DTC U1900 fault. VIEW and RECORD RCM _MSG_ OCS fault PIDs to determine the module with the concern. REFER to Section 418-00 to diagnose the HS-CAN /module concern.
U2050	No Application Present	**NOTE:** If no on-demand or continuous DTC is present in the RCM and DTC U2050 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS . INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section.
U2051	One or More Calibration Files Missing/Corrupt	INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section.

[a] DTC: Retrieved using scan tool.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Air Bag Indicator is Illuminated Continuously

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

During normal operation, the Instrument Cluster (IC) module will illuminate the air bag indicator continuously for 6 seconds after the ignition is placed to the RUN or ON position. If the Supplemental Restraint System (SRS) is fault free, the air bag warning indicator will turn off and remain off. If a fault is detected in the SRS , the air bag warning indicator will illuminate and remain illuminated for the rest of the ignition cycle. The Restraints Control Module (RCM) will communicate to the IC module via the High Speed Controller Area Network (HS-CAN). The IC module will illuminate the air bag indicator based on messaging from the RCM or if there is no communication between the RCM and IC module.

This pinpoint test is intended to diagnose the following:

- IC module

- RCM

PINPOINT TEST A: THE AIR BAG INDICATOR IS ILLUMINATED CONTINUOUSLY

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
A1 RETRIEVE RCM DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Were any DTCs retrieved during self-test?**	**Yes** If on-demand or Continuous Memory Diagnostic Trouble Codes (CMDTCs) were retrieved, GO to the DTC Charts in this section for diagnostic direction. Do not clear any DTCs until all DTCs have been resolved. **No** If the RCM **does** communicate with the scan tool, REFER to Section 413-01 to diagnose the IC module concern. If the RCM **does not** communicate with the scan tool, REFER to Section 418-00 to diagnose the no communication concern. Do not clear any DTCs until all DTCs have been resolved.

Pinpoint Test B: DTC B1085

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) continuously monitors the adaptive load limiting retractors circuits for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set and store

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on-demand DTC B1085 in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors adaptive load limiting retractor circuits for resistance, it expects a normal resistance between 1.31 and 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 ohms or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs [a]	Description	Fault Trigger Condition
1085_24_OD and 1085_24_CM	Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib	When the Restraints Control Module (RCM) measures resistance less than 0.9 ohm between the passenger safety belt load limiting retractor circuits, a fault will be indicated.
1085_25_OD and 1085_25_CM	Seatbelt Load Limiter Front Passenger Open	When the RCM measures resistance greater than 5 ohms between the passenger safety belt load limiting retractor circuits, a fault will be indicated.
1085_26_OD and 1085_26_CM	Seatbelt Load Limiter Front Passenger Short to Battery	When the RCM senses a short to voltage on either of the passenger safety belt load limiting retractor circuits, a fault will be indicated.
1085_27_OD and 1085_27_CM	Seatbelt Load Limiter Front Passenger Short to Ground	When the RCM senses a short to ground on either of the passenger safety belt load limiting retractor circuits, a fault will be indicated.
1085_28_OD and 1085_28_CM	Seatbelt Load Limiter Driver Circuit Resist Low on Squib	When the RCM measures resistance less than 0.9 ohm between the driver safety belt load limiting retractor circuits, a fault will be indicated.
1085_29_OD and 1085_29_CM	Seatbelt Load Limiter Driver Open	When the RCM measures resistance greater than 5 ohms between the driver safety belt load limiting retractor circuits, a fault will be indicated.
1085_30_OD and 1085_30_CM	Seatbelt Load Limiter Driver Short to Battery	When the RCM senses a short to voltage on either of the driver safety belt load limiting retractor circuits, a fault will be indicated.
1085_31_OD and 1085_31_CM	Seatbelt Load Limiter Driver Short to Ground	When the RCM senses a short to ground on either of the driver safety belt load limiting retractor circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B1085. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B1085.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Adaptive load limiting retractor
- RCM

PINPOINT TEST B: DTC B1085

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

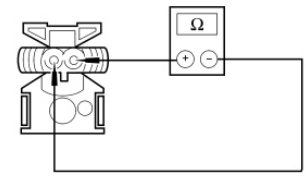
Test Step	Result / Action to Take
B1 RETRIEVE RCM DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 1085 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 1085 fault PIDs. • **Do any RCM on-demand 1085 fault PIDs indicate a fault?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 1085_28_OD (Seatbelt Load Limiter Driver Circuit Resist Low on Squib), GO to B2 . For 1085_29_OD (Seatbelt Load Limiter Driver Open), GO to B2 . For 1085_31_OD (Seatbelt Load Limiter Driver Short to Ground), GO to B8 . For 1085_30_OD (Seatbelt Load Limiter Driver Short to Battery), GO to B10 . For 1085_24_OD (Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib), GO to B11 . For 1085_25_OD (Seatbelt Load Limiter Front Passenger Open), GO to B11 . For 1085_27_OD (Seatbelt Load Limiter Front Passenger Short to Ground), GO to B17 .

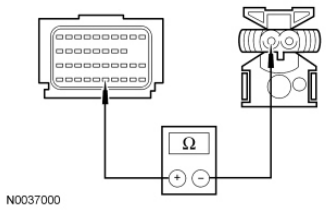
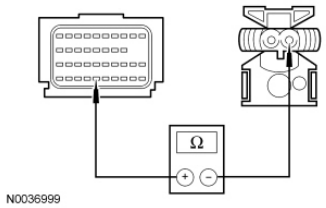
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	For 1085_26_OD (Seatbelt Load Limiter Front Passenger Short to Battery), GO to B19 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 1085_28_CM (Seatbelt Load Limiter Driver Circuit Resist Low on Squib), 1085_24_CM (Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib), 1085_29_CM (Seatbelt Load Limiter Driver Open) and 1085_25_CM (Seatbelt Load Limiter Front Passenger Open), GO to B22 . For 1085_31_CM (Seatbelt Load Limiter Driver Short to Ground) and 1085_27_CM (Seatbelt Load Limiter Front Passenger Short to Ground), GO to B24 . For 1085_30_CM (Seatbelt Load Limiter Driver Short to Battery) and 1085_26_CM (Seatbelt Load Limiter Front Passenger Short to Battery), GO to B25 .
B2 CHECK THE DRIVER ADAPTIVE LOAD LIMITING RETRACTOR RESISTANCE PID (D_LOAD)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: D_LOAD (Seatbelt Load Limiter Resistance, Driver Side) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to B21 . **No** GO to B3 .
B3 CHECK THE DRIVER ADAPTIVE LOAD LIMITING RETRACTOR RESISTANCE PID (D_LOAD) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the D_LOAD (Seatbelt Load Limiter Resistance, Driver Side) resistance PID while carrying out a harness test of the driver adaptive load limiting retractor circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.

• **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out a harness test?**	GO to B26 . **No** If the driver adaptive load limiting retractor resistance PID is less than 1.31 ohms, GO to B4 . If the driver adaptive load limiting retractor resistance PID is greater than 4.29 ohms, GO to B6 .
B4 CHECK THE DRIVER ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs (1085_28_OD) AND (1085_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Adaptive Load Limiting Retractor C323 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 1085_28_OD (Seatbelt Load Limiter Driver Circuit Resist Low on Squib) ♦ 1085_29_OD (Seatbelt Load Limiter Driver Open) • **DIAGNOSTIC TIP:** When viewing DTC B1085 on-demand fault PIDs with the driver adaptive load limiting retractor disconnected, an open circuit fault would normally be retrieved. • **Did the driver adaptive load limiting retractor on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to B20 . **No** GO to B5 .
B5 CHECK FOR A SHORT BETWEEN DRIVER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS	

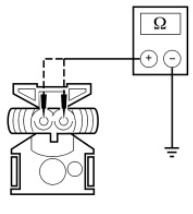
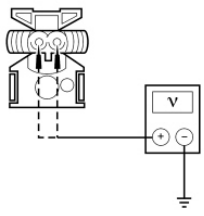
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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver adaptive load limiting retractor C323-1, circuit CR146 (GY/VT), harness side and C323-2, circuit RR146 (BU/BN), harness side.  A0030495 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to B21 . **No** REPAIR circuits CR146 (GY/VT) and RR146 (BU/BN). GO to B26 .
B6 CHECK THE DRIVER ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs (1085_28_OD) AND (1085_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Adaptive Load Limiting Retractor C323 . • Connect a fused jumper wire between driver adaptive load limiting retractor C323-1, circuit CR146 (GY/VT), harness side and C323-2, circuit RR146 (BU/BN), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs .	**Yes** GO to B20 . **No** GO to B7 .

♦ 1085_28_OD (Seatbelt Load Limiter Driver Circuit Resist Low on Squib) ♦ 1085_29_OD (Seatbelt Load Limiter Driver Open) • **DIAGNOSTIC TIP:** When viewing DTC B1085 on-demand fault PIDs with the driver safety belt load limiting retractor circuits shorted together, a low resistance fault would normally be retrieved. • **Did the driver adaptive load limiting retractor on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
B7 CHECK DRIVER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire between driver adaptive load limiting retractor C323. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-35, circuit CR146 (GY/VT), harness side and driver adaptive load limiting retractor C323-1, circuit CR146 (GY/VT), harness side.  • Measure resistance between RCM C310b-36, circuit RR146 (BU/BN), harness side and driver adaptive load limiting retractor C323-2, circuit RR146 (BU/BN), harness side.  • **Are resistances less than 0.5 ohm?**	**Yes** GO to B8 . **No** REPAIR circuit CR146 (GY/VT) or RR146 (BU/BN). GO to B26 .
B8 CHECK THE DRIVER ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs	

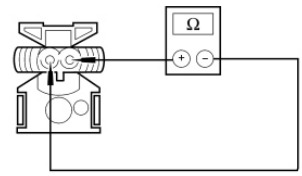
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(1085_31_OD) AND (1085_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Adaptive Load Limiting Retractor C323 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 1085_31_OD (Seatbelt Load Limiter Driver Short to Ground) ♦ 1085_29_OD (Seatbelt Load Limiter Driver Open) • **DIAGNOSTIC TIP:** When viewing DTC B1085 on-demand fault PIDs with the driver adaptive load limiting retractor disconnected, an open circuit fault would normally be retrieved. • **Did the driver adaptive load limiting retractor on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to B20 . **No** GO to B9 .
B9 CHECK DRIVER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver adaptive load limiting retractor: ♦ C323-1, circuit CR146 (GY/VT), harness side and ground. ♦ C323-2, circuit RR146 (BN/BU), harness side and ground.	**Yes** GO to B21 . **No** REPAIR circuit CR146 (GY/VT) or RR146 (BN/BU). GO to B26 .

 • **Are resistances greater than 10,000 ohms?**	
B10 CHECK DRIVER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Adaptive Load Limiting Retractor C323 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between driver adaptive load limiting retractor: ♦ C323-1, circuit CR146 (GY/VT), harness side and ground. ♦ C323-2, circuit RR146 (BU/BN), harness side and ground.  • **Is voltage present on either circuit?**	**Yes** REPAIR circuit CR146 (GY/VT) or RR146 (BU/BN). GO to B26 . **No** GO to B21 .
B11 CHECK THE PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR RESISTANCE PID (P_LOAD)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: P_LOAD (Seatbelt Load Limiter Resistance, Passenger Side) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to B21 . **No** GO to B12 .

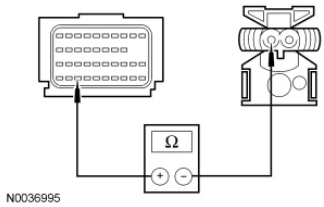
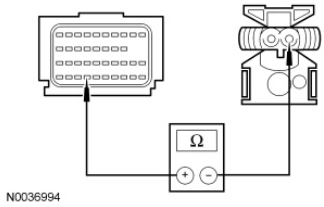
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B12 CHECK THE PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR RESISTANCE PID (P_LOAD) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the P_LOAD (Seatbelt Load Limiter Resistance, Passenger Side) resistance PID while carrying out a harness test of the passenger adaptive load limiting retractor circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B26 . **No** If the passenger adaptive load limiting retractor resistance PID is less than 1.31 ohms, GO to B13 . If the passenger adaptive load limiting retractor resistance PID is greater than 4.29 ohms, GO to B15 .
B13 CHECK THE PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs (1085_25_OD) AND (1085_24_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Adaptive Load Limiting Retractor C303 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 1085_24_OD (Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib)	**Yes** GO to B20 . **No** GO to B14 .

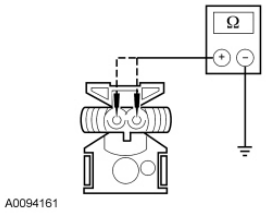
♦ 1085_25_OD (Seatbelt Load Limiter Front Passenger Open) • **DIAGNOSTIC TIP:** When viewing DTC B1085 on-demand fault PIDs with the passenger adaptive load limiting retractor disconnected, an open circuit fault would normally be retrieved. • **Did the passenger adaptive load limiting retractor on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
B14 CHECK FOR A SHORT BETWEEN PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between passenger adaptive load limiting retractor C303-1, circuit CR147 (GN/OG), harness side and C303-2, circuit RR147 (YE/VT), harness side.  A0030495 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to B21 . **No** REPAIR circuits CR147 (GN/OG) and RR147 (YE/VT). GO to B26 .
B15 CHECK THE PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs (1085_25_OD) AND (1085_24_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Adaptive Load Limiting Retractor C303 .	**Yes** GO to B20 . **No** GO to B16 .

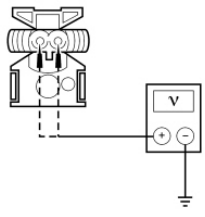
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• Connect a fused jumper wire between passenger adaptive load limiting retractor C303-1, circuit CR147 (GN/OG), harness side and C303-2, circuit RR147 (YE/VT), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 1085_24_OD (Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib) ♦ 1085_25_OD (Seatbelt Load Limiter Front Passenger Open) • **DIAGNOSTIC TIP:** When viewing DTC B1085 on-demand fault PIDs with the passenger adaptive load limiting retractor circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger adaptive load limiting retractor on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
B16 CHECK PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger adaptive load limiting retractor C303. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-38, circuit CR147 (GN/OG), harness side and passenger adaptive load limiting retractor C303-1, circuit CR147 (GN/OG), harness side.	**Yes** GO to B21 . **No** REPAIR circuit RR147 (YE/VT) or RR147 (YE/VT). GO to B26 .

 N0036995 • Measure resistance between RCM C310b-37, circuit RR147 (YE/VT), harness side and passenger adaptive load limiting retractor C303-2, circuit RR147 (YE/VT), harness side.  N0036994 • **Are resistances less than 0.5 ohm?**	
B17 CHECK THE PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs (1085_27_OD) AND (1085_25_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Adaptive Load Limiting Retractor C303 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 1085_27_OD (Seatbelt Load Limiter Front Passenger Short to Ground) ♦ 1085_25_OD (Seatbelt Load Limiter Front Passenger Open)	**Yes** GO to B20 . **No** GO to B18 .

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• **DIAGNOSTIC TIP:** When viewing DTC B1085 on-demand fault PIDs with the passenger adaptive load limiting retractor disconnected, an open circuit fault would normally be retrieved. • **Did the passenger adaptive load limiting retractor on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
B18 CHECK PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between passenger adaptive load limiting retractor: ♦ C303-2, circuit RR147 (YE/VT), harness side and ground. ♦ C303-1, circuit CR147 (GN/OG), harness side and ground.  A0094161 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to B21 . **No** REPAIR circuit RR147 (YE/VT) or CR147 (GN/OG). GO to B26 .
B19 CHECK PASSENGER ADAPTIVE LOAD LIMITING RETRACTOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Adaptive Load Limiting Retractor C303 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger adaptive load limiting retractor: ♦ C303-2, circuit RR147 (YE/VT), harness side and ground.	**Yes** REPAIR circuit RR147 (YE/VT) or CR147 (GN/OG). GO to B26 . **No** GO to B21 .

♦ C303-1, circuit CR147 (GN/OG), harness side and ground.  • **Is voltage present on either circuit?**	
B20 CONFIRM THE ADAPTIVE LOAD LIMITING RETRACTOR FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Affected Adaptive Load Limiting Retractor C323 (Driver) C303 (Passenger) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 1085 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 1085 fault PIDs. • **Does the original RCM on-demand 1085 fault PID indicate a fault?**	**Yes** INSTALL a new driver or passenger adaptive load limiting retractor. REFER to Section 501-20A . GO to B26 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For 1085_28_CM (Seatbelt Load Limiter Driver Circuit Resist Low on Squib), 1085_24_CM (Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib), 1085_29_CM (Seatbelt Load Limiter Driver Open) and 1085_25_CM (Seatbelt Load Limiter Front Passenger Open), GO to B22 . For 1085_31_CM (Seatbelt Load Limiter Driver Short to Ground) and 1085_27_CM (Seatbelt Load Limiter Front Passenger Short to Ground), GO to B24 . For 1085_30_CM (Seatbelt Load Limiter Driver Short to Battery) and 1085_26_CM (Seatbelt Load Limiter Front Passenger Short to Battery), GO to B25 .
B21 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF.	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to B26 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the

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• Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: All Restraint System Components (if previously disconnected) . • Connect: RCM C310a and C310b (if previously disconnected) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 1085 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 1085 fault PIDs. • **Does the original RCM on-demand 1085 fault PID indicate a fault?**	fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For 1085_28_CM (Seatbelt Load Limiter Driver Circuit Resist Low on Squib), 1085_24_CM (Seatbelt Load Limiter Front Passenger Circuit Resist Low on Squib), 1085_29_CM (Seatbelt Load Limiter Driver Open) and 1085_25_CM (Seatbelt Load Limiter Front Passenger Open), GO to B22 . For 1085_31_CM (Seatbelt Load Limiter Driver Short to Ground) and 1085_27_CM (Seatbelt Load Limiter Front Passenger Short to Ground), GO to B24 . For 1085_30_CM (Seatbelt Load Limiter Driver Short to Battery) and 1085_26_CM (Seatbelt Load Limiter Front Passenger Short to Battery), GO to B25 .
B22 CHECK ADAPTIVE LOAD LIMITING RETRACTOR PRETENSIONER RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN	
• If the fault was reported for the driver adaptive load limiting retractor, monitor the D_LOAD (Seatbelt Load Limiter Resistance, Driver Side) resistance PID. • If the fault was reported for the passenger adaptive load limiting retractor, monitor the P_LOAD (Seatbelt Load Limiter Resistance, Passenger Side) pretensioner resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness. • **Does any adaptive load limiting retractor resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B26 . **No** GO to B23 .
B23 CHECK THE HARNESS AND CONNECTORS	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the affected adaptive load limiting retractor C323 (driver) or C303 (passenger): ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. • **Were any concerns found?**	**Yes** REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B26 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to B26 .
B24 CHECK ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • If the fault was reported for the driver adaptive load limiting retractor, monitor the 1085_31_OD (Seatbelt Load Limiter Driver Short to Ground) on-demand fault PID on the scan tool. • If the fault was reported for the passenger adaptive load limiting retractor, monitor the 1085_27_OD (Seatbelt Load Limiter Front Passenger Short to Ground) on-demand fault PID on the scan tool. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any adaptive load limiting retractor on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B26 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to B26 .
B25 CHECK ADAPTIVE LOAD LIMITING RETRACTOR FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the side air bag module electrical connector C3049 (driver) or C3050 (passenger) on the side with the affected pretensioner. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • If the fault was reported for the driver adaptive load limiting retractor , monitor the 1085_30_OD (Seatbelt Load Limiter Driver Short to Battery) on-demand fault PID. • If the fault was reported for the passenger adaptive load limiting retractor, monitor the 1085_26_OD (Seatbelt Load Limiter Front Passenger Short to Battery) on-demand fault PID. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness. • **Does the adaptive load limiting retractor short to battery on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to B26 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to B26 .
B26 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test C: DTC B1118

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) checks the passenger front crash sensor for faults. If the RCM detects a fault on any of the passenger front crash sensor circuits, it will store DTC B1118 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1118 (Passenger Front Crash Sensor Mount/Communication Fault) - When the RCM is unable to communicate with the passenger front crash sensor, a fault will be indicated.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Impact severity sensor
- Incorrect sensor mounting
- RCM

PINPOINT TEST C: DTC B1118

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

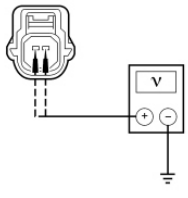
Test Step	Result / Action to Take
C1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B1118 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to C2 . **No** This is an intermittent fault when present as a

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	CMDTC only. The fault condition is not present at this time. GO to C12 .
C2 INSPECT THE PASSENGER FRONT CRASH SENSOR MOUNTING AND MOUNTING SURFACE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Inspect the passenger front crash sensor mounting and make sure that the retaining bolt is fully seated and tightened correctly. • Remove the passenger front crash sensor. Refer to Front Impact Severity Sensor in this section. • Inspect the passenger front crash sensor and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, the passenger front crash sensor attached to the mounting surface incorrectly or was the passenger front crash sensor bolt not fully seated and tightened correctly?**	**Yes** CLEAN and TIGHTEN bolt or REPAIR the mounting surface as necessary. REINSTALL the passenger front crash sensor. GO to C13 . **No** GO to C3 .
C3 INSTALL THE PASSENGER FRONT CRASH SENSOR AND CARRY OUT THE SELF TEST	
• Clean the passenger front crash sensor mounting bolt and mounting surface as necessary. • Install the passenger front crash sensor. Refer to Front Impact Severity Sensor in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B1118 retrieved on-demand during self-test?**	**Yes** GO to C4 . **No** Fault corrected. GO to C13 .
C4 CHECK THE PASSENGER FRONT CRASH SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Front Crash Sensor C1466 .	**Yes** GO to C6 . **No** GO to C5 .

• Measure resistance between passenger front crash sensor C1466-2, circuit RR130 (GN/BU), harness side and the passenger front crash sensor case ground. • **Is resistance less than 10 ohms?**	
C5 CLEAN THE PASSENGER FRONT CRASH SENSOR MOUNTING SURFACE AND CARRY OUT THE SELF TEST	
• Remove the passenger front crash sensor. Refer to Front Impact Severity Sensor in this section. • Clean and repair the mounting surface as necessary. • Clean the passenger front crash sensor mounting bolt. • Install the passenger front crash sensor. Refer to Front Impact Severity Sensor in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B1118 retrieved on-demand during self-test?**	**Yes** GO to C6 . **No** Fault corrected. GO to C13 .
C6 CHECK PASSENGER FRONT CRASH SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Front Crash Sensor C1466 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger front crash sensor: ♦ C1466-1, circuit VR214 (WH/BU), harness side and ground. ♦ C1466-2, circuit RR130 (GN/BU), harness side and ground.	**Yes** REPAIR circuit VR214 (WH/BU) or RR130 (GN/BU). GO to C13 . **No** GO to C7 .

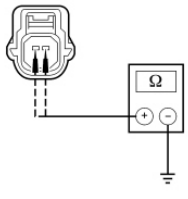
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- **Is voltage present on either circuit?**

C7 CHECK PASSENGER FRONT CRASH SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
- Measure resistance between passenger front crash sensor:
  - C1466-1, circuit VR214 (WH/BU), harness side and ground.
  - C1466-2, circuit RR130 (GN/BU), harness side and ground.



- **Are resistances greater than 10,000 ohms?**

Yes
GO to C8 .

No
REPAIR circuit VR214 (WH/BU) or RR130 (GN/BU). GO to C13 .

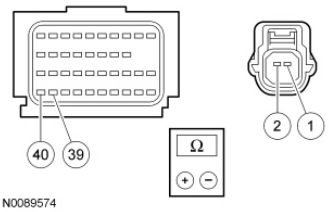
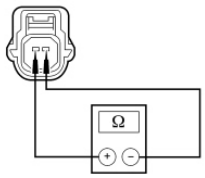
C8 CHECK PASSENGER FRONT CRASH SENSOR CIRCUITS FOR AN OPEN

- Measure resistance between RCM C310b, harness side and passenger front crash sensor C1466, harness side using the following chart.

RCM	Circuit	Passenger Front Crash Sensor
C310b-39	VR214 (WH/BU)	C1466-1
C310b-40	RR130 (GN/BU)	C1466-2

Yes
GO to C9 .

No
REPAIR circuit VR214 (WH/BU) or RR130 (GN/BU). GO to C13 .

 N0089574 • **Is resistance less than 0.5 ohm?**	
C9 CHECK FOR A SHORT BETWEEN PASSENGER FRONT CRASH SENSOR CIRCUITS	
• Measure resistance between passenger front crash sensor C1466-1, circuit VR214 (WH/BU), harness side and C1466-2, circuit RR130 (GN/BU), harness side.  N0036987 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to C10 . **No** REPAIR circuits VR214 (WH/BU) and RR130 (GN/BU). GO to C13 .
C10 CHECK THE PASSENGER FRONT CRASH SENSOR	
• Connect: RCM C310a and C310b . • Install a known good passenger front crash sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was on-demand DTC B1118 retrieved on-demand during self-test?**	**Yes** GO to C11 . **No** Fault corrected. GO to C13 .
C11 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to C13 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard

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• Install the original passenger front crash sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B1118 retrieved on-demand during self-test?**	fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to C13 .
C12 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was on-demand DTC B1118 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. The fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to C2 . **No** INSPECT the impact sensor mounting surface for damage, corrosion or dirt. INSPECT the wiring, terminals and connectors for damage, corrosion or dirt. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to C13 .
C13 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test D: DTC B1884

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

When the ignition is in the ON position, the Passenger Air Bag Deactivation (PAD) indicator prove-out period is initiated by the Restraints Control Module (RCM). The RCM briefly activates the PAD indicator to verify to the occupants correct functional operation of the PAD indicator. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

If the RCM detects an open or short to ground on the PAD indicator circuit, it will store DTC B1884 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1884 (PAD Warning Lamp Circuit Failure) - If the RCM detects an open circuit or short to ground on the PAD indicator circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Passenger Air Bag Deactivation (PAD) indicator
- RCM

PINPOINT TEST D: DTC B1884

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

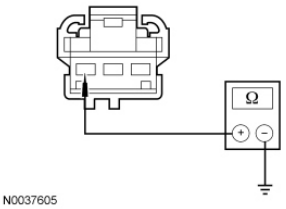
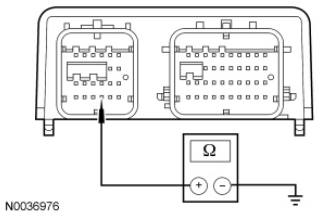
Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

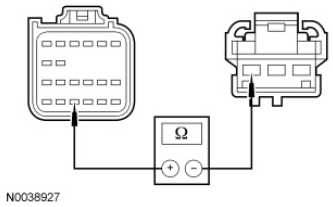
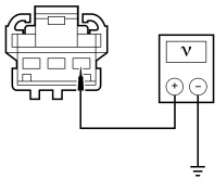
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

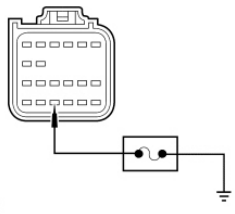
Test Step	Result / Action to Take
D1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM .	**Yes** If the PAD indicator **does** illuminate, GO to D2 . If the PAD indicator **does not** illuminate, GO to D4 .

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• **Was DTC B1884 retrieved on-demand during self-test?**	**No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to D8 .
D2 CHECK CIRCUIT CR116 (GN/WH) FOR SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: PAD Indicator C2286 . • Measure resistance between PAD indicator C2286-3, circuit CR116 (GN/WH), harness side and ground.  N0037605 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to D7 . **No** GO to D3 .
D3 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 22, component side and ground.  N0036976 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit CR116 (GN/WH). GO to D9 . **No** GO to D7 .
D4 CHECK PAD INDICATOR CIRCUIT FOR AN OPEN	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Disconnect: PAD Indicator C2286 . • Measure resistance between PAD indicator C2286-3, circuit CR116 (GN/WH), harness side and RCM C310a-22, circuit CR116 (GN/WH), harness side.  N0038927 • **Is resistance less than 0.5 ohm?**	**Yes** GO to D5 . **No** REPAIR circuit CR116 (GN/WH). GO to D9 .
D5 CHECK PAD IGNITION CIRCUIT FOR VOLTAGE	
• Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between PAD indicator C2286-1, circuit CBP17 (BN/GN), harness side and ground.  N0005022 • **Is voltage greater than 10 volts?**	**Yes** GO to D6 . **No** REPAIR circuit CBP17 (BN/GN). GO to D9 .
D6 CHECK THE PAD INDICATOR	
• Ignition OFF. • Deactivate the SRS . Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section.	**Yes** GO to D7 . **No** INSTALL a new PAD indicator. REFER to Passenger Air Bag Deactivation (PAD) Indicator in this section. GO to

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• Connect: PAD Indicator C2286 . • Ignition ON. • Connect a fused jumper wire between RCM C310a-22, circuit CR116 (GN/WH), harness side and ground.  N0036974 • **Does the PAD indicator illuminate?**	D9 .
D7 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: PAD Indicator C2286 (if disconnected in prior step) . • Connect: RCM C310a and C310b (if disconnected in prior step) . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was on-demand DTC B1884 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to D9 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to D9 .
D8 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B1884 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to D2 . **No**

	The fault is not present and cannot be recreated at this time. CHECK for causes of intermittent open or short to ground on circuit CR116 (GN/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to D9 .
D9 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If previously directed to deactivate the SRS , reactivate the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Deactivation and Reactivation in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test E: DTC B1890

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

When the ignition is in the ON position, the Passenger Air Bag Deactivation (PAD) indicator prove-out period is initiated by the Restraints Control Module (RCM). The RCM briefly activates the PAD indicator to verify to the occupants correct functional operation of the PAD indicator. Refer to Air Bag and Safety Belt

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Pretensioner Supplemental Restraint System (SRS) in this section.

During the PAD prove-out period, if the RCM detects a short to battery on the PAD indicator circuit, it will store DTC B1890 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1890 (PAD Warning Lamp Circuit Short to Battery) - If the RCM detects a short to battery on the PAD indicator circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- PAD indicator
- RCM

PINPOINT TEST E: DTC B1890

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

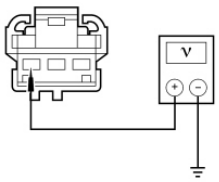
NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

Test Step	Result / Action to Take
E1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B1890 retrieved on-demand during self-test?**	**Yes** GO to E2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to E4 .
E2 CHECK PAD INDICATOR CIRCUIT FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: PAD Indicator C2286 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between PAD indicator C2286-3, circuit CR116 (GN/WH), harness side and ground.  N0005019 • **Is any voltage present?**	**Yes** REPAIR circuit CR116 (GN/WH). GO to E5 . **No** GO to E3 .
E3 CHECK THE RCM	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **NOTE:** DTC B1884 should be retrieved when carrying out the on-demand self test due to an open on circuit CR116 (GN/WH). DTC B1890 should not be retrieved at this time. • **Was DTC B1890 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to E5 . **No** INSTALL a new PAD indicator. GO to E5 .
E4 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was on-demand DTC B1890 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to E2 .

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	No The fault is not present and cannot be recreated at this time. CHECK for causes of intermittent short to battery on circuit CR116 (GN/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to E5 .
E5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test F: DTC B2290

NOTE: DTC B2290 reported by the Restraints Control Module (RCM) is informational only and indicates the presence of a fault in the Occupant Classification System Module (OCSM). Refer to the DTC Charts when DTC B2290 is reported by the RCM for diagnostic instructions.

NOTE: The following pinpoint test must only be used to diagnose DTC B2290 when reported by the OCSM .

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Occupant Classification System (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The OCSM monitors the 2 OCS rails (weight sensors) and circuity for faults. If the OCSM detects a fault with the sensor(s) or circuitry, it will store DTC B2290 in memory and send a message to the RCM which sends a message to the Instrument Cluster (IC) module to illuminate the air bag indicator.

Fault PIDs [a]	Description	Fault Trigger Condition
2290_8_OD and 2290_8_CM	Passenger Seat Occupant Classification System (OCS) Sensor No.2 Circuit Short to Battery	When the Occupant Classification System Module (OCSM) senses a short to voltage on either one of sensor 2 circuits, a fault will be indicated.
2290_9_OD and 2290_9_CM	Passenger Seat OCS Sensor No.2 Circuit Short to Ground	When the OCSM senses a short to ground on either one of sensor 1 circuits, a fault will be indicated.
2290_10_OD and 2290_10_CM	Passenger Seat OCS Sensor No.2 Comm. Fault / Open	When the OCSM is unable to communicate with sensor 2 or senses an open circuit, a fault will be indicated.
2290_11_OD and 2290_11_CM	Passenger Seat OCS Sensor No.2 Internal Fault	When the OCSM senses a internal failure with sensor 2, a fault will be indicated.
2290_12_OD and 2290_12_CM	Passenger Seat OCS Sensor No.1 Circuit Short to Battery	When the OCSM senses a short to voltage on either one of sensor 2 circuits, a fault will be indicated.
2290_13_OD and 2290_13_CM	Passenger Seat OCS Sensor No.1 Circuit Short to Ground	When the OCSM senses a short to ground on either one of sensor 2 circuits, a fault will be indicated.
2290_14_OD and 2290_14_CM	Passenger Seat OCS Sensor No.1 Comm. Fault/Open	When the OCSM is unable to communicate with sensor 1 or senses an open circuit, a fault will be indicated.
2290_15_OD and 2290_15_CM	Passenger Seat OCS Sensor No.1 Internal Fault	When the OCSM is unable to communicate with sensor 1 or senses an open circuit, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2290. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2290.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- OCS system component

PINPOINT TEST F: DTC B2290

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load

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limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

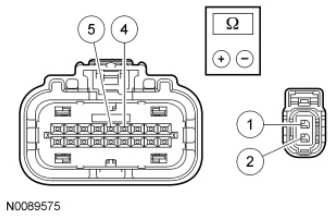
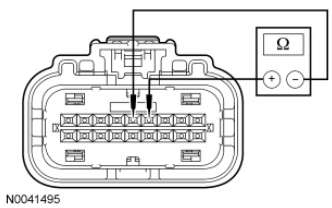
NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

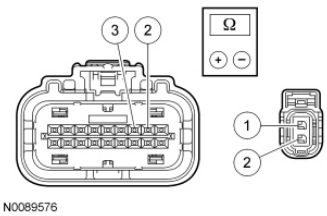
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

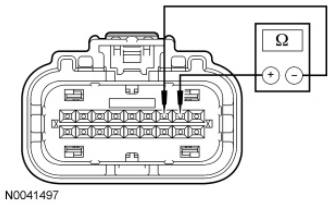
NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

Test Step	Result / Action to Take
F1 RETRIEVE OCSM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • Enter the following diagnostic mode on the scan tool: DataLogger - OCSM - View and Record All 2290 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2290 fault PIDs. • **Do any OCSM on-demand 2290 fault PIDs indicate a fault?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to F2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to F14 .
F2 CHECK THE SEAT WIRING AND CONNECTORS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Carry out a thorough visual inspection of the OCS system wiring, terminals and connectors and the related seat wiring harness and body wiring harness terminals and connectors. • **Were any problems noted?**	**Yes** REPAIR the seat connectors and wiring as needed. GO to F15 . **No** Using the fault PIDs recorded in Step F1, GO to the appropriate pinpoint test step. For 2290_15_OD (Passenger Seat OCS Sensor No.1 Internal Fault) (inboard) or 2290_11_OD (Passenger Seat OCS Sensor No.2 Internal Fault) (outboard), INSTALL a new OCS rail. REFER to Occupant Classification Sensor in this section. For 2290_14_OD (Passenger Seat OCS Sensor No.1 Comm. Fault/Open) (inboard), GO to F3 . For 2290_10_OD (Passenger Seat OCS Sensor No.2 Comm. Fault / Open) (outboard), GO to F6 . For 2290_13_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Ground) (inboard), GO to F9 . For 2290_9_OD (Passenger Seat OCS Sensor No.2

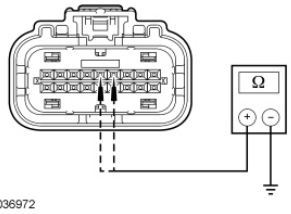
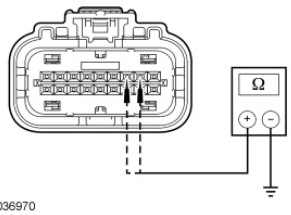
	Circuit Short to Ground) (outboard), GO to F10 . For 2290_12_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Battery) (inboard), GO to F11 . For 2290_8_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Battery) (outboard), GO to F12 .
F3 CHECK OCS RAIL 1 CIRCUITS FOR AN OPEN	
• Disconnect: OCSM C3159 . • Disconnect: OCS Rail 1 C3291 . • Measure resistance between OCSM C3285, harness side and OCS rail 1, harness side using the following chart. **OCSM / Circuit / OCS Rail 1** C3159-4 / VR211 (WH/BN) / C3291-2 C3159-5 / RR140 (GN/OG) / C3291-1  N0089575 • **Are resistances less than 0.5 ohm?**	**Yes** GO to F4 . **No** REPAIR circuit VR211 (WH/BN) or RR140 (GN/OG). GO to F15 .
F4 CHECK FOR A SHORT BETWEEN OCS RAIL 1 CIRCUITS	
• Measure resistance between OCSM C3159-4, circuit VR211 (WH/BN), harness side and OCSM C3159-5, circuit RR140 (GN/OG), harness side.  N0041495 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to F5 . **No** REPAIR circuits VR211 (WH/BN) and RR140 (GN/OG). GO to F15 .
F5 CHECK THE OCSM	

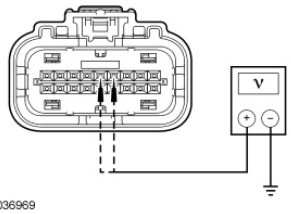
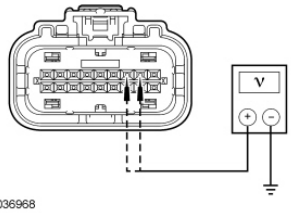
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• Install a known good OCS rail. Refer to Occupant Classification Sensor in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Carry out the OCS System Reset procedure. Refer to Occupant Classification Sensor (OCS) System Reset in this section. • Ignition OFF. • **NOTE:** The ignition switch must be cycled after Zero Seat Weight Test and/or the System Reset procedure. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • Enter the following diagnostic mode on the scan tool: DataLogger - OCSM - View and Record All 2290 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2290 fault PIDs. • **Do any OCSM on-demand 2290 fault PIDs indicate a fault?**	**Yes** INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section. GO to F15 . **No** Fault corrected. GO to F15 .
F6 CHECK OCS RAIL 2 CIRCUITS FOR AN OPEN	
• Disconnect: OCSM C3159 . • Disconnect: OCS Rail 2 C3292 . • Measure resistance between OCSM C3285, harness side and OCS rail 2 C3292, harness side using the following chart. **OCSM / Circuit / OCS Rail 2** C3159-2 / VR212 (YE/GN) / C3292-2 C3159-3 / RR141 (VT/BN) / C3292-1  N0089576 • **Are resistances less than 0.5 ohm?**	**Yes** GO to F7 . **No** REPAIR circuit VR212 (YE/GN) or RR141 (VT/BN). GO to F15 .

F7 CHECK FOR A SHORT BETWEEN OCS RAIL 2 CIRCUITS	
• Measure resistance between OCSM C3159-2, circuit VR212 (YE/GN), harness side and OCSM C3159-3, circuit RR141 (VT/BN), harness side.  • **Is resistance greater than 10,000 ohms?**	**Yes** GO to F8 . **No** REPAIR circuits VR212 (YE/GN) and RR141 (VT/BN). GO to F15 .
F8 CHECK THE OCSM	
• Install a known good OCS rail. Refer to Occupant Classification Sensor in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Carry out the OCS System Reset procedure. Refer to Occupant Classification Sensor (OCS) System Reset in this section. • Ignition OFF. • **NOTE:** The ignition switch must be cycled after Zero Seat Weight Test and/or the System Reset procedure. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • Enter the following diagnostic mode on the scan tool: DataLogger - OCSM - View and Record All 2290 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2290 fault PIDs. • **Do any OCSM on-demand 2290 fault PIDs indicate a fault?**	**Yes** INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section. GO to F15 . **No** Fault corrected. GO to F15 .
F9 CHECK OCS RAIL 1 CIRCUITS FOR A SHORT TO GROUND	

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• Disconnect: OCSM C3159 . • Measure resistance between: ♦ OCSM C3159-4, circuit VR211 (WH/BN), harness side and ground. ♦ OCSM C3159-5, circuit RR140 (GN/OG), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to F13 . **No** REPAIR circuit VR211 (WH/BN) or RR140 (GN/OG). GO to F15 .
F10 CHECK OCS RAIL 2 CIRCUITS FOR A SHORT TO GROUND	
• Disconnect: OCSM C3159 . • Measure resistance between: ♦ OCSM C3159-2, circuit VR212 (YE/GN), harness side and ground. ♦ OCSM C3159-3, circuit RR141 (VT/BN), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to F13 . **No** REPAIR circuit VR212 (YE/GN) or RR141 (VT/BN). GO to F15 .
F11 CHECK OCS RAIL 1 CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: Passenger Seat Side Air Bag Module C3050 . • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Disconnect: OCSM C3159 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON.	**Yes** REPAIR circuit VR211 (WH/BN) or RR140 (GN/OG). GO to F15 . **No** GO to F13 .

• Measure voltage between OCSM : ♦ C3159-4, circuit VR211 (WH/BN), harness side and ground. ♦ C3159-5, circuit RR140 (GN/OG), harness side and ground.  N0036969 • **Is voltage present on either circuit?**	
F12 CHECK OCS RAIL 2 CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: Passenger Seat Side Air Bag Module C3050 . • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Disconnect: OCSM C3159 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between OCSM : ♦ C3159-2, circuit VR212 (YE/GN), harness side and ground. ♦ C3159-3, circuit RR141 (VT/BN), harness side and ground.  N0036968 • **Is voltage present on either circuit?**	**Yes** REPAIR circuit VR212 (YE/GN) or RR141 (VT/BN). GO to F15 . **No** GO to F13 .
F13 CHECK THE OCS SYSTEM	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be	**Yes** INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section. GO to F15 . **No**

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recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Install a new OCS rail. Refer to Occupant Classification Sensor in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Carry out the OCS System Reset procedure. Refer to Occupant Classification Sensor (OCS) System Reset in this section. • Ignition OFF. • **NOTE:** The ignition switch must be cycled after Zero Seat Weight Test and/or the System Reset procedure. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • Enter the following diagnostic mode on the scan tool: DataLogger - OCSM - View and Record All 2290 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2290 fault PIDs. • **Do any OCSM on-demand 2290 fault PIDs indicate a fault?**	Fault corrected. GO to F15 .
F14 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat Side Air Bag Module C3050 . • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • Enter the following diagnostic mode on the scan tool: DataLogger - OCSM - View and Record All 2290 Fault PIDs .	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. CHECK for causes of the intermittent fault at or near the affected SRS component connector. REPAIR any intermittent concerns found. If an intermittent concern **was** found and repaired, GO to F15 . If an intermittent concern **was not** found and repaired, USE the fault PIDs recorded and GO to the appropriate pinpoint test step. For 2290_15_OD (Passenger Seat OCS Sensor No.1 Internal Fault) (inboard) or 2290_11_OD (Passenger Seat OCS Sensor No.2 Internal Fault) (outboard), INSTALL a new OCS rail. REFER to Occupant

♦ Refer to PID list in Normal Operation to view 2290 fault PIDs. • **Do any OCSM on-demand 2290 fault PIDs indicate a fault?**	Classification Sensor in this section. For 2290_14_OD (Passenger Seat OCS Sensor No.1 Comm. Fault/Open) (inboard), GO to F3 . For 2290_10_OD (Passenger Seat OCS Sensor No.2 Comm. Fault / Open) (outboard), GO to F6 . For 2290_13_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Ground) (inboard), GO to F9 . For 2290_9_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Ground) (outboard), GO to F10 . For 2290_12_OD (Passenger Seat OCS Sensor No.1 Circuit Short to Battery) (inboard), GO to F11 . For 2290_8_OD (Passenger Seat OCS Sensor No.2 Circuit Short to Battery) (outboard), GO to F12 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to F15 .
F15 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

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Pinpoint Test G: DTC B2292

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) continuously monitors the safety belt buckle pretensioner circuits for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2292 in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors safety belt buckle pretensioner circuits for resistance, it expects a normal resistance between 1.31 and 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs [a]	Description	Fault Trigger Condition
2292_24_OD and 2292_24_CM	Pretensioner Circuit Short to Ground, Front Passenger Side	When the Restraints Control Module (RCM) senses a short to ground on either of the passenger pretensioner circuits, a fault will be indicated.
2292_25_OD and 2292_25_CM	Pretensioner Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger pretensioner circuits, a fault will be indicated.
2292_26_OD and 2292_26_CM	Pretensioner Circuit Open, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger pretensioner circuits, a fault will be indicated.
2292_27_OD and 2292_27_CM	Pretensioner Circuit Resistance Low, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger pretensioner circuits, a fault will be indicated.
2292_28_OD and 2292_28_CM	Pretensioner Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on either of the driver pretensioner circuits, a fault will be indicated.
2292_29_OD and 2292_29_CM	Pretensioner Circuit Short to Battery, Front Driver Side	When the RCM senses a short to voltage on either of the driver pretensioner circuits, a fault will be indicated.
2292_30_OD and 2292_30_CM	Pretensioner Circuit Open, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver pretensioner circuits, a fault will be indicated.
2292_31_OD and 2292_31_CM	Pretensioner Circuit Resistance Low, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver pretensioner circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2292. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous memory DTC B2292.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Safety belt buckle pretensioner
- RCM

PINPOINT TEST G: DTC B2292

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental Restraint System (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

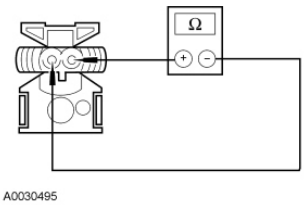
Test Step	Result / Action to Take
G1 RETRIEVE RCM DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2292 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2292 fault PIDs. • **Do any RCM on-demand 2292 fault PIDs indicate a fault?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side), GO to G2 . For 2292_30_OD (Pretensioner Circuit Open, Front Driver Side), GO to G2 . For 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side), GO to G8 . For 2292_29_OD (Pretensioner Circuit Short to Battery, Front Driver Side), GO to G10 . For 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side), GO to G11 .

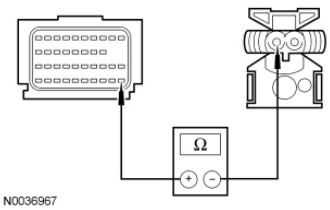
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	For 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side), GO to G11 . For 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side), GO to G17 . For 2292_25_OD (Pretensioner Circuit Short to Battery, Front Passenger Side), GO to G19 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side) and 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), GO to G22 . For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) and 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), GO to G24 . For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) and 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), GO to G25 .
G2 CHECK THE DRIVER SAFETY BELT PRETENSIONER RESISTANCE PID (DR_PTENS)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: DR_PTENS (Pretensioner Circuit Resistance, Driver side) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to G23 . **No** GO to G3 .
G3 CHECK THE DRIVER SAFETY BELT BUCKLE PRETENSIONER RESISTANCE PID (DR_PTENS) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the DR_PTENS (Pretensioner Circuit Resistance, Driver	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed.

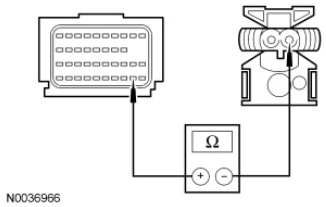
side) resistance PID while carrying out a harness test of the driver safety belt buckle pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out a harness test?**	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to G26 . **No** If the driver safety belt buckle pretensioner resistance PID is less than 1.31 ohms, GO to G4 . If the driver safety belt buckle pretensioner resistance PID is greater than 4.29 ohms, GO to G6 .
G4 CHECK DRIVER SAFETY BELT BUCKLE PRETENSIONER FAULT PIDs (2292_31_OD) AND (2292_30_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2292_30_OD (Pretensioner Circuit Open, Front Driver Side) ♦ 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety belt buckle pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to G22 . **No** GO to G5 .

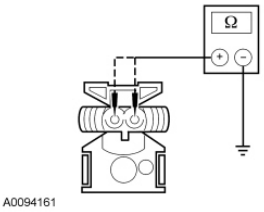
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G5 CHECK FOR A SHORT BETWEEN DRIVER SAFETY BELT BUCKLE PRETENSIONER CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver safety belt buckle pretensioner C3201-1, circuit CR120 (BU/OG), harness side and C3201-2, circuit RR120 (BN/GN)/(GN/RD), harness side.  A0030495 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to G23 . **No** REPAIR circuits CR120 (BU/OG) and RR120 (BN/GN)/(GN/RD). GO to G26 .
G6 CHECK THE DRIVER SAFETY BELT BUCKLE PRETENSIONER FAULT PIDs (2292_30_OD) AND (2292_31_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201 . • Connect a fused jumper wire between driver safety belt pretensioner C3201-1, circuit CR120 (BU/OG), harness side and C3201-2, circuit RR120 (BN/GN)/(GN/RD), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON.	**Yes** GO to G22 . **No** GO to G7 .

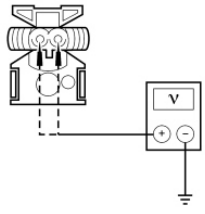
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2292_30_OD (Pretensioner Circuit Open, Front Driver Side) ♦ 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner circuits shorted together, a low resistance fault would normally be retrieved. • **Did the driver safety belt buckle pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
G7 CHECK DRIVER SAFETY BELT PRETENSIONER CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the driver safety belt buckle pretensioner C3201. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-31, circuit CR120 (BU/OG), harness side and driver safety belt buckle pretensioner C3201-1, circuit CR120 (BU/OG), harness side.  • Measure resistance between RCM C310b-32, circuit RR120 (BN/GN), harness side and driver safety belt buckle pretensioner C3201-2, circuit RR120 (BN/GN)/(GN/RD), harness side.	**Yes** 21GO to G8 . **No** REPAIR circuit CR120 (BU/OG) or RR120 (BN/GN)/(GN/RD). GO to G26 .

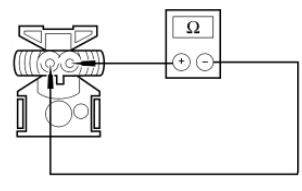
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 • **Is resistance less than 0.5 ohm?**	
G8 CHECK THE DRIVER SAFETY BELT BUCKLE PRETENSIONER FAULT PIDs (2292_28_OD) AND (2292_30_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Pretensioner C3201 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side) ♦ 2292_30_OD (Pretensioner Circuit Open, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety belt buckle pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to G22 . **No** GO to G9 .
G9 CHECK DRIVER SAFETY BELT PRETENSIONER CIRCUITS FOR A SHORT TO GROUND	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver safety belt buckle pretensioner: ♦ C3201-1, circuit CR120 (BU/OG), harness side and ground. ♦ C3201-2, circuit RR120 (BN/GN)/(GN/RD), harness side and ground.  A0094161 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to G23 . **No** REPAIR circuit CR120 (BU/OG) or RR120 (BN/GN)/(GN/RD). GO to G26 .
G10 CHECK DRIVER SAFETY BELT PRETENSIONER CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3049 . • Disconnect: Driver Safety Belt Buckle Pretensioner C3201 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between driver safety belt buckle pretensioner: ♦ C3201-1, circuit CR120 (BU/OG), harness side and ground. ♦ C3201-2, circuit RR120 (BN/GN)/(GN/RD), harness side and ground.	**Yes** REPAIR circuit CR120 (BU/OG) or RR120 (BN/GN)/(GN/RD). GO to G26 . **No** GO to G23 .

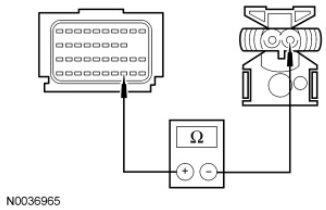
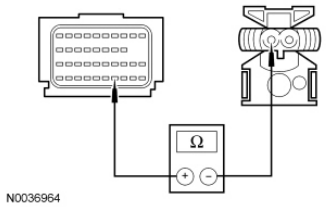
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 • **Is voltage present on either circuit?**	
G11 CHECK THE PASSENGER SAFETY BELT PRETENSIONER RESISTANCE PID (PS_PTENS)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: PS_PTENS (Passenger Retractor Circuit Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to G23 . **No** GO to G12 .
G12 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER RESISTANCE PID (PS_PTENS) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the PS_PTENS (Passenger Retractor Circuit Resistance) resistance PID while carrying out a harness test of the passenger safety belt buckle pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to G26 . **No** If the passenger safety belt buckle pretensioner resistance PID is less than 1.31 ohms, GO to G13 . If the passenger safety belt buckle pretensioner resistance PID is greater than 4.29 ohms, GO to G15 .
G13 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER FAULT PIDs (2292_26_OD) AND (2292_27_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF.	**Yes** GO to G22 . **No** GO to G14 .

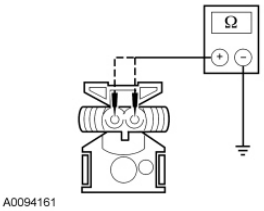
• Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side) ♦ 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
G14 CHECK FOR A SHORT BETWEEN THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between passenger safety belt buckle pretensioner C3202-1, circuit CR122 (WH/OG), harness side and C3202-2, circuit RR122 (BN or TN), harness side.  A0030495 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to G23 . **No** REPAIR circuits CR122 (WH/OG) and RR122 (BN or TN). GO to G26 .

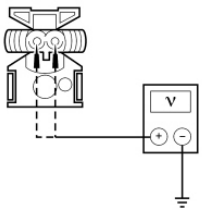
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G15 CHECK THE PASSENGER SAFETY BELT PRETENSIONER FAULT PIDs (2292_26_OD) AND (2292_27_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Connect a fused jumper wire between passenger safety belt pretensioner C3202-1, circuit CR122 (WH/OG), harness side and C3202-2, circuit RR122 (BN or TN), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side) ♦ 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger safety belt buckle pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to G22 . **No** GO to G16 .
G16 CHECK PASSENGER SAFETY BELT PRETENSIONER CIRCUITS FOR AN OPEN	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger safety belt buckle pretensioner C3202. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-33, circuit RR122 (BN or TN), harness side and passenger safety belt buckle pretensioner C3202-2, circuit RR122 (BN or TN), harness side.  • Measure resistance between RCM C310b-34, circuit CR122 (WH/OG), harness side and passenger safety belt buckle pretensioner C3202-1, circuit CR122 (WH/OG), harness side.  • **Are resistances less than 0.5 ohm?**	**Yes** GO to G21 . **No** REPAIR circuit RR122 (BN or TN) or CR122 (WH/OG). GO to G26 .
G17 CHECK THE PASSENGER SAFETY BELT BUCKLE PRETENSIONER FAULT PIDs (2292_24_OD) AND (2292_26_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to G20 . **No** GO to G18 .

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• Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side) ♦ 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
G18 CHECK PASSENGER SAFETY BELT BUCKLE PRETENSIONER CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between passenger safety belt buckle pretensioner: ♦ C3202-2, circuit RR122 (BN or TN), harness side and ground. ♦ C3202-1, circuit CR122 (WH/OG), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to G21 . **No** REPAIR circuit RR122 (BN or TN) or CR122 (WH/OG). GO to G26 .
G19 CHECK PASSENGER SAFETY BELT BUCKLE PRETENSIONER CIRCUITS FOR A	

SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3050 . • Disconnect: Passenger Safety Belt Buckle Pretensioner C3202 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger safety belt buckle pretensioner: ♦ C3202-2, circuit RR122 (BN or TN), harness side and ground. ♦ C3202-1, circuit CR122 (WH/OG), harness side and ground.  N0037005 • **Is voltage present on either circuit?**	**Yes** REPAIR circuit RR122 (BN or TN) or CR122 (WH/OG). GO to G26 . **No** GO to G21 .
G20 CONFIRM THE SAFETY BELT BUCKLE PRETENSIONER FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Affected Safety Belt Buckle Pretensioner C3201 (Driver) C3202 (Passenger) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON.	**Yes** INSTALL a new driver or passenger safety belt buckle pretensioner. REFER to Section 501-20A . GO to G26 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side) and 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side),

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• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2292 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2292 fault PIDs. • **Does the original RCM on-demand 2292 fault PID indicate a fault?**	GO to G22 . For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) and 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), GO to G24 . For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) and 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), GO to G25 .
G21 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: All Restraint System Components (if previously disconnected) . • Connect: RCM C310a and C310b (if previously disconnected) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2292 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2292 fault PIDs. • **Does the original RCM on-demand 2292 fault PID indicate a fault?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) . GO to G26 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side) and 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), GO to G22 . For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) and 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), GO to G24 . For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) and 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), GO to G25 .
G22 CHECK SAFETY BELT BUCKLE PRETENSIONER RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN	
• If the fault was reported for the driver safety belt buckle pretensioner, monitor the DR_PTENS (Driver Pretensioner Circuit Resistance) resistance PID. • If the fault was reported for the passenger safety belt buckle pretensioner, monitor the	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.

PS_PTENS (Passenger Pretensioner Circuit Resistance) resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness. • **Does any safety belt buckle pretensioner resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**	GO to G26 . **No** GO to G23 .
G23 CHECK THE HARNESS AND CONNECTORS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the affected safety belt buckle pretensioner C3201 (driver) or C3202 (passenger): ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. • **Were any concerns found?**	**Yes** REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to G26 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to G26 .
G24 CHECK SAFETY BELT BUCKLE PRETENSIONER FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • If the fault was reported for the driver safety belt buckle pretensioner, monitor the 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side) on-demand fault PID on the scan tool. • If the fault was reported for the passenger safety belt buckle pretensioner, monitor the 2292_24_OD (Pretensioner Circuit Short to	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to G26 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent

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Ground, Front Passenger Side) on-demand fault PID on the scan tool. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any safety belt buckle pretensioner on-demand fault PID indicate a fault is present?**	fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to G26 .
G25 CHECK SAFETY BELT PRETENSIONER FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the side air bag module electrical connector C3049 (driver) or C3050 (passenger) on the side with the affected pretensioner. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • If the fault was reported for the driver safety belt buckle pretensioner, monitor the 2292_29_OD (Pretensioner Circuit Short to Battery, Front Driver Side) on-demand fault PID. • If the fault was reported for the passenger safety belt buckle pretensioner, monitor the 2292_25_OD (Pretensioner Circuit Short to Battery, Front Passenger Side) on-demand fault PID. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness. • **Does the safety belt buckle pretensioner short to battery on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to G26 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to G26 .
G26 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF.	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for

• **⚠ WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test H: DTC B2293

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) continuously monitors all front air bag module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2293 in memory if any of these conditions are detected. If the RCM detects a fault on any of the front air bag circuits, it will store DTC B2293 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors all front air bag module circuits for resistance, it expects a normal loop resistance between 1.31 to 4.29 ohms.

If any loop (loop 1, loop 2, canister vent and/or adaptive tether) resistance for the driver and/or passenger air bag is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

Fault PIDs [a]	Description	Fault Trigger Condition
2293_0_OD and 2293_0_CM	Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib	When the Restraints Control Module (RCM) measures resistance less than 0.9 ohm between the passenger adaptive tether loop circuits, a fault will be indicated.
2293_1_OD and 2293_1_CM	Air bag Passenger Front Adaptive Tether Open	When the RCM measures resistance greater than 5 ohms between the passenger adaptive tether loop circuits, a fault will be indicated.
2293_2_OD and 2293_2_CM	Air bag Passenger Front Adaptive Tether Short to Battery	When the RCM senses a short to voltage on either of the passenger adaptive tether loop circuits, a fault will be indicated.

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2293_3_OD and 2293_3_CM	Air bag Passenger Front Adaptive Tether Short to Ground	When the RCM senses a short to ground on either of the passenger adaptive tether loop circuits, a fault will be indicated.
2293_8_OD and 2293_8_CM	Air bag Passenger Front Can Vent Circuit Resist. Low on Squib	When the RCM measures resistance less than 0.9 ohm between the passenger air bag can vent loop circuits, a fault will be indicated.
2293_9_OD and 2293_9_CM	Air bag Passenger Front Can Vent Open	When the RCM measures resistance greater than 5 ohms between on the passenger air bag can vent loop circuits, a fault will be indicated.
2293_10_OD and 2293_10_CM	Air bag Passenger Front Can Vent Short to Battery	When the RCM senses a short to voltage on either of the passenger air bag can vent loop circuits, a fault will be indicated.
2293_11_OD and 2293_11_CM	Air bag Passenger Front Can Vent Short to Ground	When the RCM senses a short to ground on either of the passenger air bag can vent loop circuits, a fault will be indicated.
2293_12_OD and 2293_12_CM	Air bag Driver Front Can Vent Circuit Resist. Low on Squib	When the RCM measures resistance less than 0.9 ohm between the driver air bag can vent loop circuits, a fault will be indicated.
2293_13_OD and 2293_13_CM	Air bag Driver Front Can Vent Open	When the RCM measures resistance greater than 5 ohms between the driver air bag can vent loop circuits, a fault will be indicated.
2293_14_OD and 2293_14_CM	Air bag Driver Front Can Vent Short to Battery	When the RCM senses a short to voltage on either of the driver air bag can vent loop circuits, a fault will be indicated.
2293_15_OD and 2293_15_CM	Air bag Driver Front Can Vent Short to Ground	When the RCM senses a short to ground on either of the driver air bag can vent loop circuits, a fault will be indicated.
2293_16_OD and 2293_16_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger air bag loop circuits, a fault will be indicated.
2293_17_OD and 2293_17_CM	Air Bag Circuit Open - Loop No. 2, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger air bag loop circuits, a fault will be indicated.
2293_18_OD and 2293_18_CM	Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger air bag loop circuits, a fault will be indicated.
2293_19_OD and 2293_19_CM	Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side	When the RCM senses a short to ground on either of the passenger air bag loop circuits, a fault will be indicated.
2293_20_OD and 2293_20_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver air bag loop circuits, a fault will be indicated.
2293_21_OD and 2293_21_CM	Air Bag Circuit Open - Loop No. 2, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver air bag loop circuits, a fault will be indicated.
2293_22_OD and 2293_22_CM	Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side	When the RCM senses a short to voltage on either of the driver air bag loop circuits, a fault will be indicated.
2293_23_OD and 2293_23_CM	Air Bag Circuit Short to Ground - Loop No. 2, Front	When the RCM senses a short to ground on either of the driver air bag loop circuits, a fault will be indicated.

	Driver Side	
2293_24_OD and 2293_24_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger air bag loop circuits, a fault will be indicated.
2293_25_OD and 2293_25_CM	Air Bag Circuit Open - Loop No. 1, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger air bag loop circuits, a fault will be indicated.
2293_26_OD and 2293_26_CM	Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger air bag loop circuits, a fault will be indicated.
2293_27_OD and 2293_27_CM	Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side	When the RCM senses a short to ground on either of the passenger air bag loop circuits, a fault will be indicated.
2293_28_OD and 2293_28_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver air bag loop circuits, a fault will be indicated.
2293_29_OD and 2293_29_CM	Air Bag Circuit Open - Loop No. 1, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver air bag loop circuits, a fault will be indicated.
2293_30_OD and 2293_30_CM	Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side	When the RCM senses a short to voltage on either of the driver air bag loop circuits, a fault will be indicated.
2293_31_OD and 2293_31_CM	Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side	When the RCM senses a short to ground on either of the driver air bag loop circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2293. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2293.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Air bag module
- RCM

PINPOINT TEST H: DTC B2293

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

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NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

Test Step	Result / Action to Take
H1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2293 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2293 fault PIDs. • **Do any RCM on-demand 2293 fault PIDs indicate a fault?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), GO to H2 . For 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side), GO to H2 . For 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), GO to H10 . For 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), GO to H13 . For 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), GO to H15 . For 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side), GO to H15 . For 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), GO to H23 . For 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front

Driver Side), GO to H26 .

For 2293_13_OD (Air bag Driver Front Can Vent Open), GO to H28 .

For 2293_12_OD (Air bag Driver Front Can Vent Circuit Resist. Low on Squib), GO to H28 .

For 2293_15_OD (Air bag Driver Front Can Vent Short to Ground), GO to H36 .

For 2293_14_OD (Air bag Driver Front Can Vent Short to Battery), GO to H39 . For 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), GO to H41 .

For 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), GO to H41 .

For 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), GO to H47 .

For 2293_26_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), GO to H49 .

For 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), GO to H50 .

For 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), GO to H50 .

For 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), GO to H56 .

For 2293_18_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), GO to H58 .

For 2293_1_OD (Air bag Passenger Front Adaptive Tether Open), GO to H59 .

For 2293_0_OD (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib), GO to H59 .

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For 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground), GO to H65 .

For 2293_2_OD (Air bag Passenger Front Adaptive Tether Short to Battery), GO to H67 .

For 2293_9_OD (Air bag Passenger Front Can Vent Open), GO to H68 .

For 2293_8_OD (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib), GO to H68 .

For 2293_11_OD (Air bag Passenger Front Can Vent Short to Ground), GO to H74 .

For 2293_10_OD (Air bag Passenger Front Can Vent Short to Battery), GO to H76 .

No
This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time.

Using the fault PIDs recorded, GO to the appropriate pinpoint test step.

For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), GO to H81 .

For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side), GO to H81 .

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), GO to H83 .

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), GO to H85 .

For 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), GO to H81 .

For 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side),

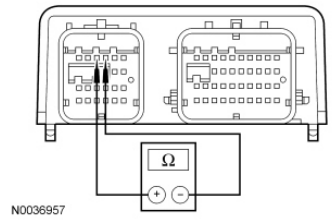
	GO to H81 . For 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), GO to H83 . For 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), GO to H85 . For 2293_13_CM (Air bag Driver Front Can Vent Open), GO to H81 . For 2293_12_CM (Air bag Driver Front Can Vent Circuit Resist. Low on Squib), GO to H81 . For 2293_15_CM (Air bag Driver Front Can Vent Short to Ground), GO to H83 . For 2293_14_CM (Air bag Driver Front Can Vent Short to Battery), GO to H85 . For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), GO to H82 . For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), GO to H82 . For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), GO to H84 . For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), GO to H86 . For 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), GO to H84 . For 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front

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	Passenger Side), GO to H86 . For 2293_1_CM (Air bag Passenger Front Adaptive Tether Open), GO to H82 . For 2293_0_CM (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib), GO to H82 . For 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground), GO to H84 . For 2293_2_CM (Air bag Passenger Front Adaptive Tether Short to Battery), GO to H86 . For 2293_9_CM (Air bag Passenger Front Can Vent Open), GO to H82 . For 2293_8_CM (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib), GO to H82 . For 2293_11_CM (Air bag Passenger Front Can Vent Short to Ground), GO to H84 . For 2293_10_CM (Air bag Passenger Front Can Vent Short to Battery), GO to H86 .
H2 CHECK DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID (D_ABAGR)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: D_ABAGR (Driver Air Bag) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H3 .
H3 CHECK DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID (D_ABAGR) WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, continue monitoring the D_ABAGR (Driver Air Bag) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness, connectors, tilting and rotating the steering	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. REFER to Clockspring in this section. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for

wheel frequently. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	schematic and connector information. GO to H88 . **No** If the driver air bag module loop 1 resistance PID is less than 1.31 ohms, GO to H4 . If the driver air bag module loop 1 resistance PID is greater than 4.29 ohms, GO to H7 .
H4 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_28_OD) AND (2293_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to H77 . **No** GO to H5 .
H5 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_28_OD) AND (2293_29_OD) FOR A CHANGE IN FAULT STATUS (DRIVER AIR BAG REMOVED)	

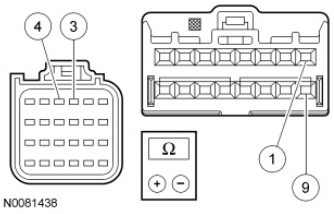
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NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to H79 . **No** GO to H6 .
H6 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 3 and C310a pin 4, component side.  • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR101 (VT/BN) and RR101 (YE/GN). GO to H88 . **No** GO to H80 .

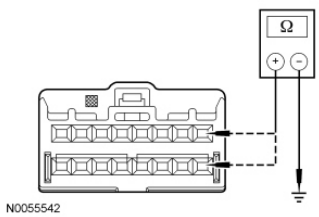
H7 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_29_OD) AND (2293_28_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Connect a fused jumper wire between driver air bag module loop 1 C216a-1, harness side and C216a-2, harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved for loop 1. Loop 2 and canister vent will show an open circuit fault. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**	**Yes** GO to H77 . **No** GO to H8 .
H8 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_29_OD) AND (2293_28_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF.	**Yes** GO to H79 . **No** GO to H9 .

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• Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from driver air bag module loop 1 C216a. • Disconnect: Clockspring C218a . • Connect a fused jumper wire between clockspring C218a-1, circuit CR101 (VT/BN), harness side and clockspring C218a-9, circuit RR101 (YE/GN), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved for loop 1. Loop 2 and canister vent will show an open circuit fault. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**	
H9 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the clockspring C218a. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a, harness side and clockspring C218a, harness side using the following chart. **RCM** / **Circuit** / **Clockspring** C310a-4 / CR101 (VT/BN) / C218a-1 C310a-3 / RR101 (YE/GN) / C218a-9	**Yes** GO to H80 . **No** REPAIR circuit CR101 (VT/BN) or RR101 (YE/GN). GO to H88 .

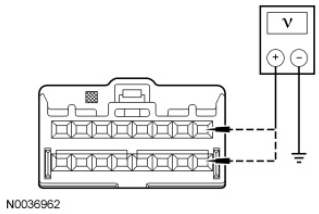
 • **Are resistances less than 0.5 ohm?**	
H10 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_31_OD) AND (2293_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) ♦ 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to H77 . **No** GO to H11 .
H11 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_31_OD) AND (2293_29_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different	**Yes** GO to H79 .

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fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) ♦ 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the clockspring disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**No** GO to H12 .
H12 CHECK DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between clockspring: ♦ C218a-1, circuit CR101 (VT/BN), harness side and ground. ♦ C218a-9, circuit RR101 (YE/GN), harness side and ground.  N0055542 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR101 (VT/BN) or RR101 (YE/GN). GO to H88 .
H13 CHECK THE DRIVER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_30_OD) AND (2293_29_OD) FOR A	

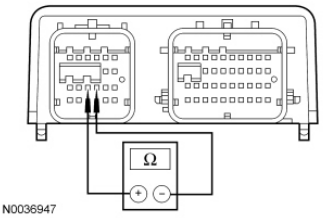
CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side) ♦ 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**	**Yes** GO to H79 . **No** GO to H14 .
H14 CHECK DRIVER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO VOLTAGE (CLOCKSPRING DISCONNECTED)	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between clockspring: ♦ C218a-1, circuit CR101 (VT/BN), harness side and ground.	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR101 (VT/BN) or RR101 (YE/GN). GO to H88 . **No** GO to H80 .

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♦ C218a-9, circuit RR101 (YE/GN), harness side and ground.  • **Is voltage present on either circuit?**	
H15 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID (D_ABAGR2)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: D_ABAGR2 (Driver Air Bag #2 Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H16 .
H16 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID (D_ABAGR2) WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, continue monitoring the D_ABAGR2 (Driver Air Bag #2 Resistance) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors), by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** If the driver air bag module loop 2 resistance PID is less than 1.31 ohms, GO to H17 . If the driver air bag module loop 2 resistance PID is greater than 4.29 ohms, GO to H20 .
H17 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_20_OD) AND (2293_21_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not	**Yes** GO to H77 . **No** GO to H18 .

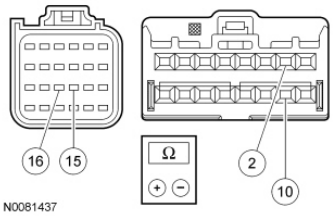
the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side) ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H18 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_20_OD) AND (2293_21_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Disconnect: Clockspring C218a . • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side) ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)	**Yes** GO to H79 . **No** GO to H19 .

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• **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H19 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 15 and C310a pin 16, component side.  • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR102 (BU) and RR102 (WH). GO to H88 . **No** GO to H80 .
H20 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_21_OD) AND (2293_20_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Connect a fused jumper wire between driver air bag module loop 2 C216b-1, harness side and C216b-2, harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM .	**Yes** GO to H77 . **No** GO to H21 .

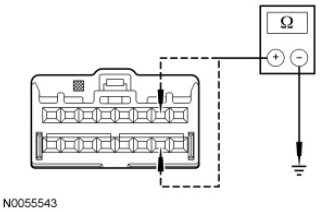
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side) ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved for loop 2. Loop 1 and canister vent will show an open circuit fault. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
H21 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_21_OD) AND (2293_20_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Remove the jumper wire from driver air bag module loop 2 C216b. • Disconnect: Clockspring C218a . • Connect a fused jumper wire between clockspring C218a-2, circuit CR102 (BU), harness side and clockspring C218a-10, circuit RR102 (WH), harness side. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side) ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved for loop 2. Loop 1 and canister vent will show an open circuit fault. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to H79 . **No** GO to H22 .

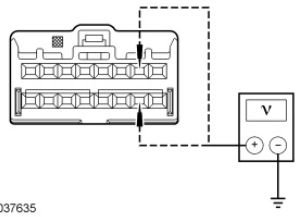
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H22 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the clockspring C218a. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a, harness side and clockspring C218a, harness side using the following chart. **RCM** / **Circuit** / **Clockspring** C310a-16 / CR102 (BU) / C218a-2 C310a-15 / RR102 (WH) / C218a-10  • **Are resistances less than 0.5 ohm?**	**Yes** GO to H80 . **No** REPAIR circuit CR102 (BU) or RR102 (WH). GO to H88 .
H23 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_23_OD) AND (2293_21_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM .	**Yes** GO to H77 . **No** GO to H24 .

• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) ♦ 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
H24 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_23_OD) AND (2293_21_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Disconnect: Clockspring C218a . • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) ♦ 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to H79 . **No** GO to H25 .
H25 CHECK DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND (CLOCKSPRING DISCONNECTED)	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b .	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can

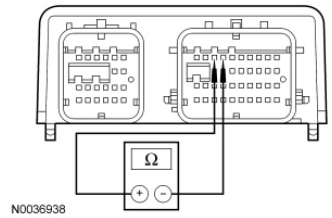
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• Measure resistance between clockspring: ♦ C218a-2, circuit CR102 (BU), harness side and ground. ♦ C218a-10, circuit RR102 (WH), harness side and ground.  N0055543 • **Are resistances greater than 10,000 ohms?**	exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR102 (BU) or RR102 (WH). GO to H88 .
H26 CHECK THE DRIVER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_22_OD) AND (2293_21_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side) ♦ 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved for loop 1 and loop 2. • **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**	**Yes** GO to H79 . **No** GO to H27 .

H27 CHECK DRIVER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO VOLTAGE (CLOCKSPRING DISCONNECTED)	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between clockspring: ♦ C218a-2, circuit CR102 (BU), harness side and ground. ♦ C218a-10, circuit RR102 (WH), harness side and ground.  • **Is voltage present on either circuit?**	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR102 (BU) or RR102 (WH). GO to H88 . **No** GO to H80 .
H28 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT RESISTANCE PID (D_VENT)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: D_VENT (Airbag Canister Vent Resistance, Driver Side) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H29 .
H29 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT RESISTANCE PID (D_VENT) WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, continue monitoring the D_VENT (Airbag Canister Vent Resistance, Driver Side) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. REFER to Clockspring in this section. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 .

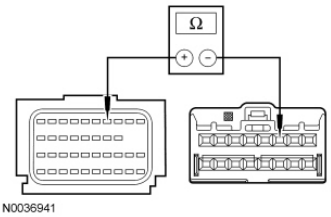
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	No If the driver air bag module canister vent resistance PID is less than 1.31 ohms, GO to H30 . If the driver air bag module canister vent resistance PID is greater than 4.29 ohms, GO to H33 .
H30 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_12_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_12_OD (Air bag Driver Front Can Vent Circuit Resist. Low on Squib) ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to H77 . **No** GO to H31 .
H31 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_12_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS (DRIVER AIR BAG REMOVED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not	**Yes** GO to H79 . **No** GO to H32 .

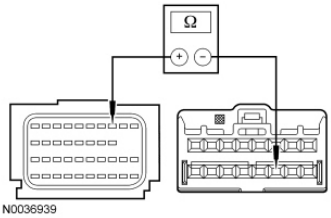
the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_12_OD (Air bag Driver Front Can Vent Circuit Resist. Low on Squib) ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H32 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b pin 3 and C310b pin 4, component side.  • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR143 (VT) and RR143 (BU/GN). GO to H88 . **No** GO to H80 .
H33 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_12_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this	**Yes** GO to H77 . **No**

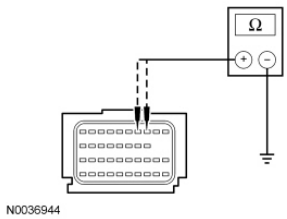
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indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Connect a fused jumper wire between driver air bag module C216c-1, harness side and C216c-2, harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_12_OD (Air bag Driver Front Can Vent Circuit Resist. Low on Squib) ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module canister vent circuits shorted together, a low resistance fault would normally be retrieved. Loop 1 and loop 2 will show an open circuit fault. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**	GO to H34 .
H34 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_12_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from driver air bag module C216c. • Disconnect: Clockspring C218a . • Connect a fused jumper wire between clockspring C218a-3, circuit CR143 (VT), harness side and clockspring C218a-11, circuit RR143 (BU/GN), harness	**Yes** GO to H79 . **No** GO to H35 .

side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_12_OD (Air bag Driver Front Can Vent Circuit Resist. Low on Squib) ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module canister vent circuits shorted together, a low resistance fault would normally be retrieved. Loop 1 and loop 2 will show an open circuit fault. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**	
H35 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT CIRCUITS FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the clockspring C218a. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-4, circuit CR143 (VT), harness side and clockspring C218a-3, circuit CR143 (VT), harness side.  N0036941 • Measure resistance between RCM C310b-3, circuit RR143 (BU/GN), harness side and clockspring C218a-11, circuit RR143 (BU/GN), harness side.	**Yes** GO to H80 . **No** REPAIR circuit CR143 (VT) or RR143 (BU/GN). GO to H88 .

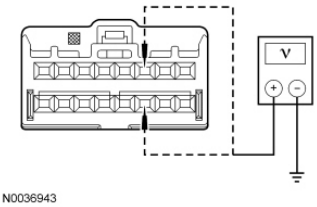
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 • **Are resistances less than 0.5 ohm?**	
H36 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_15_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) ♦ 2293_15_OD (Air bag Driver Front Can Vent Short to Ground) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to H77 . **No** GO to H37 .
H37 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_15_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.	**Yes** GO to H79 . **No** GO to H38 .

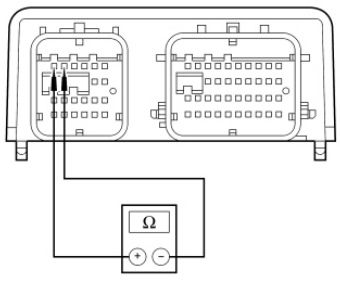
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) ♦ 2293_15_OD (Air bag Driver Front Can Vent Short to Ground) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
H38 CHECK DRIVER AIR BAG MODULE CANISTER VENT CIRCUITS FOR A SHORT TO GROUND (CLOCKSPRING DISCONNECTED)	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM : ♦ C310b-4, circuit CR143 (VT), harness side and ground. ♦ C310b-3, circuit RR143 (BU/GN), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR143 (VT) or RR143 (BU/GN). GO to H88 .
H39 CHECK THE DRIVER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_14_OD) AND (2293_13_OD) FOR A CHANGE IN FAULT STATUS (CLOCKSPRING DISCONNECTED)	

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NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Disconnect: Clockspring C218a . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_13_OD (Air bag Driver Front Can Vent Open) ♦ 2293_14_OD (Air bag Driver Front Can Vent Short to Battery) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved for loop 1, loop 2 and canister vent. • **Did the driver air bag module canister vent on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**	**Yes** GO to H79 . **No** GO to H40 .
H40 CHECK DRIVER AIR BAG MODULE CANISTER VENT CIRCUITS FOR A SHORT TO VOLTAGE (CLOCKSPRING DISCONNECTED)	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between clockspring: ♦ C218a-3, circuit CR143 (VT), harness side and ground. ♦ C218a-11, circuit RR143 (BU/GN), harness side and ground.	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR143 (VT) or RR143 (BU/GN). GO to H88 . **No** GO to H80 .

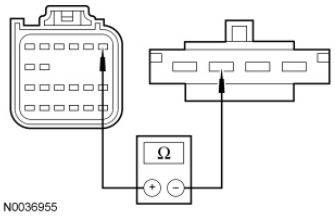
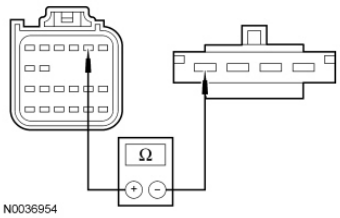
 N0036943 • **Is voltage present on either circuit?**	
H41 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID (P_ABAGR)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: P_ABAGR (Passenger Air Bag) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H42 .
H42 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID (P_ABAGR) WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, continue monitoring the P_ABAGR (Passenger Air Bag) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** If the passenger air bag module loop 1 resistance PID is less than 1.31 ohms, GO to H43 . If the passenger air bag module loop 1 resistance PID is greater than 4.29 ohms, GO to H45 .
H43 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_24_OD) AND (2293_25_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to H78 . **No** GO to H44 .

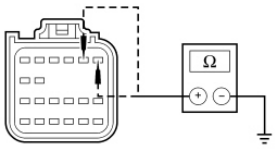
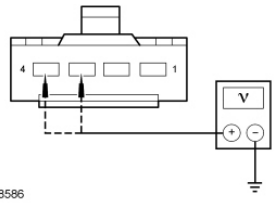
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• Disconnect: Passenger Air Bag Module C256 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) ♦ 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved for loop 1 and loop 2. • **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H44 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 1 and C310a pin 2, component side.  A0041266 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR103 (GY/BU) and RR103 (VT/GN). GO to H88 . **No** GO to H80 .
H45 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_25_OD) AND (2293_24_OD) FOR A CHANGE IN FAULT STATUS	
	Yes GO to H78 .

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 . • Connect a fused jumper wire between passenger air bag module C256-3, circuit CR103 (GY/BU), harness side and C256-4, circuit RR103 (VT/GN), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) ♦ 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved for loop 1. Loop 2 will show an open circuit fault due to the passenger air bag being disconnected. • **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**No** GO to H46 .
H46 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger air bag module C256. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a-1, circuit CR103 (GY/BU), harness side and passenger air bag module C256-3, circuit CR103 (GY/BU), harness side.	**Yes** GO to H80 . **No** REPAIR circuit CR103 (GY/BU) or RR103 (VT/GN). GO to H88 .

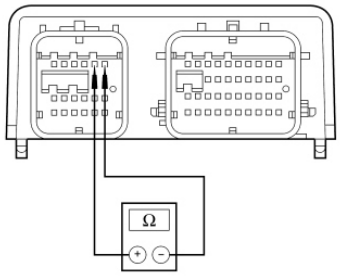
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 • Measure resistance between RCM C310a-2, circuit RR103 (VT/GN), harness side and passenger air bag module C256-4, circuit RR103 (VT/GN), harness side.  • **Are resistances less than 0.5 ohm?**	
H47 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 FAULT PIDs (2293_27_OD) AND (2293_25_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) ♦ 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved for loop 1 and loop 2. • **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a short to ground**	**Yes** GO to H78 . **No** GO to H48 .

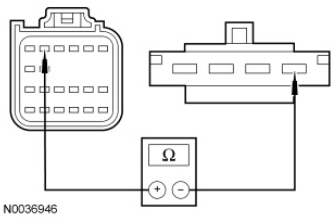
to an open circuit fault?	
H48 CHECK PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM : ♦ C310a-1, circuit CR103 (GY/BU), harness side and ground. ♦ C310a-2, circuit RR103 (VT/GN), harness side and ground.  A0041212 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR103 (GY/BU) or RR103 (VT/GN). GO to H88 .
H49 CHECK PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger air bag module: ♦ C256-3, circuit CR103 (GY/BU), harness side and ground. ♦ C256-4, circuit RR103 (VT/GN), harness side and ground.  A0088586 • **Is voltage present on either circuit?**	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR103 (GY/BU) or RR103 (VT/GN). GO to H88 . **No** GO to H80 .
H50 CHECK PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID (P_ABAGR2)	

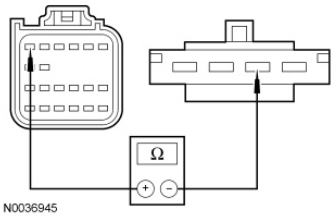
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• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: P_ABAGR2 (Passenger Side Air Bag #2 Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H51 .
H51 CHECK PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID (P_ABAGR2) WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, continue monitoring the P_ABAGR2 (Passenger Side Air Bag #2 Resistance) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** If the passenger air bag module loop 2 resistance PID is less than 1.31 ohms, GO to H52 . If the passenger air bag module loop 2 resistance PID is greater than 4.29 ohms, GO to H54 .
H52 CHECK PASSENGER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_16_OD) AND (2293_17_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs .	**Yes** GO to H78 . **No** GO to H53 .

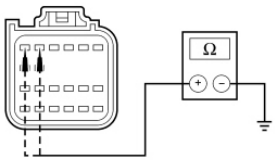
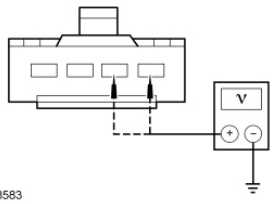
♦ 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side) ♦ 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved for loop 1 and loop 2. • **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H53 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 5 and C310a pin 6, component side.  A0041276 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR104 (YE/GY) and RR104 (WH/BU). GO to H88 . **No** GO to H80 .
H54 CHECK PASSENGER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_17_OD) AND (2293_16_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 .	**Yes** GO to H78 . **No** GO to H55 .

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• Connect a fused jumper wire between passenger air bag module C256-1, circuit CR104 (YE/GY), harness side and C256-2, circuit RR104 (WH/BU), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side) ♦ 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved for loop 2. Loop 1 will show an open circuit fault due to the passenger air bag module being disconnected. • **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
H55 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger air bag module C256. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a-5, circuit CR104 (YE/GY), harness side and passenger air bag module C256-1, circuit CR104 (YE/GY), harness side.  • Measure resistance between RCM C310a-6, circuit RR104 (WH/BU), harness side and passenger air bag module C256-2, circuit RR104 (WH/BU), harness side.	**Yes** GO to H80 . **No** REPAIR circuit CR104 (YE/GY) or RR104 (WH/BU). GO to H88 .

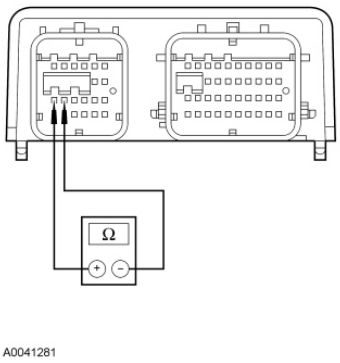
 • **Are resistances less than 0.5 ohm?**	
H56 CHECK PASSENGER AIR BAG MODULE LOOP 2 FAULT PIDs (2293_19_OD) AND (2293_17_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side) ♦ 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved for loop 1 and loop 2. • **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to H78 . **No** GO to H57 .
H57 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM :	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or

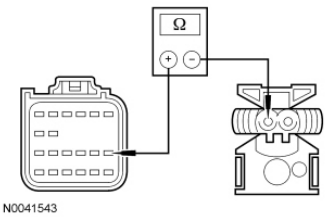
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♦ C310a-5, circuit CR104 (YE/GY), harness side and ground. ♦ C310a-6, circuit RR104 (WH/BU), harness side and ground.  A0041272 • **Are resistances greater than 10,000 ohms?**	defeat the shorting bar. REPAIR circuit CR104 (YE/GY) or RR104 (WH/BU). GO to H88 .
H58 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger air bag module: ♦ C256-1, circuit CR104 (YE/GY), harness side and ground. ♦ C256-2, circuit RR104 (WH/BU), harness side and ground.  A0088583 • **Is voltage present on either circuit?**	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR104 (YE/GY) or RR104 (WH/BU). GO to H88 . **No** GO to H80 .
H59 CHECK THE PASSENGER AIR BAG MODULE ADAPTIVE TETHER RESISTANCE PID (P_TETHER)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: P_TETHER (Passenger Side Adaptive Tether Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H60 .
H60 CHECK THE PASSENGER AIR BAG MODULE ADAPTIVE TETHER RESISTANCE PID (P_TETHER)	

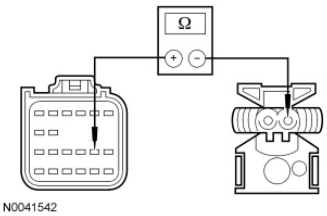
WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, continue monitoring the P_TETHER (Passenger Side Adaptive Tether Resistance) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** If the passenger air bag module loop 1 resistance PID is less than 1.31 ohms, GO to H61 . If the passenger air bag module loop 1 resistance PID is greater than 4.29 ohms, GO to H63 .
H61 CHECK THE PASSENGER AIR BAG MODULE ADAPTIVE TETHER FAULT PIDs (2293_0_OD) AND (2293_1_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Adaptive Tether 2-Pin Electrical Connector . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_0_OD (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib) ♦ 2293_1_OD (Air bag Passenger Front Adaptive Tether Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag	**Yes** GO to H78 . **No** GO to H62 .

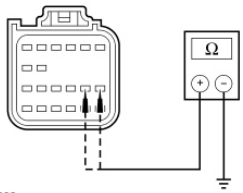
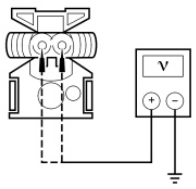
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module adaptive tether disconnected, open circuit faults would normally be retrieved. • **Did the passenger air bag module adaptive tether on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H62 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 13 and C310a pin 14, component side.  A0041281 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR145 (WH/OG) and RR145 (GY/YE). GO to H88 . **No** GO to H80 .
H63 CHECK THE PASSENGER AIR BAG MODULE ADAPTIVE TETHER FAULT PIDs (2293_0_OD) AND (2293_1_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Adaptive Tether 2-Pin Electrical Connector . • Connect a fused jumper wire between passenger air bag module adaptive tether 2-pin electrical connector, circuit CR145 (WH/OG), harness side and circuit	**Yes** GO to H78 . **No** GO to H64 .

RR145 (GY/YE), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_0_OD (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib) ♦ 2293_1_OD (Air bag Passenger Front Adaptive Tether Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module adaptive tether circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger air bag module adaptive tether on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
H64 CHECK THE PASSENGER AIR BAG MODULE ADAPTIVE TETHER CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger air bag module adaptive tether 2-pin electrical connector. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a-13, circuit CR145 (WH/OG), harness side and passenger air bag module adaptive tether 2-pin electrical connector, circuit CR145 (WH/OG), harness side.  • Measure resistance between RCM C310a-14, circuit RR145 (GY/YE), harness side and passenger air bag module adaptive tether 2-pin electrical connector, circuit RR145 (GY/YE), harness side.	**Yes** GO to H80 . **No** REPAIR circuit CR145 (WH/OG) or RR145 (GY/YE). GO to H88 .

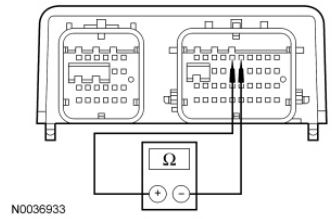
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 • **Are resistances less than 0.5 ohm?**	
H65 CHECK THE PASSENGER AIR BAG MODULE ADAPTIVE TETHER FAULT PIDs (2293_3_OD) AND (2293_1_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Adaptive Tether 2-Pin Electrical Connector. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_1_OD (Air bag Passenger Front Adaptive Tether Open) ♦ 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module adaptive tether electrical connector disconnected, an open circuit fault would normally be retrieved. • **Did the passenger air bag module adaptive tether on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to H78 . **No** GO to H66 .
H66 CHECK PASSENGER AIR BAG MODULE ADAPTIVE TETHER CIRCUITS FOR A SHORT TO GROUND	

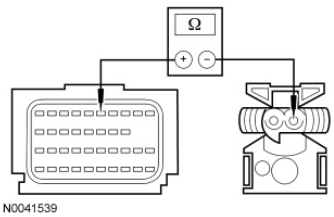
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM : ♦ C310a-13, circuit CR145 (WH/OG), harness side and ground. ♦ C310a-14, circuit RR145 (GY/YE), harness side and ground.  N0036932 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR145 (WH/OG) or RR103 RR145 (GY/YE). GO to H88 .
H67 CHECK PASSENGER AIR BAG MODULE ADAPTIVE TETHER CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Adaptive Tether 2-Pin Electrical Connector . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between: ♦ passenger air bag module adaptive tether 2-pin electrical connector, circuit CR145 (WH/OG), harness side and ground. ♦ passenger air bag module adaptive tether 2-pin electrical connector, circuit RR145 (GY/YE), harness side and ground.  N0041541 • **Is voltage present on either circuit?**	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR145 (WH/OG) or RR145 (GY/YE). GO to H88 . **No** GO to H80 .

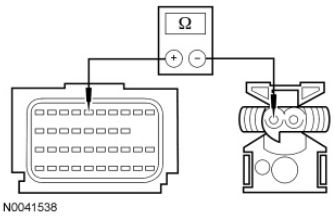
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H68 CHECK PASSENGER AIR BAG MODULE CANISTER VENT RESISTANCE PID (P_VENT)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: P_VENT (Airbag Canister Vent Resistance, Passenger Side) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to H80 . **No** GO to H69 .
H69 CHECK PASSENGER AIR BAG MODULE CANISTER VENT RESISTANCE PID (P_VENT) WHILE CARRYING OUT A HARNESS TEST	
• **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, continue monitoring the P_VENT (Airbag Canister Vent Resistance, Passenger Side) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** If the passenger air bag module canister vent resistance PID is less than 1.31 ohms, GO to H70 . If the passenger air bag module canister vent resistance PID is greater than 4.29 ohms, GO to H72 .
H70 CHECK PASSENGER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_8_OD) AND (2293_9_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Canister Vent 2-Pin Electrical Connector . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS)	**Yes** GO to H78 . **No** GO to H71 .

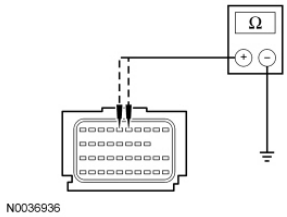
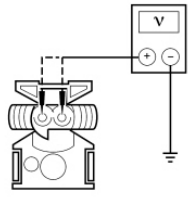
Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_8_OD (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib) ♦ 2293_9_OD (Air bag Passenger Front Can Vent Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module canister vent disconnected, an open circuit fault would normally be retrieved. • **Did the passenger air bag module canister vent on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
H71 CHECK THE RCM FOR LOW RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b pin 5 and C310b pin 6, component side.  • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR144 (GY/OG) and RR144 (VT/GN). GO to H88 . **No** GO to H80 .
H72 CHECK PASSENGER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_9_OD) AND (2293_8_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector	**Yes** GO to H78 . **No** GO to H73 .

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identification. • Disconnect: Passenger Air Bag Module Canister Vent 2-Pin Electrical Connector . • Connect a fused jumper wire between passenger air bag module canister vent 2-pin electrical connector circuit CR144 (GY/OG), harness side, and circuit RR144 (VT/GN), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_8_OD (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib) ♦ 2293_9_OD (Air bag Passenger Front Can Vent Open) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module canister vent circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger air bag module canister vent on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
H73 CHECK PASSENGER AIR BAG MODULE CANISTER VENT CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from passenger air bag module canister vent 2-pin electrical connector. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-5, circuit CR144 (GY/OG), harness side and passenger air bag module canister vent 2-pin electrical connector, circuit CR144 (GY/OG), harness side.  • Measure resistance between RCM C310b-6, circuit RR144 (VT/GN), harness side and passenger air bag module canister vent 2-pin electrical connector, circuit	**Yes** GO to H80 . **No** REPAIR circuit CR144 (GY/OG) or RR144 (VT/GN). GO to H88 .

RR144 (VT/GN), harness side.  N0041538 • **Are resistances less than 0.5 ohm?**	
H74 CHECK PASSENGER AIR BAG MODULE CANISTER VENT FAULT PIDs (2293_11_OD) AND (2293_9_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Canister Vent 2-Pin Electrical Connector . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2293_9_OD (Air bag Passenger Front Can Vent Open) ♦ 2293_11_OD (Air bag Passenger Front Can Vent Short to Ground) • **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module canister vent electrical connector disconnected, open circuit faults would normally be retrieved. • **Did the passenger air bag module canister vent on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to H78 . **No** GO to H75 .
H75 CHECK PASSENGER AIR BAG MODULE CANISTER VENT CIRCUITS FOR A SHORT TO GROUND	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM : ♦ C310b-5, circuit CR144 (GY/OG), harness side and ground. ♦ C310b-6, circuit RR144 (VT/GN), harness side and ground.  N0036936 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to H80 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR144 (GY/OG) or RR144 (VT/GN). GO to H88 .
H76 CHECK PASSENGER AIR BAG MODULE CANISTER VENT CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • **NOTE:** Refer to Passenger Air Bag Module under Principles of Operation in this section for connector identification. • Disconnect: Passenger Air Bag Module Canister Vent 2-Pin Electrical Connector . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between: ♦ passenger air bag module canister vent 2-pin electrical connector, circuit CR144 (GY/OG), harness side and ground. ♦ passenger air bag module canister vent 2-pin electrical connector, circuit RR144 (VT/GN), harness side and ground.  A0094832 • **Is voltage present on either circuit?**	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR144 (GY/OG) and/or RR144 (VT/GN). GO to H88 . **No** GO to H80 .

H77 CONFIRM THE DRIVER AIR BAG MODULE FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Install the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2293 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2293 fault PIDs. • **Does the original RCM on-demand 2293 fault PID indicate a fault?**	**Yes** INSTALL a new driver air bag module. REFER to Driver Air Bag Module in this section. GO to H88 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), GO to H81 . For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side), GO to H81 . For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), GO to H83 . For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), GO to H85 . For 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), GO to H81 . For 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), GO to H81 . For 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), GO to H83 . For 2293_22_CM (Air Bag Circuit

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	Short to Battery - Loop No. 2, Front Driver Side), GO to H85 . For 2293_13_CM (Air bag Driver Front Can Vent Open), GO to H81 . For 2293_12_CM (Air bag Driver Front Can Vent Circuit Resist. Low on Squib), GO to H81 . For 2293_15_CM (Air bag Driver Front Can Vent Short to Ground), GO to H83 . For 2293_14_CM (Air bag Driver Front Can Vent Short to Battery), GO to H85 . For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), GO to H82 . For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), GO to H82 . For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), GO to H84 . For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), GO to H86 . For 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), GO to H84 . For 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), GO to H86 . For 2293_1_CM (Air bag Passenger Front Adaptive Tether Open), GO to H82 . For 2293_0_CM (Air bag Passenger

	Front Adaptive Tether Circuit Resist. Low on Squib), GO to H82 . For 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground), GO to H84 . For 2293_2_CM (Air bag Passenger Front Adaptive Tether Short to Battery), GO to H86 . For 2293_9_CM (Air bag Passenger Front Can Vent Open), GO to H82 . For 2293_8_CM (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib), GO to H82 . For 2293_11_CM (Air bag Passenger Front Can Vent Short to Ground), GO to H84 . For 2293_10_CM (Air bag Passenger Front Can Vent Short to Battery), GO to H86 .
H78 CONFIRM THE PASSENGER AIR BAG MODULE FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Passenger Air Bag Module (if previously disconnected) . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2293 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2293 fault PIDs. • **Does the original RCM on-demand 2293 fault PID indicate a fault?**	**Yes** INSTALL a new passenger air bag module. REFER to Passenger Air Bag Module in this section. GO to H88 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), GO to H81 .

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For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side), GO to H81 .

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), GO to H83 .

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), GO to H85 .

For 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), GO to H81 .

For 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), GO to H81 .

For 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), GO to H83 .

For 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), GO to H85 .

For 2293_13_CM (Air bag Driver Front Can Vent Open), GO to H81 .

For 2293_12_CM (Air bag Driver Front Can Vent Circuit Resist. Low on Squib), GO to H81 .

For 2293_15_CM (Air bag Driver Front Can Vent Short to Ground), GO to H83 .

For 2293_14_CM (Air bag Driver Front Can Vent Short to Battery), GO to H85 . For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), GO to H82 .

For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), GO to H82 .

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), GO to H84 .

	For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), GO to H86 . For 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), GO to H84 . For 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), GO to H86 . For 2293_1_CM (Air bag Passenger Front Adaptive Tether Open), GO to H82 . For 2293_0_CM (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib), GO to H82 . For 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground), GO to H84 . For 2293_2_CM (Air bag Passenger Front Adaptive Tether Short to Battery), GO to H86 . For 2293_9_CM (Air bag Passenger Front Can Vent Open), GO to H82 . For 2293_8_CM (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib), GO to H82 . For 2293_11_CM (Air bag Passenger Front Can Vent Short to Ground), GO to H84 . For 2293_10_CM (Air bag Passenger Front Can Vent Short to Battery), GO to H86 .
H79 CONFIRM THE CLOCKSPRING FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical	**Yes** INSTALL a new clockspring. REFER to Clockspring in this section. GO to

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connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded.

- Ignition OFF.
- Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
- Connect: Clockspring C218a .
- Install the driver air bag module. Refer to Driver Air Bag Module in this section.
- Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self Test - RCM .
- Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2293 Fault PIDs .
    - ♦ Refer to PID list in Normal Operation to view 2293 fault PIDs.
- **Does the original RCM on-demand 2293 fault PID indicate a fault?**

H88 .

No
This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time.

In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

Using the fault PIDs recorded, GO to the appropriate pinpoint test step.

For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), GO to H81 .

For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side), GO to H81 .

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), GO to H83 .

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), GO to H85 .

For 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), GO to H81 .

For 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), GO to H81 .

For 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), GO to H83 .

For 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), GO to H85 .

For 2293_13_CM (Air bag Driver Front Can Vent Open), GO to H81 .

For 2293_12_CM (Air bag Driver Front Can Vent Circuit Resist. Low on Squib), GO to H81 .

For 2293_15_CM (Air bag Driver Front Can Vent Short to Ground), GO to H83 .

For 2293_14_CM (Air bag Driver Front Can Vent Short to Battery), GO to H85 . For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), GO to H82 .

For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), GO to H82 .

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), GO to H84 .

For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), GO to H86 .

For 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), GO to H82 .

For 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), GO to H82 .

For 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), GO to H84 .

For 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), GO to H86 .

For 2293_1_CM (Air bag Passenger Front Adaptive Tether Open), GO to H82 .

For 2293_0_CM (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib), GO to H82 .

For 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to

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	Ground), GO to H84 . For 2293_2_CM (Air bag Passenger Front Adaptive Tether Short to Battery), GO to H86 . For 2293_9_CM (Air bag Passenger Front Can Vent Open), GO to H82 . For 2293_8_CM (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib), GO to H82 . For 2293_11_CM (Air bag Passenger Front Can Vent Short to Ground), GO to H84 . For 2293_10_CM (Air bag Passenger Front Can Vent Short to Battery), GO to H86 .
H80 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If previously removed, install the driver air bag module. Refer to Driver Air Bag Module in this section. • Connect: Clockspring C218a (if previously disconnected) . • Connect: Passenger Air Bag Module (if previously disconnected) . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2293 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2293 fault PIDs. • **Does the original RCM on-demand 2293 fault PID indicate a fault?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to H88 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), GO to H81 . For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side), GO to H81 . For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front

	Driver Side), GO to H83 . For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side), GO to H85 . For 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), GO to H81 . For 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), GO to H81 . For 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), GO to H83 . For 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), GO to H85 . For 2293_13_CM (Air bag Driver Front Can Vent Open), GO to H81 . For 2293_12_CM (Air bag Driver Front Can Vent Circuit Resist. Low on Squib), GO to H81 . For 2293_15_CM (Air bag Driver Front Can Vent Short to Ground), GO to H83 . For 2293_14_CM (Air bag Driver Front Can Vent Short to Battery), GO to H85 . For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), GO to H82 . For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), GO to H82 . For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), GO to H84 . For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), GO to H86 . For 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2,

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	Front Passenger Side), GO to H82 . For 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), GO to H82 . For 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), GO to H84 . For 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), GO to H86 . For 2293_1_CM (Air bag Passenger Front Adaptive Tether Open), GO to H82 . For 2293_0_CM (Air bag Passenger Front Adaptive Tether Circuit Resist. Low on Squib), GO to H82 . For 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground), GO to H84 . For 2293_2_CM (Air bag Passenger Front Adaptive Tether Short to Battery), GO to H86 . For 2293_9_CM (Air bag Passenger Front Can Vent Open), GO to H82 . For 2293_8_CM (Air bag Passenger Front Can Vent Circuit Resist. Low on Squib), GO to H82 . For 2293_11_CM (Air bag Passenger Front Can Vent Short to Ground), GO to H84 . For 2293_10_CM (Air bag Passenger Front Can Vent Short to Battery), GO to H86 .
H81 CHECK DRIVER AIR BAG MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN	
• Ignition ON. • If the fault was reported for the driver air bag module loop 1 and/or loop 2, monitor the following PIDs: ♦ D_ABAGR (Driver Air Bag) resistance PID. ♦ D_ABAGR2 (Driver Air Bag #2 Resistance) resistance PID.	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information.

• If the fault was reported for the driver air bag module canister vent, monitor the following PIDs: ♦ D_VENT (Airbag Canister Vent Resistance, Driver Side) resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness, tilting and rotating the steering wheel frequently. • **Does any driver air bag resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**	GO to H88 . **No** GO to H87 .
H82 CHECK PASSENGER AIR BAG MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN	
• Ignition ON. • If the fault was reported for the passenger air bag module loop 1 and/or loop 2, monitor the following PIDs: ♦ P_ABAGR (Passenger Air Bag) resistance PID. ♦ P_ABAGR2 (Passenger Side Air Bag #2 Resistance) resistance PID. • If the fault was reported for the passenger air bag module adaptive tether and/or canister vent, monitor the following PIDs: ♦ P_TETHER (Passenger Side Adaptive Tether Resistance) resistance PID. ♦ P_VENT (Airbag Canister Vent Resistance, Passenger Side) resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness. • **Does any passenger air bag resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** GO to H87 .
H83 CHECK DRIVER AIR BAG MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND	

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• Ignition ON. • Monitor the following fault PIDs: ♦ 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side) on-demand fault PIDs. ♦ 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) on-demand fault PIDs. ♦ 2293_15_OD (Air bag Driver Front Can Vent Short to Ground) on-demand fault PIDs. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • **NOTE:** Do not remove the driver air bag module from its mounted position at this time. • With the driver air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently. • **Does any RCM on-demand 2293 fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** GO to H87 .
H84 CHECK PASSENGER AIR BAG MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND	
• Ignition ON. • Monitor the following fault PIDs: ♦ 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) on-demand fault PIDs. ♦ 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side) on-demand fault PIDs. ♦ 2293_11_OD (Air bag Passenger Front Can Vent Short to Ground) on-demand fault PIDs. ♦ 2293_3_OD (Air bag Passenger Front Adaptive Tether Short to Ground) on-demand fault PIDs. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • **NOTE:** Do not remove the passenger air bag module from its mounted position at this time. • With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any RCM on-demand 2293 fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** GO to H87 .
H85 CHECK DRIVER AIR BAG MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO BATTERY	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this	**Yes** DEPOWER the SRS and REPAIR as necessary.

section. • Remove the driver air bag module. Refer to Driver Air Bag Module in this section. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Monitor the following fault PIDs: ♦ 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) on-demand fault PIDs. ♦ 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side) on-demand fault PIDs. ♦ 2293_14_OD (Air bag Driver Front Can Vent Short to Battery) on-demand fault PIDs. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently. • **Does any RCM on-demand 2293 fault PID indicate a fault is present?**	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** GO to H87 .
H86 CHECK PASSENGER AIR BAG MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO BATTERY	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Air Bag Module C256 and C2351 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Monitor the following fault PIDs: ♦ 2293_26_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) on-demand fault PIDs. ♦ 2293_18_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side) on-demand fault PIDs. ♦ 2293_10_OD (Air bag Passenger Front Can Vent Short to Battery) on-demand fault PIDs. ♦ 2293_2_OD (Air bag Passenger Front Adaptive Tether Short to Battery) on-demand fault PIDs. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update. • **NOTE:** Do not remove the passenger air bag module from its mounted position at this time.	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** GO to H87 .

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• With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any RCM on-demand 2293 fault PID indicate a fault is present?**	
H87 CHECK THE HARNESS AND CONNECTORS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If the fault was reported for the driver air bag: ♦ remove the driver air bag module. Refer to Driver Air Bag Module in this section. ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. • If the fault was reported for the passenger air bag: ♦ disconnect the passenger air bag module C256 and C2351. ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. • **Were any concerns found?**	**Yes** REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to H88 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently and rotating the steering wheel (driver air bag module fault). **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to H88 .
H88 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test I: DTC B2294

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) continuously monitors the driver and passenger Safety Canopy® module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2294 in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors Safety Canopy® module circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs [a]	Description	Fault Trigger Condition
2294_24_OD and 2294_24_CM	A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side	When the Restraints Control Module (RCM) measures resistance less than 0.9 ohm between the passenger safety canopy circuits, a fault will be indicated.
2294_25_OD and 2294_25_CM	A - B or A - C Pillar Curtain Circuit Open, Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger safety canopy circuits, a fault will be indicated.
2294_26_OD and 2294_26_CM	A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side	When the RCM senses a short to ground on either of the passenger safety canopy circuits, a fault will be indicated.
2294_27_OD and 2294_27_CM	A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side	When the RCM senses a short to voltage on either of the passenger safety canopy circuits, a fault will be indicated.
2294_28_OD and 2294_28_CM	A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver safety canopy circuits, a fault will be indicated.
2294_29_OD and 2294_29_CM	A - B or A - C Pillar Curtain Circuit Open, Driver Side	When the RCM measures resistance greater than 5 ohms between the driver safety canopy circuits, a fault will be indicated.
2294_30_OD and 2294_30_CM	A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side	When the RCM senses a short to ground on either of the driver safety canopy circuits, a fault will be indicated.
2294_31_OD and 2294_31_CM	A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side	When the RCM senses a short to voltage on either of the driver safety canopy circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2294. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC

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B2294.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Safety Canopy® module
- RCM

PINPOINT TEST I: DTC B2294

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental Restraint System (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

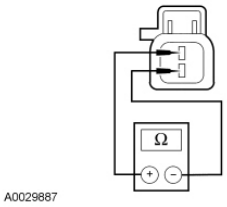
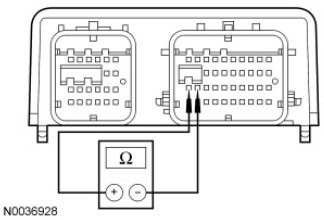
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
I1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2294 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2294 fault PIDs. • **Do any RCM on-demand 2294 fault PIDs indicate a fault?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), GO to I2 . For 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side), GO to I2 . For 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side), GO to I9 . For 2294_31_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side), GO to I11 . For 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance

	Low, Passenger Side), GO to I12 . For 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), GO to I12 . For 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), GO to I19 . For 2294_27_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), GO to I21 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For (2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), GO to I24 . For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), GO to I26 . For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), GO to I27 .
I2 CHECK THE DRIVER SAFETY CANOPY® MODULE RESISTANCE PID (DCURTL1)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to I23 . **No** GO to I3 .
I3 CHECK THE DRIVER SAFETY CANOPY® MODULE RESISTANCE PID (DCURTL1) WHILE	

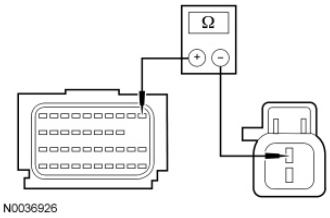
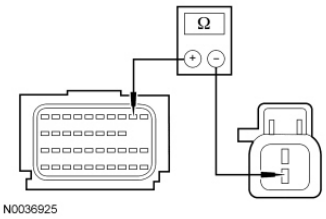
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CARRYING OUT A HARNESS TEST	
• Continue monitoring the DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) Resistance PID while carrying out a harness test of the driver safety canopy circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to I28 . **No** If the driver safety canopy resistance PID is less than 1.31 ohm, GO to I4 . If the driver safety canopy resistance PID is greater than 4.29 ohms, GO to I7 .
I4 CHECK THE DRIVER SAFETY CANOPY® MODULE FAULT PIDs (2294_28_OD) AND (2294_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side) ♦ 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved.	**Yes** GO to I22 . **No** GO to I5 .

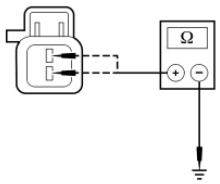
• **Did the driver safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
I5 CHECK FOR A SHORT BETWEEN DRIVER SAFETY CANOPY CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between driver safety canopy C3213-1 (Explorer/Mountaineer)/C9006-1 (Explorer Sport Trac), circuit CR109 (BN/BU), harness side and C3213-2 (Explorer/Mountaineer)/C9006-2 (Explorer Sport Trac), circuit RR109 (BU/GN), harness side.  • **Is resistance greater than 10,000 ohms?**	**Yes** GO to I23 . **No** GO to I6 .
I6 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b pin 21, component side, and C310b pin 22, component side.  • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR109 (BN/BU) and RR109 (BU/GN). GO to I28 . **No** GO to I23 .
I7 CHECK THE DRIVER SAFETY CANOPY® MODULE FAULT PIDs (2294_29_OD) AND (2294_28_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.	**Yes** GO to I22 . **No** GO to I8 .

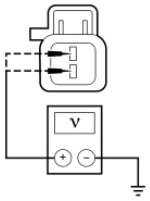
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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac) . • Connect a fused jumper wire between driver safety canopy C3213-1 (Explorer/Mountaineer)/C9006-1 (Explorer Sport Trac), circuit CR109 (BN/BU), harness side and C3213-2 (Explorer/Mountaineer)/C9006-2 (Explorer Sport Trac), circuit RR109 (BU/GN), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side) ♦ 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy circuits shorted together, a low resistance fault would normally be retrieved. • **Did the driver safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
I8 CHECK DRIVER SAFETY CANOPY® MODULE CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the fused jumper wire from the driver safety canopy C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac). • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-21, circuit CR109 (BN/BU), harness side and driver safety canopy C3213-1 (Explorer/Mountaineer)/C9006-1 (Explorer Sport Trac), circuit CR109 (BN/BU), harness side.	**Yes** GO to I23 . **No** REPAIR circuit CR109 (BN/BU) or RR109 (BU/GN). GO to I28 .

 N0036926 • Measure resistance between RCM C310b-22, circuit RR109 (BU/GN), harness side and driver safety canopy C3213-2 (Explorer/Mountaineer)/C9006-2 (Explorer Sport Trac), circuit RR109 (BU/GN), harness side.  N0036925 • **Are resistances less than 0.5 ohm?**	
I9 CHECK THE DRIVER SAFETY CANOPY® MODULE FAULT PIDs (2294_30_OD) AND (2294_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)	**Yes** GO to I22 . **No** GO to I10 .

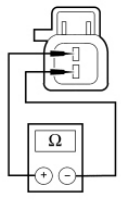
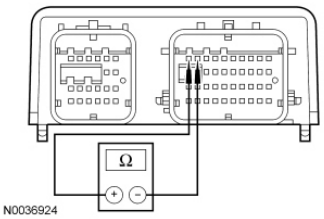
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♦ 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
I10 CHECK DRIVER SAFETY CANOPY® MODULE CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver safety canopy: ♦ C3213-1 (Explorer/Mountaineer)/C9006-1 (Explorer Sport Trac), circuit CR109 (BN/BU), harness side and ground. ♦ C3213-2 (Explorer/Mountaineer)/C9006-2 (Explorer Sport Trac), circuit RR109 (BU/GN), harness side and ground.  N0081823 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to I23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR109 (BN/BU) or RR109 (BU/GN). GO to I28 .
I11 CHECK DRIVER SAFETY CANOPY® MODULE CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Canopy C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac) . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON.	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR109 (BN/BU) or RR109 (BU/GN). GO to I28 . **No** GO to I23 .

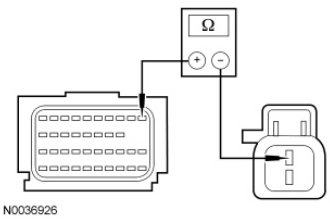
• Measure voltage between driver safety canopy: ♦ C3213-1 (Explorer/Mountaineer)/C9006-1 (Explorer Sport Trac), circuit CR109 (BN/BU), harness side and ground. ♦ C3213-2 (Explorer/Mountaineer)/C9006-2 (Explorer Sport Trac), circuit RR109 (BU/GN), harness side and ground.  N0005052 • **Is voltage present on either circuit?**	
I12 CHECK THE PASSENGER SAFETY CANOPY® MODULE RESISTANCE PID (PCURTL1)	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to I23 . **No** GO to I13 .
I13 CHECK THE PASSENGER SAFETY CANOPY® MODULE RESISTANCE PID (PCURTL1) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) resistance PID while carrying out a harness test of the passenger safety canopy circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to I28 . **No** If the passenger safety canopy resistance PID is less than 1.31 ohm, GO to I14 . If the passenger safety canopy resistance PID is greater than 4.29 ohms, GO to I17 .
I14 CHECK THE PASSENGER SAFETY CANOPY® MODULE FAULT PIDs (2294_24_OD) AND (2294_25_OD) FOR A CHANGE IN FAULT	

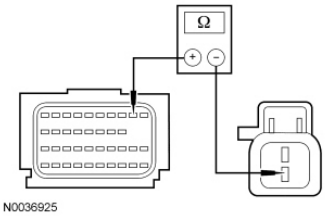
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STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) ♦ 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to I22 . **No** GO to I15 .
I15 CHECK FOR A SHORT BETWEEN PASSENGER SAFETY CANOPY CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between passenger Safety Canopy® module: C3214-1 (Explorer/Mountaineer)/C9007-1 (Explorer Sport Trac), circuit CR111 (BN/WH), harness side and C3214-2 (Explorer/Mountaineer)/ C9007-2 (Explorer Sport Trac), circuit RR111 (YE/VT), harness side.	**Yes** GO to I23 . **No** GO to I16 .

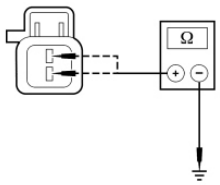
 A0029887 • **Is resistance greater than 10,000 ohms?**	
I16 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b pin 1, component side, and C310b pin 2, component side.  N0036924 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR111 (BN/WH) and RR111 (YE/VT). GO to I28 . **No** GO to I23 .
I17 CHECK THE PASSENGER SAFETY CANOPY® MODULE FAULT PIDs (2294_24_OD) AND (2294_24_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac) . • Connect a fused jumper wire between passenger safety canopy C3214-1 (Explorer/Mountaineer)/C9007-1 (Explorer Sport Trac), circuit CR111 (BN/WH), harness side and C3214-2 (Explorer/Mountaineer)/ C9007-2 (Explorer Sport Trac), circuit RR111 (YE/VT), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** GO to I22 . **No** GO to I18 .

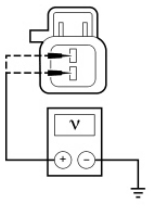
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• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) ♦ 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	
I18 CHECK PASSENGER SAFETY CANOPY® MODULE CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the passenger safety canopy C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac). • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-1, circuit CR111 (BN/WH), harness side and passenger Safety Canopy® module C3214-1 (Explorer/Mountaineer)/C9007-1 (Explorer Sport Trac), circuit CR111 (BN/WH), harness side.  • Measure resistance between RCM C310b-2, circuit RR111 (YE/VT), harness side and passenger Safety Canopy® module C3214-2 (Explorer/Mountaineer)/C9007-2 (Explorer Sport Trac), circuit RR111 (YE/VT), harness side.	**Yes** GO to I23 . **No** REPAIR circuit CR111 (BN/WH) or RR111 (YE/VT). GO to I28 .

 • **Are resistances less than 0.5 ohm?**	
I19 CHECK THE PASSENGER SAFETY CANOPY® MODULE FAULT PIDs (2294_26_OD) AND (2294_25_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac) . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side) ♦ 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to I22 . **No** GO to I20 .
I20 CHECK PASSENGER SAFETY CANOPY® MODULE CIRCUITS FOR A SHORT TO GROUND	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between passenger safety canopy: ♦ C3214-1 (Explorer/Mountaineer)/C9007-1 (Explorer Sport Trac), circuit CR111 (BN/WH), harness side and ground. ♦ C3214-2 (Explorer/Mountaineer)/C9007-2 (Explorer Sport Trac), circuit RR111 (YE/VT), harness side and ground.  N0081823 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to I23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR111 (BN/WH) or RR111 (YE/VT). GO to I28 .
I21 CHECK PASSENGER SAFETY CANOPY® MODULE CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Canopy C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac) . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger safety canopy: ♦ C3214-1 (Explorer/Mountaineer)/C9007-1 (Explorer Sport Trac), circuit CR111 (BN/WH), harness side and ground. ♦ C3214-2 (Explorer/Mountaineer)/C9007-2 (Explorer Sport Trac), circuit RR111 (YE/VT), harness side and ground.	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR111 (BN/WH) or RR111 (YE/VT). GO to I28 . **No** GO to I23 .

 N0005052 • **Is voltage present on either circuit?**	
I22 CONFIRM THE SAFETY CANOPY® MODULE FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Affected Safety Canopy C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac) (Driver) or C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac) (Passenger) . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2294 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2294 fault PIDs. • **Does the original RCM on-demand 2294 fault PID indicate a fault?**	**Yes** INSTALL a new driver or passenger safety canopy. REFER to Safety Canopy Module - Explorer, Mountaineer or Safety Canopy Module - Explorer Sport Trac in this section. GO to I28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For (2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), GO to I24 . For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), GO to I26 . For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), GO to I27 .
I23 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded.	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to I28 . **No**

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• Ignition OFF. • If previously directed to disconnect any SRS component(s): ♦ depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. ♦ connect all previously disconnected restraint system component(s), including RCM C310a and C310b. ♦ repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2294 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2294 fault PIDs. • **Does the original RCM on-demand 2294 fault PID indicate a fault?**	In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For (2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), GO to I24 . For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), GO to I26 . For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), GO to I27 .
I24 CHECK SAFETY CANOPY® MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN	
• If the fault was reported for the driver safety canopy, monitor the DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) resistance PID. • If the fault was reported for the passenger safety canopy, monitor the PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any safety canopy resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to I28 . **No** GO to I25 .
I25 CHECK THE HARNESS AND CONNECTORS	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the affected Safety Canopy® module C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac) (Driver) or C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac) (Passenger): ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. • **Were any concerns found?**	**Yes** REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to I28 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to I28 .
I26 CHECK THE AFFECTED SAFETY CANOPY® MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • If the fault was reported for the driver safety canopy, monitor the 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) fault PID. • If the fault was reported for the passenger safety canopy, monitor the 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side) fault PID. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update. • Attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness. • **Does any safety canopy on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to I28 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to I28 .
I27 CHECK THE AFFECTED SAFETY CANOPY® MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE	
• Ignition OFF.	**Yes** DEPOWER the SRS and REPAIR as

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• Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If the fault was reported for the driver safety canopy, disconnect the driver Safety Canopy® module C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac). • If the fault was reported for the passenger safety canopy, disconnect the passenger Safety Canopy® module C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac). • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update. • Monitor the 2294_31_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side) fault PIDs. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any safety canopy on-demand fault PID indicate a fault is present?**	necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to I28 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to I28 .
I28 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test J: DTC B2295

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

A side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a Safety Canopy® module. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The Restraints Control Module (RCM) continuously monitors the driver and passenger side air bag module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2295 in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors side air bag module circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs [a]	Description	Fault Trigger Condition
2295_24_OD and 2295_24_CM	Side Air Bag Circuit Resistance Low, Front Passenger Side	When the Restraints Control Module (RCM) measures resistance less than 0.9 ohm between the passenger side air bag module circuits, a fault will be indicated.
2295_25_OD and 2295_25_CM	Side Air Bag Circuit Open, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger side air bag module circuits, a fault will be indicated.
2295_26_OD and 2295_26_CM	Side Air Bag Circuit Short to Ground, Front Passenger Side	When the RCM senses a short to ground on either of the passenger side air bag module circuits, a fault will be indicated.
2295_27_OD and 2295_27_CM	Side Air Bag Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger side air bag module circuits, a fault will be indicated.
2295_28_OD and 2295_28_CM	Side Air Bag Circuit Resistance Low, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver side air bag module circuits, a fault will be indicated.
2295_29_OD and 2295_29_CM	Side Air Bag Circuit Open, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver side air bag module circuits, a fault will be indicated.
2295_30_OD and 2295_30_CM	Side Air Bag Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on either of the driver side air bag module circuits, a fault will be indicated.
2295_31_OD and 2295_31_CM	Side Air Bag Circuit Short to Battery, Front Driver Side	When the RCM senses a short to voltage on either of the driver side air bag module circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2295. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2295.

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This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Side air bag module
- RCM

PINPOINT TEST J: DTC B2295

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental Restraint System (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

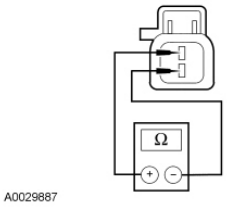
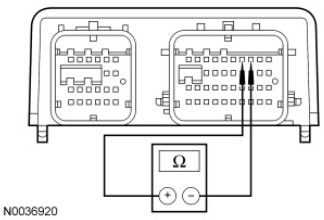
NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
J1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2295 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2295 fault PIDs. • **Do any RCM on-demand 2295 fault PIDs indicate a fault?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side), GO to J2 . For (2295_29_OD (Side Air Bag Circuit Open, Front Driver Side), GO to J2 . For 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side), GO to J9 . For 2295_31_OD (Side Air Bag Circuit Short to Battery, Front Driver Side), GO to J11 . For 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side), GO to J12 .

	For 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side), GO to J12 . For 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side), GO to J19 . For (2295_27_OD (Side Air Bag Circuit Short to Battery, Front Passenger Side), GO to J21 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), GO to J24 . For (2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), GO to J26 . For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), GO to J27 .
J2 CHECK THE DRIVER SIDE AIR BAG MODULE RESISTANCE PID (DS_AB)	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: DS_AB (Driver Side Impact Air Bag Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to J23 . **No** GO to J3 .
J3 CHECK THE DRIVER SIDE AIR BAG RESISTANCE PID (DS_AB) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the DS_AB (Driver Side Impact Air Bag Resistance) resistance PID while carrying out a harness test of the driver side air	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed.

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bag circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to J28 . **No** If the driver side air bag resistance PID is less than 1.31 ohms, GO to J4 . If the driver safety canopy resistance PID is greater than 4.29 ohms, GO to J7 .
J4 CHECK THE DRIVER SIDE AIR BAG MODULE FAULT PIDs (2295_28_OD) AND (2295_29_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3049 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side) ♦ 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag disconnected, an open circuit fault would normally be retrieved. • **Did the driver side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	**Yes** GO to J22 . **No** GO to J5 .
J5 CHECK FOR A SHORT BETWEEN DRIVER SEAT SIDE AIR BAG CIRCUITS	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between driver side air bag C3049-2, circuit CR105 (GN/BU), harness side and C3049-1, circuit RR105 (GY/YE), harness side.  A0029887 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to J22 . **No** GO to J6 .
J6 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b pin 7, component side, and C310b pin 8, component side.  N0036920 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR105 (GN/BU) and RR105 (GY/YE). GO to J25 . **No** GO to J23 .
J7 CHECK THE DRIVER SIDE AIR BAG MODULE FAULT PIDs (2295_29_OD) AND (2295_28_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3049 .	**Yes** GO to J22 . **No** GO to J8 .

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- Connect a fused jumper wire between driver side air bag C3049-2, circuit CR105 (GN/BU), harness side and C3049-1, circuit RR105 (GY/YE), harness side.
- Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self Test - RCM .
- Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs .
  - 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side)
  - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

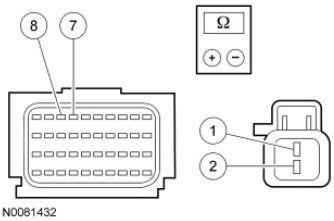
J8 CHECK DRIVER SIDE AIR BAG MODULE CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.
- Remove the jumper wire from the driver side air bag C3049.
- Disconnect: RCM C310a and C310b .
- Measure resistance between RCM C310b, harness side and driver seat side air bag C3049, harness side using the following chart.

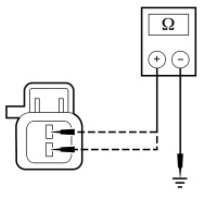
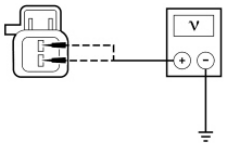
RCM	Circuit	Driver Seat Side Air Bag Module
C310b-8	CR105 (GN/BU)	C3049-1
C310b-7	RR105 (GY/YE)	C3049-2

Yes
GO to J23 .

No
REPAIR circuit CR105 (GN/BU) or RR105 (GY/YE). GO to J28 .

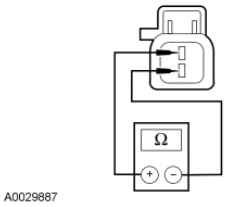
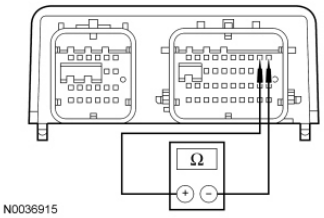
 • **Are resistances less than 0.5 ohm?**	
J9 CHECK THE DRIVER SIDE AIR BAG MODULE FAULT PIDs (2295_30_OD) AND (2295_28_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3049 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side) ♦ 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side) • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module disconnected, an open circuit fault would normally be retrieved. • **Did the driver side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	**Yes** GO to J22 . **No** GO to J10 .
J10 CHECK DRIVER SIDE AIR BAG MODULE CIRCUITS FOR A SHORT TO GROUND	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver side air bag: ♦ C3049-1, circuit CR105 (GN/BU), harness side and ground. ♦ C3049-2, circuit RR105 (GY/YE), harness side and ground.  N0062801 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to J23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR105 (GN/BU) or RR105 (GY/YE). GO to J28 .
J11 CHECK DRIVER SIDE AIR BAG MODULE CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3049 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between driver side air bag: ♦ C3049-1, circuit CR105 (GN/BU), harness side and ground. ♦ C3049-2, circuit RR105 (GY/YE), harness side and ground.  N0059342 • **Is voltage present on either circuit?**	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR105 (GN/BU) or RR105 (GY/YE). GO to J28 . **No** GO to J23 .
J12 CHECK THE PASSENGER SIDE AIR BAG MODULE RESISTANCE PID (PS_AB)	
• Ignition ON.	**Yes** GO to J23 .

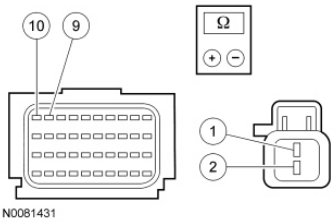
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: PS_AB (Passenger Side Impact Air Bag Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**No** GO to J13 .
J13 CHECK THE PASSENGER SIDE AIR BAG RESISTANCE PID (PS_AB) WHILE CARRYING OUT A HARNESS TEST	
• Continue monitoring the PS_AB (Passenger Side Impact Air Bag Resistance) resistance PID while carrying out a harness test of the passenger side air bag circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to J28 . **No** If the passenger side air bag resistance PID is less than 1.31 ohms, GO to J14 . If the passenger side air bag resistance PID is greater than 4.29 ohms, GO to J17 .
J14 CHECK THE PASSENGER SIDE AIR BAG MODULE FAULT PIDs (2295_24_OD) AND (2295_25_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3050 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM .	**Yes** GO to J22 . **No** GO to J15 .

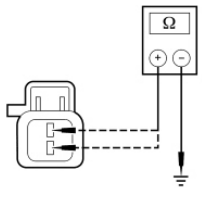
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• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side) ♦ 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit fault would normally be retrieved. • **Did the passenger side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**	
J15 CHECK FOR A SHORT BETWEEN PASSENGER SEAT SIDE AIR BAG CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between passenger side air bag C3050-1, circuit CR106 (GN/BU), harness side and C3050-2, circuit RR106 (GN/YE), harness side.  • **Is resistance greater than 10,000 ohms?**	**Yes** GO to J23 . **No** GO to J16 .
J16 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b pin 9, component side, and C310b pin 10, component side.  • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR106 (GN/BU) and RR106 (GN/YE). GO to J28 . **No** GO to J23 .

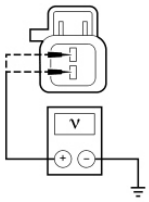
J17 CHECK THE PASSENGER SIDE AIR BAG MODULE FAULT PIDs (2295_25_OD) AND (2295_24_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3050 . • Connect a fused jumper wire between passenger side air bag C3050-1, circuit CR106 (GN/BU), harness side and C3050-2, circuit RR106 (GN/YE), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs . ♦ 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side) ♦ 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag circuits shorted together, a low resistance fault would normally be retrieved. • **Did the passenger side air bag on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**	**Yes** GO to J22 . **No** GO to J18 .
J18 CHECK PASSENGER SIDE AIR BAG MODULE CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the jumper wire from the passenger side air bag C3050. • Disconnect: RCM C310a and C310b .	**Yes** GO to J23 . **No** REPAIR circuit CR106 (GN/BU) or RR106 (GN/YE). GO to J28 .

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• Measure resistance between RCM C310b, harness side and passenger seat side air bag module C3050, harness side using the following chart. **RCM** / **Circuit** / **Passenger Seat Side Air Bag Module** C310b-9 / CR106 (VT/GY) / C3050-1 C310b-10 / RR106 (YE/OG) / C3050-2  N0081431 • **Are resistances less than 0.5 ohm?**	
J19 CHECK THE PASSENGER SIDE AIR BAG MODULE FAULT PIDs (2295_26_OD) AND (2295_25_OD) FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3050 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record The Following Fault PIDs .	**Yes** GO to J22 . **No** GO to J20 .

♦ 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side) ♦ 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side) • **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit fault would normally be retrieved. • **Did the passenger side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**	
J20 CHECK PASSENGER SIDE AIR BAG MODULE CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between passenger side air bag: ♦ C314-2, circuit CR106 (VT/GY), harness side and ground. ♦ C314-1, circuit RR106 (YE/OG), harness side and ground.  • **Is resistance greater than 10,000 ohms?**	**Yes** GO to J23 . **No** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR106 (VT/GY) or RR106 (YE/OG). GO to J28 .
J21 CHECK PASSENGER SIDE AIR BAG MODULE CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Side Air Bag Module C3050 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger side air bag:	**Yes** Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR circuit CR106 (VT/GY) or RR106 (YE/OG). GO to J28 . **No** GO to J23 .

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♦ C314-2, circuit CR106 (VT/GY), harness side and ground. ♦ C314-1, circuit RR106 (YE/OG), harness side and ground.  N0005052 • **Is voltage present on either circuit?**	
J22 CONFIRM THE SIDE AIR BAG MODULE FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Affected Side Air Bag C3049 (Driver) C3050 (Passenger) . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2295 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2295 fault PIDs. • **Does the original RCM on-demand 2295 fault PID indicate a fault?**	**Yes** REMOVE and INSPECT the seat side air bag module jumper harness, connector terminals, C3049 (Driver) C3050 (Passenger) for damage. REFER to Side Air Bag Module in this section. If a concern is found, REPAIR or INSTALL a new seat jumper harness. GO to J28 . If a concern was not found, INSTALL a new driver or passenger side air bag module. GO to J28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), GO to J24 . For (2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), GO to J26 . For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM

	(Side Air Bag Circuit Short to Battery, Front Passenger Side), GO to J27 .
J23 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • If previously directed to disconnect any SRS component(s): ♦ depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. ♦ connect all previously disconnected restraint system component(s), including RCM C310a and C310b. ♦ repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2295 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2295 fault PIDs. • **Does the original RCM on-demand 2295 fault PID indicate a fault?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to J28 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, GO to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), GO to J24 . For (2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), GO to J26 . For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), GO to J27 .
J24 CHECK SIDE AIR BAG MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN	
• If the fault was reported for the driver side air bag module, monitor the DS_AB (Driver Side Impact Air Bag Resistance) resistance PID. • If the fault was reported for the passenger side air bag, monitor the PS_AB (Passenger Side Impact Air Bag Resistance) resistance PID. • **NOTE:** A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to J28 . **No** GO to J25 .

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• Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any side air bag on-demand fault PID indicate a fault is present or is the side air bag resistance PID less than 1.31 ohms or greater than 4.29 ohms?**	
J25 CHECK THE HARNESS AND CONNECTORS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the affected side air bag module C3049 (driver) C3050 (passenger): ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. • **Were any concerns found?**	**Yes** REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to J28 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to J28 .
J26 CHECK SIDE AIR BAG MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND	
• If the fault was reported for the driver side air bag module, monitor the 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side) fault PID on the scan tool. • If the fault was reported for the passenger side air bag, monitor the 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side) fault PID on the scan tool. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any side air bag on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to J28 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do**

	so in the pinpoint test. REPAIR any intermittent wiring, terminal or connector concerns found. GO to J28 .
J27 CHECK SIDE AIR BAG MODULE FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the affected side air bag module C3049 (driver) C3050 (passenger). • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update. • Monitor the 2295_31_OD (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_OD (Side Air Bag Circuit Short to Battery, Front Passenger Side) on-demand fault PIDs on the scan tool. • Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness. • **Does any side air bag on-demand fault PID indicate a fault is present?**	**Yes** DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to J28 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to J28 .
J28 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

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Pinpoint Test K: DTC B2296

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) checks all of the impact sensor circuits for faults. If the RCM detects one of the following faults on any of the impact sensor circuits, it will store DTC B2296 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: Do not probe any impact sensor. The impact sensor is an electronic device and cannot be tested using a multi-meter.

Fault PIDs [a]	Description	Fault Trigger Condition
2296_18_OD and 2296_18_CM	Driver/Center Front Crash Sensor Internal Fault (LH front impact severity sensor)	When the Restraints Control Module (RCM) senses a internal failure with the driver/center front impact sensor, a fault will be indicated.
2296_19_OD and 2296_19_CM	Driver/Center Front Crash Sensor Mount/Communication Fault (LH front impact severity sensor)	When the RCM is unable to communicate with the driver/center front impact sensor, a fault will be indicated.
2296_24_OD and 2296_24_CM	Side Crash Sensor 2 Internal Fault, Passenger side (second row passenger side impact sensor)	When the RCM senses a internal failure with the passenger side second row impact sensor, a fault will be indicated.
2296_25_OD and 2296_25_CM	Side Crash Sensor Mount or Communication Fault, Row No. 2 Passenger Side (second row passenger side impact sensor)	When the RCM is unable to communicate with the passenger side second row impact sensor, a fault will be indicated.
2296_26_OD and 2296_26_CM	Side Crash Sensor 2 Internal Fault, Driver side (second row driver side impact sensor)	When the RCM senses a internal failure with the driver side second row impact sensor, a fault will be indicated.
2296_27_OD and 2296_27_CM	Side Crash Sensor Mount or Communication Fault, Row No. 2 Driver Side (second row driver side impact sensor)	When the RCM is unable to communicate with the driver side second row impact sensor, a fault will be indicated.
2296_28_OD and 2296_28_CM	Side Crash Sensor Internal Fault, Front Passenger Side (first row passenger side impact sensor)	When the RCM senses a internal failure with the passenger side first row impact sensor, a fault will be indicated.
2296_29_OD and 2296_29_CM	Side Crash Sensor Mount or Communication Fault, Front Passenger Side	When the RCM is unable to communicate with the passenger side first row impact sensor, a fault will be indicated.

	(first row passenger side impact sensor)	
2296_30_OD and 2296_30_CM	Side Crash Sensor Internal Fault, Front Driver Side (first row driver side impact sensor)	When the RCM senses a internal failure with the driver/center front impact sensor, a fault will be indicated.
2296_31_OD and 2296_31_CM	Side Crash Sensor Mount or Communication Fault, Front Driver Side (first row driver side impact sensor)	When the RCM is unable to communicate with the driver side first row impact sensor, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2296. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2296.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Impact sensor
- Incorrect sensor mounting
- RCM

PINPOINT TEST K: DTC B2296

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: Do not probe any impact sensor. The impact sensor is an electronic device and cannot be tested using a multi-meter.

Test Step	Result / Action to Take
K1 RETRIEVE RCM DTCs	
	Yes The fault condition is still present. This fault

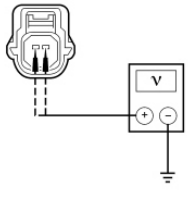
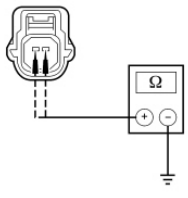
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• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs indicate a fault?**	cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2296_31_OD (Side Crash Sensor Mount or Communication Fault, Front Driver Side), GO to K2 . For 2296_30_OD (Side Crash Sensor Internal Fault, Front Driver Side), INSTALL a new first row driver side impact sensor. REFER to Side Impact Sensor - Front Door in this section. GO to K54 . For 2296_29_OD (Side Crash Sensor Mount or Communication Fault, Front Passenger Side), GO to K12 . For 2296_28_OD (Side Crash Sensor Internal Fault, Front Passenger Side), INSTALL a new first row passenger side impact sensor. REFER to Side Impact Sensor - Front Door in this section. GO to K54 . For 2296_27_OD (Side Crash Sensor Mount or Communication Fault, Row No. 2 Driver Side), GO to K22 . For 2296_26_OD (Side Crash Sensor 2 Internal Fault, Driver side), INSTALL a new second row driver side impact sensor. REFER to Side Impact Sensor - C-Pillar, Explorer Sport Trac in this section. GO to K54 . For 2296_25_OD (Side Crash Sensor Mount or Communication Fault, Row No. 2 Passenger Side), GO to K32 . For 2296_24_OD (Side Crash Sensor 2 Internal Fault, Passenger side), INSTALL a new second row passenger side impact sensor. REFER to Side Impact Sensor - C-Pillar, Explorer Sport Trac in this section. GO to K54 . For 2296_19_OD (Driver/Center Front Crash Sensor Mount/Communication Fault), GO to K42 . For 2296_18_OD (Driver/Center Front Crash Sensor Internal Fault), INSTALL a new front impact severity sensor. REFER to Front Impact

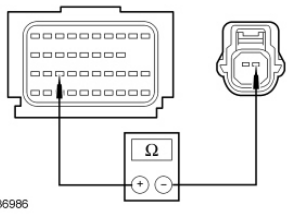
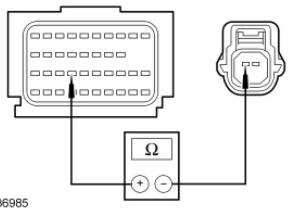
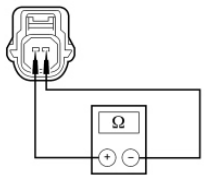
	Severity Sensor in this section. GO to K54 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to K53 .
K2 INSPECT THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the first row driver side impact sensor located in the driver front door. Refer to Side Impact Sensor - Front Door in this section. • Inspect the first row driver side impact sensor for: ♦ loose electrical connector. ♦ improper mounting. ♦ loose sensor mounting bolt. ♦ damaged U-nut. • Remove the first row driver side impact sensor. • Inspect the first row driver side impact sensor, electrical connector and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, the first row driver side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**	**Yes** CLEAN and TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the first row driver side impact sensor. GO to K54 . **No** GO to K3 .
K3 INSTALL THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the first row driver side impact sensor mounting bolt. • Install the first row driver side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs.	**Yes** GO to K4 . **No** Fault corrected. GO to K54 .

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• **Do any RCM on-demand 2296 fault PIDs for the first row driver side impact sensor indicate a fault?**	
K4 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Driver Side Impact Sensor C567a . • Measure resistance between first row driver side impact sensor C567a-2, circuit RR131 (VT/GY), harness side and the first row driver side impact sensor case ground. • **Is resistance less than 10 ohms?**	**Yes** GO to K6 . **No** GO to K5 .
K5 CLEAN THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST	
• Remove the first row driver side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the first row driver side impact sensor mounting bolt. • Install the first row driver side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the first row driver side impact sensor indicate a fault?**	**Yes** GO to K6 . **No** Fault corrected. GO to K54 .
K6 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Driver Side Impact Sensor C567a .	**Yes** REPAIR circuit VR217 (GY/YE) or RR131 (VT/GY). GO to K54 . **No** GO to K7 .

• Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between first row driver side impact sensor: ♦ C567a-2, circuit RR131 (VT/GY), harness side and ground. ♦ C567a-1, circuit VR217 (GY/YE), harness side and ground.  N0036990 • **Is voltage present on either circuit?**	
K7 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between first row driver side impact sensor: ♦ C567a-2, circuit RR131 (VT/GY), harness side and ground. ♦ C567a-1, circuit VR217 (GY/YE), harness side and ground.  N0036989 • **Are resistances greater than 10,000 ohms?**	**Yes** GO to K8 . **No** REPAIR short to ground in circuit VR217 (GY/YE) or RR131 (VT/GY). GO to K54 .
K8 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS FOR AN OPEN	
• Measure resistance between RCM C310b-28, circuit VR217 (GY/YE), harness side and first row driver side impact sensor C567a-1, circuit VR217 (GY/YE), harness side.	**Yes** GO to K9 . **No** REPAIR circuit VR217 (GY/YE). GO to K54 .

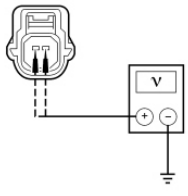
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 N0036986 • **Are resistances less than 0.5 ohm?**	
K9 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUIT FOR AN OPEN	
• Measure resistance between RCM C310b-27, circuit RR131 (VT/GY), harness side and first row driver side impact sensor C567a-2, circuit RR131 (VT/GY), harness side.  N0036985 • **Is resistance less than 0.5 ohm?**	**Yes** GO to K10 . **No** REPAIR circuit RR131 (VT/GY). GO to K54 .
K10 CHECK FOR A SHORT BETWEEN FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS	
• Measure resistance between first row driver side impact sensor C567a-1, circuit VR217 (GY/YE), harness side and C567a-2, circuit RR131 (VT/GY), harness side.  N0036987 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to K11 . **No** REPAIR circuits VR217 (GY/YE) and RR131 (VT/GY). GO to K54 .
K11 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b . • Install a known good first row driver side impact sensor.	**Yes** GO to K52 . **No** Fault corrected. GO to K54 .

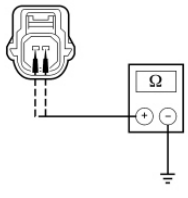
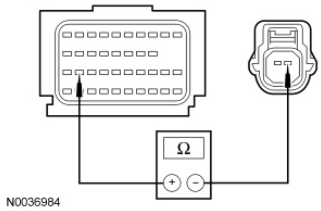
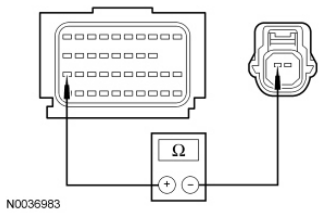
• Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the first row driver side impact sensor indicate a fault?**	
K12 INSPECT THE FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Access the first row passenger side impact sensor located in the front door. Refer to Side Impact Sensor - Front Door in this section. • Inspect the first row passenger side impact sensor for: ♦ loose electrical connector. ♦ improper mounting. ♦ loose sensor mounting bolt. ♦ damaged U-nut. • Remove the first row passenger side impact sensor. • Inspect the first row passenger side impact sensor, electrical connector and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, the first row passenger side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**	**Yes** CLEAN and TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the first row passenger side impact sensor. GO to K54 . **No** GO to K13 .
K13 INSTALL THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the first row passenger side impact sensor mounting bolt. • Install the first row passenger side impact sensor.	**Yes** GO to K14 . **No** Fault corrected. GO to K54 .

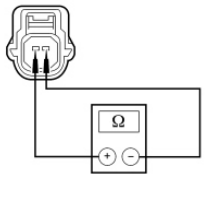
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• Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the first row passenger side impact sensor indicating a fault?**	
K14 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Passenger Side Impact Sensor C644a . • Measure resistance between the first row passenger side impact sensor C644a-2, circuit RR132 (BU/WH), harness side and the first row passenger side impact sensor case ground. • **Is resistance less than 10 ohms?**	**Yes** GO to K16 . **No** GO to K15 .
K15 CLEAN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE SELF TEST	
• Remove the first row passenger side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the first row passenger side impact sensor mounting bolt. • Install the first row passenger side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs.	**Yes** GO to K16 . **No** Fault corrected. GO to K54 .

• **Do any RCM on-demand 2296 fault PIDs for the first row passenger side impact sensor indicating a fault?**	
K16 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: First Row Passenger Side Impact Sensor C644a . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between first row passenger side impact sensor: ♦ C644a-1, circuit VR218 (YE/OG), harness side and ground. ♦ C644a-2, circuit RR132 (BU/WH), harness side and ground.  N0036990 • **Is voltage present on either circuit?**	**Yes** REPAIR circuit VR218 (YE/OG) or RR132 (BU/WH). GO to K54 . **No** GO to K17 .
K17 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between first row passenger side impact sensor: ♦ C644a-1, circuit VR218 (YE/OG), harness side and ground. ♦ C644a-2, circuit RR132 (BU/WH), harness side and ground.	**Yes** GO to K18 . **No** REPAIR circuit VR218 (YE/OG) or RR132 (BU/WH). GO to K54 .

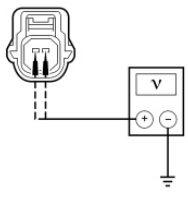
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 • **Are resistances greater than 10,000 ohms?**	
K18 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUIT FOR AN OPEN	
• Measure resistance between RCM C310b-29, circuit VR218 (YE/OG), harness side and first row passenger side impact sensor C644a-1, circuit VR218 (YE/OG), harness side.  • **Are resistances less than 0.5 ohm?**	**Yes** GO to K19 . **No** REPAIR circuit VR218 (YE/OG). GO to K54 .
K19 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUIT FOR AN OPEN	
• Measure resistance between RCM C310b-30, circuit RR132 (BU/WH), harness side and first row passenger side impact sensor C644a-2, circuit RR132 (BU/WH), harness side.  • **Is resistance less than 0.5 ohm?**	**Yes** GO to K20 . **No** REPAIR circuit RR132 (BU/WH). GO to K54 .
K20 CHECK FOR A SHORT BETWEEN FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS	
• Measure resistance between first row passenger side impact sensor C644a-1, circuit VR218 (YE/OG), harness side and C644a-2, circuit RR132 (BU/WH), harness side.	**Yes** GO to K21 . **No** REPAIR circuits VR218 (YE/OG) and RR132 (BU/WH). GO to K54 .

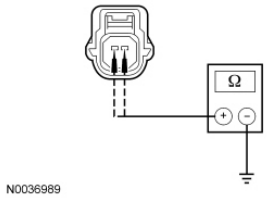
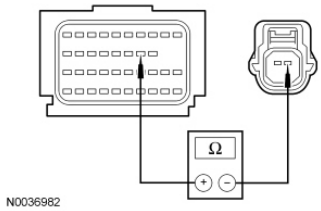
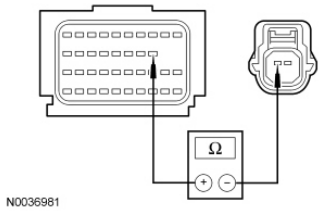
 N0036987 • **Is resistance greater than 10,000 ohms?**	
K21 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b . • Install a known good first row passenger side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the first row passenger side impact sensor indicating a fault?**	**Yes** GO to K52 . **No** Fault corrected. GO to K54 .
K22 INSPECT THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Inspect the second row driver side impact sensor mounting and make sure that the retaining bolts are fully seated and tightened correctly. • Remove the second row driver side impact sensor. • Inspect the second row driver side impact sensor and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, the second row driver side impact sensor attached to the mounting surface incorrectly or were the impact sensor bolts not fully seated and tightened correctly?**	**Yes** CLEAN and TIGHTEN the bolts or REPAIR the mounting surface as necessary. REINSTALL the second row driver side impact sensor. GO to K54 . **No** GO to K23 .

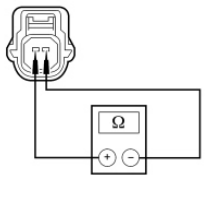
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K23 INSTALL THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the second row driver side impact sensor mounting bolt. • Install the second row driver side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the second row driver side impact sensor indicating a fault?**	**Yes** GO to K24 . **No** Fault corrected. GO to K54 .
K24 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Driver Side Impact Sensor C3248 . • Measure resistance between second row driver side impact sensor C3248-2, circuit RR135 (GN/BN), harness side and the second row driver side impact sensor case ground. • **Is resistance less than 10 ohms?**	**Yes** GO to K26 . **No** GO to K25 .
K25 CLEAN THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE SELF TEST	
• Remove the second row driver side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the second row driver side impact sensor mounting bolts. • Install the second row driver side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint	**Yes** GO to K26 . **No** Fault corrected. GO to K54 .

System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the second row driver side impact sensor indicating a fault?**	
K26 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Driver Side Impact Sensor C3248 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between second row driver side impact sensor: ♦ C3248-1, circuit VR221 (BU/GN), harness side and ground. ♦ C3248-2, circuit RR135 (GN/BN), harness side and ground.  N0036990 • **Is voltage present on either circuit?**	**Yes** REPAIR circuit VR221 (BU/GN) or RR135 (GN/BN). GO to K54 . **No** GO to K27 .
K27 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between second row driver side impact sensor:	**Yes** GO to K28 . **No** REPAIR circuit VR221 (BU/GN) or RR135 (GN/BN). GO to K54 .

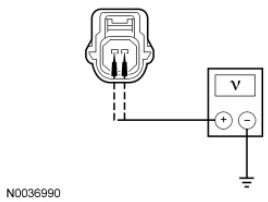
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♦ C3248-1, circuit VR221 (BU/GN), harness side and ground. ♦ C3248-2, circuit RR135 (GN/BN), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	
K28 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS FOR AN OPEN	
• Measure resistance between RCM C310b-14, circuit VR221 (BU/GN), harness side and second row driver side impact sensor C3248-1, circuit VR221 (BU/GN), harness side.  • **Are resistances less than 0.5 ohm?**	**Yes** GO to K29 . **No** REPAIR circuit VR221 (BU/GN). GO to K54 .
K29 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUIT FOR AN OPEN	
• Measure resistance between RCM C310b-13, circuit RR135 (GN/BN), harness side and second row driver side impact sensor C3248-2, circuit RR135 (GN/BN), harness side.  • **Is resistance less than 0.5 ohm?**	**Yes** GO to K30 . **No** REPAIR circuit RR135 (GN/BN). GO to K54 .
K30 CHECK FOR A SHORT BETWEEN SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS	

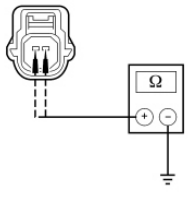
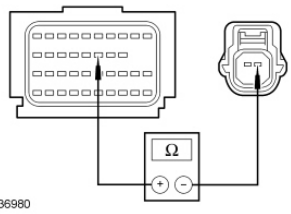
• Measure resistance between second row driver side impact sensor C3248-1, circuit VR221 (BU/GN), harness side and C3248-2, circuit RR135 (GN/BN), harness side.  N0036987 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to K31 . **No** REPAIR circuits VR221 (BU/GN) and RR135 (GN/BN). GO to K54 .
K31 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b . • Install a known good second row driver side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the second row driver side impact sensor indicating a fault?**	**Yes** GO to K52 . **No** Fault corrected. GO to K54 .
K32 INSPECT THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Inspect the second row passenger side impact sensor mounting and make sure that the retaining bolt are fully seated and tightened correctly. • Remove the second row passenger side impact sensor. • Inspect the second row passenger side impact sensor and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, the second row passenger side**	**Yes** CLEAN, TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the second row passenger side impact sensor. GO to K54 . **No** GO to K33 .

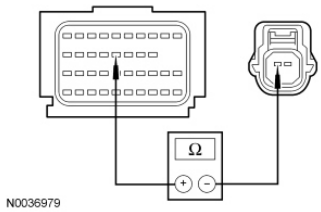
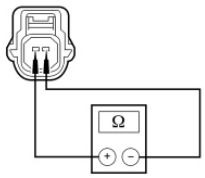
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impact sensor attached to the mounting surface incorrectly or were the impact sensor bolt not fully seated and tightened correctly?	
K33 INSTALL THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the second row passenger side impact sensor mounting bolt. • Install the second row passenger side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the second row passenger side impact sensor indicating a fault?**	**Yes** GO to K34 . **No** Fault corrected. GO to K54 .
K34 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Passenger Side Impact Sensor C3249 . • Measure resistance between second row passenger side impact sensor C3249-2, circuit RR136 (BN/WH), harness side and the second row passenger side impact sensor case ground. • **Is resistance less than 10 ohms?**	**Yes** GO to K36 . **No** GO to K35 .
K35 CLEAN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE SELF TEST	
• Remove the second row passenger side impact sensor. • Clean and repair the mounting surface as necessary. • Clean the second row passenger side impact sensor mounting bolts.	**Yes** GO to K36 . **No** Fault corrected. GO to K54 .

• Install the second row passenger side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the second row passenger side impact sensor indicating a fault?**	
K36 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Second Row Passenger Side Impact Sensor C3249 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between second row passenger side impact sensor: ♦ C3249-1, circuit VR222 (GY/OG), harness side and ground. ♦ C3249-2, circuit RR136 (BN/WH), harness side and ground.  • **Is voltage present on either circuit?**	**Yes** REPAIR circuits VR222 (GY/OG) or RR136 (BN/WH). GO to K54 . **No** GO to K37 .
K37 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between second row passenger side impact sensor: ♦ C3249-1, circuit VR222 (GY/OG), harness side and ground. ♦ C3249-2, circuit RR136 (BN/WH), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to K38 . **No** REPAIR circuits VR222 (GY/OG) or RR136 (BN/WH). GO to K54 .
K38 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR AN OPEN	
• Measure resistance between RCM C310b-15, circuit VR222 (GY/OG), harness side and second row passenger side impact sensor C3249-1, circuit VR222 (GY/OG), harness side.  • **Are resistances less than 0.5 ohm?**	**Yes** GO to K39 . **No** REPAIR circuit VR222 (GY/OG). GO to K54 .
K39 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUIT FOR AN OPEN	
• Measure resistance between RCM C310b-16, circuit RR136 (BN/WH), harness side and second row passenger side impact sensor C3249-2, circuit RR136 (BN/WH), harness side.	**Yes** GO to K40 . **No** REPAIR circuit RR136 (BN/WH). GO to K54 .

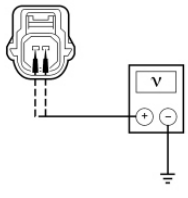
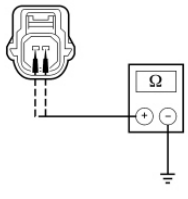
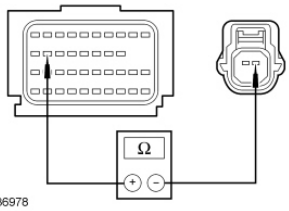
 N0036979 • **Is resistance less than 0.5 ohm?**	
K40 CHECK FOR A SHORT BETWEEN SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS	
• Measure resistance between second row passenger side impact sensor C3249-1, circuit VR222 (GY/OG), harness side and C3249-2, circuit RR136 (BN/WH), harness side.  N0036987 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to K41 . **No** REPAIR circuits VR222 (GY/OG) and RR136 (BN/WH). GO to K54 .
K41 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR	
• Connect: RCM C310a and C310b . • Install a known good second row passenger side impact sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the second row passenger side impact sensor indicating a fault?**	**Yes** GO to K52 . **No** Fault corrected. GO to K54 .
K42 INSPECT THE DRIVER\CENTER FRONT CRASH SENSOR MOUNTING AND MOUNTING SURFACE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and	**Yes** CLEAN and TIGHTEN bolt or REPAIR the mounting surface as necessary. REINSTALL the driver\center front crash sensor. GO to K54 .

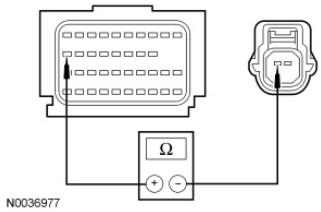
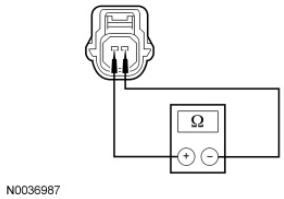
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Repowering in this section. • Inspect the driver\center crash sensor mounting and make sure that the retaining bolt is fully seated and tightened correctly. • Remove the driver\center front crash sensor. Refer to Front Impact Severity Sensor . • Inspect the driver\center front crash sensor and mounting surface for damage, corrosion or dirt. • **Was a significant amount of corrosion or dirt found, the driver\center front crash sensor attached to the mounting surface incorrectly or was the driver\center front crash sensor bolt not fully seated and tightened correctly?**	**No** GO to K43 .
K43 INSTALL THE DRIVER\CENTER FRONT CRASH SENSOR AND CARRY OUT THE SELF TEST	
• Clean and repair the mounting surface as necessary. • Clean the driver\center front crash sensor mounting bolt. • Install the driver\center front crash sensor. Refer to Front Impact Severity Sensor . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the driver\center front crash sensor indicating a fault?**	**Yes** GO to K44 . **No** Fault corrected. GO to K54 .
K44 CHECK THE DRIVER\CENTER FRONT CRASH SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver\Center Front Crash Sensor C1465 . • Measure resistance between driver\center front crash sensor C1465-2, circuit RR129 (YE/GY), harness side and the driver\center front crash sensor case ground.	**Yes** GO to K46 . **No** GO to K45 .

• **Is resistance less than 10 ohms?**	
K45 CLEAN THE DRIVER\CENTER FRONT CRASH SENSOR MOUNTING SURFACE AND CARRY OUT THE SELF TEST	
• Remove the driver\center front crash sensor. Refer to Front Impact Severity Sensor . • Clean and repair the mounting surface as necessary. • Clean the driver\center front crash sensor mounting bolt. • Install the driver\center front crash sensor. Refer to Front Impact Severity Sensor . • Repower the SRS . **Do not** prove out the SRS in this section at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the driver\center front crash sensor indicating a fault?**	**Yes** GO to K46 . **No** Fault corrected. GO to K54 .
K46 CHECK DRIVER\CENTER FRONT CRASH SENSOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver\Center Front Crash Sensor C1465 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between driver\center front crash sensor: ♦ C1465-1, circuit VR213 (VT/GN), harness side and ground. ♦ C1465-2, circuit RR129 (YE/GY), harness side and ground.	**Yes** REPAIR circuit VR213 (VT/GN) or RR129 (YE/GY). GO to K54 . **No** GO to K47 .

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 • **Is voltage present on either circuit?**	
K47 CHECK DRIVER\CENTER FRONT CRASH SENSOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Measure resistance between driver\center front crash sensor: ♦ C1465-1, circuit VR213 (VT/GN), harness side and ground. ♦ C1465-2, circuit RR129 (YE/GY), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to K48 . **No** REPAIR circuit VR213 (VT/GN) or RR129 (YE/GY). GO to K54 .
K48 CHECK DRIVER\CENTER FRONT CRASH SENSOR CIRCUIT FOR AN OPEN	
• Measure resistance between RCM C310b-19, circuit VR213 (VT/GN), harness side and LH front impact severity sensor C1465-1, circuit VR213 (VT/GN), harness side.  • **Is resistance less than 0.5 ohm?**	**Yes** GO to K49 . **No** REPAIR circuit VR213 (VT/GN). GO to K54 .
K49 CHECK DRIVER\CENTER FRONT CRASH SENSOR FOR AN OPEN	

• Measure resistance between RCM C310b-20, circuit RR129 (YE/GY), harness side and LH front impact severity sensor C1465-2, circuit RR129 (YE/GY), harness side.  N0036977 • **Is resistance less than 0.5 ohm?**	**Yes** GO to K50 . **No** REPAIR circuit RR129 (YE/GY). GO to K54 .
K50 CHECK FOR A SHORT BETWEEN DRIVER\CENTER FRONT CRASH SENSOR CIRCUITS	
• Measure resistance between LH front impact severity sensor C1465-1, circuit VR213 (VT/GN), harness side and C1465-2, circuit RR129 (YE/GY), harness side.  N0036987 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to K51 . **No** REPAIR circuits VR213 (VT/GN) and RR129 (YE/GY). GO to K54 .
K51 CHECK THE DRIVER\CENTER FRONT CRASH SENSOR	
• Connect: RCM C310a and C310b . • Install a known good LH front impact severity sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs for the driver\center front crash sensor indicating a fault?**	**Yes** GO to K52 . **No** Fault corrected. GO to K54 .

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K52 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Install the original sensor. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Does the original RCM on-demand 2296 fault PID indicate a fault?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to K54 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to K54 .
K53 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2296 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2296 fault PIDs. • **Do any RCM on-demand 2296 fault PIDs indicate a fault?**	**Yes** The fault condition is now present. The fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Using the fault PIDs recorded, GO to the appropriate pinpoint test step. For 2296_31_OD (Side Crash Sensor Mount or Communication Fault, Front Driver Side), GO to K2 . For 2296_30_OD (Side Crash Sensor Internal Fault, Front Driver Side), INSTALL a new first row driver side impact sensor. REFER to Side Impact Sensor - Front Door in this section. GO to K54 . For 2296_29_OD (Side Crash Sensor Mount or Communication Fault, Front Passenger Side), GO to K12 . For 2296_28_OD (Side Crash Sensor Internal Fault, Front Passenger Side), INSTALL a new first row passenger side impact sensor. REFER to Side Impact Sensor - Front Door in this

	section. GO to K54 . For 2296_27_OD (Side Crash Sensor Mount or Communication Fault, Row No. 2 Driver Side), GO to K22 . For 2296_26_OD (Side Crash Sensor 2 Internal Fault, Driver side), INSTALL a new second row driver side impact sensor. REFER to Side Impact Sensor - C-Pillar, Explorer Sport Trac in this section. GO to K54 . For 2296_25_OD (Side Crash Sensor Mount or Communication Fault, Row No. 2 Passenger Side), GO to K32 . For 2296_24_OD (Side Crash Sensor 2 Internal Fault, Passenger side), INSTALL a new second row passenger side impact sensor. REFER to Side Impact Sensor - C-Pillar, Explorer Sport Trac in this section. GO to K54 . For 2296_19_OD (Driver/Center Front Crash Sensor Mount/Communication Fault), GO to K42 . For 2296_18_OD (Driver/Center Front Crash Sensor Internal Fault), INSTALL a new front impact severity sensor. REFER to Front Impact Severity Sensor in this section. GO to K54 . **No** INSPECT the affected impact sensor and mounting surface for damage, corrosion or dirt. INSPECT the wiring, terminals and connectors for damage, corrosion or dirt. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to K54 .
K54 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN

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• Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	the vehicle to the customer.

Pinpoint Test L: DTC B2434

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the Restraints Control Module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2434 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2434 (Drivers Seat Belt Buckle Switch Circuit Short to Ground) - If the RCM detects a short to ground on the driver safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST L: DTC B2434

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

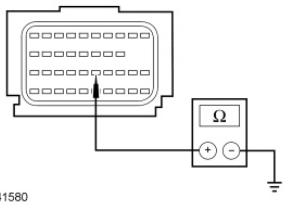
Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
L1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2434 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to L2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to L5 .
L2 CHECK DRIVER SAFETY BELT BUCKLE SWITCH FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Switch C3065 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety belt buckle switch on-demand DTC change from indicating B2434 to B2691?**	**Yes** INSTALL a new driver safety belt buckle assembly. REFER to Section 501-20A . GO to L6 . **No** GO to L3 .
L3 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO GROUND	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-25, circuit CR201 (GN/BU), harness side and ground.  A0041580 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to L4 . **No** REPAIR circuit CR201 (BU/OG)/(GN/BU). GO to L6 .
L4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Connect: Driver Safety Belt Buckle Switch C3065 . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2434 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to L6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to L6 .
L5 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2434 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to L2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS**

	components at this time. SRS components should only be installed when directed to do so in the pinpoint test. REPAIR any intermittent wiring, terminal or connector concerns found. GO to L6 .
L6 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test M: DTC B2435

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the Restraints Control Module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2435 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2435 (Drivers Seat Belt Buckle Switch Resistance Out of Range) - If the RCM detects a current out of range between buckled and unbuckled on the driver safety belt buckle switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Driver safety belt buckle and pretensioner assembly
- RCM

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PINPOINT TEST M: DTC B2435

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
M1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2435 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to M2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to M4 .
M2 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Safety Belt Buckle Switch C3065 .	**Yes** INSTALL a new driver safety belt buckle assembly. REFER to Section 501-20A . GO to M5 . **No** GO to M3 .

• Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, an open circuit fault would normally be retrieved. • **Did the driver safety belt buckle switch on-demand DTC change from indicating B2435 to B2691?**	
M3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Driver Safety Belt Buckle Switch C3065 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2435 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to M5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to M4 .
M4 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the driver safety belt buckle switch C3065: ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to M2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and

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terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. ♦ repair any concerns found. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. • Connect: All Previously Disconnected Component(s)/Connector(s) . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2435 retrieved on-demand during self-test?**	cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to M5 .
M5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test N: DTC B2438

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the Restraints Control Module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2438 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2438 (Passenger's Seat Belt Buckle Switch Circuit Short to Ground) - If the RCM detects a short to ground on the passenger safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST N: DTC B2438

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

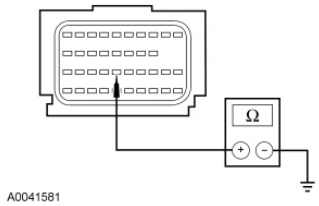
NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
N1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM .	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to N2 .

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• **Was DTC B2438 retrieved on-demand during self-test?**	**No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to N5 .
N2 CHECK PASSENGER SAFETY BELT BUCKLE SWITCH FOR A SHORT TO GROUND	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Switch C3066 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2438 to B2692?**	**Yes** INSTALL a new passenger safety belt buckle assembly. REFER to Section 501-20A . GO to N6 . **No** GO to N3 .
N3 CHECK THE SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310b-26, circuit CR203 (GY/VT), harness side and ground.	**Yes** GO to N4 . **No** REPAIR circuit CR203 (GY/VT). GO to N6 .

 • **Is resistance greater than 10,000 ohms?**	
N4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Connect: Passenger Safety Belt Buckle Switch C3066 . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2438 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to N6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to N5 .
N5 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2438 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to N2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to N6 .
N6 CHECK FOR ADDITIONAL SRS DTCs	

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• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test O: DTC B2439

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the Restraints Control Module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2439 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2439 (Passengers Seat Belt Buckle Switch Resistance Out of Range) - If the RCM detects a current out of range between buckled and unbuckled on the passenger safety belt buckle switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST O: DTC B2439

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
O1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2439 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to O2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to O4 .
O2 CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Safety Belt Buckle Switch C3066 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and	**Yes** INSTALL a new passenger safety belt buckle assembly. REFER to Section 501-20A . GO to O5 . **No** GO to O3 .

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Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, an open circuit fault would normally be retrieved. • **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2439 to B2692?**	
O3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Passenger Safety Belt Buckle Switch C3066 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2439 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to O5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to O4 .
O4 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the passenger safety belt buckle switch C3066: ♦ inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals. ♦ inspect wire harness for any damage, pinched, cut or pierced wires. ♦ repair any concerns found.	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to O2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to O5 .

Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. • Connect: All Previously Disconnected Component(s)/Connector(s) . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2439 retrieved on-demand during self-test?**	
O5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test P: DTC B2691

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the Restraints Control Module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules.

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If the RCM detects an open circuit or short to voltage fault, it will store DTC B2691 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2691 (Seat Belt Buckle Switch Circuit Fault, Front Driver's Side) - If the RCM detects an open or short to voltage on the driver safety belt buckle switch circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST P: DTC B2691

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

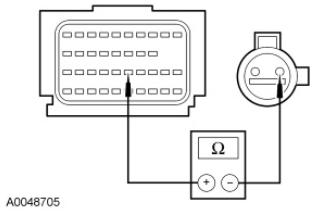
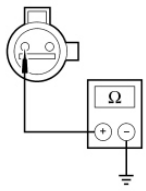
NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

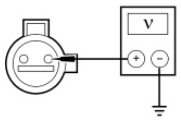
NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
P1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2691 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to P2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to P7 .
P2 CHECK DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR AN OPEN	

• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Disconnect: Driver Safety Belt Buckle Switch C3065 . • Measure resistance between RCM C310b-25, circuit CR201 (GN/BU), harness side and driver safety belt buckle switch C3065-1, circuit CR201 (BU/OG), harness side.  A0048705 • **Is resistance less than 0.5 ohm?**	**Yes** GO to P3 . **No** REPAIR circuit CR201 (BU/OG)/(GN/BU). GO to P8 .
P3 CHECK DRIVER SAFETY BELT BUCKLE SWITCH GROUND CIRCUIT FOR AN OPEN	
• Measure resistance between driver safety belt buckle switch C3065-2, circuit GD145 (BK/BU), harness side and ground.  A0048711 • **Is resistance less than 5 ohms?**	**Yes** GO to P4 . **No** REPAIR circuit GD145 (BK/BU). GO to P8 .
P4 CHECK DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO VOLTAGE	
• Disconnect: Driver Seat Side Air Bag Module C3049 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** REPAIR circuit CR201 (BU/OG)/(GN/BU). GO to P8 . **No** GO to P5 .

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• Ignition ON. • Measure voltage between driver safety belt buckle switch C3065-1, circuit CR201 (BU/OG), harness side and ground.  A0048712 • **Is any voltage present?**	
P5 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH DTCs FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a and C310b . • Connect a fused jumper wire between driver safety belt buckle switch C3065-1, circuit CR201 (BU/OG)/(GN/BU), harness side and C3065-2, circuit GD145 (BK/BU), harness side. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved. • **Did the driver safety belt buckle switch on-demand DTC change**	**Yes** INSTALL a new driver safety belt buckle assembly. REFER to Section 501-20A . GO to P8 . **No** GO to P6 .

from indicating B2691 to B2434?	
P6 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the fused jumper wire from driver safety belt buckle switch C3065. • Connect: Driver Safety Belt Buckle Switch C3065 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2691 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to P8 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to P7 .
P7 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Side Air Bag Module C3049 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2691 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to P2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to P8 .
P8 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF.	**Yes** Do not clear any DTCs until all DTCs have been

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• **⚠ WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test Q: DTC B2692

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the Restraints Control Module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled, to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules.

If the RCM detects an open circuit or short to voltage fault, it will store DTC B2692 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2692 (Front Passenger's Safety Belt Buckle Switch Circuit Fault) - If the RCM detects an open or short to voltage on the passenger safety belt buckle switch circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST Q: DTC B2692

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

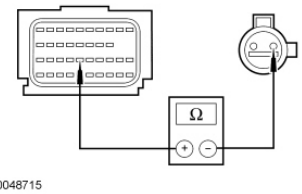
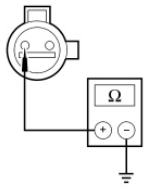
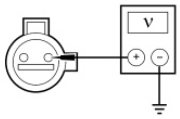
Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
Q1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2692 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Q2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to Q7 .
Q2 CHECK PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Disconnect: Passenger Safety Belt Buckle Switch C3066 . • Measure resistance between RCM C310b-26, circuit CR203 (GY/VT), harness side and the passenger safety belt buckle switch C3066-1, circuit CR203 (GY/VT), harness side.	**Yes** GO to Q3 . **No** REPAIR circuit CR203 (GY/VT). GO to Q8 .

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 A0048715 • **Is resistance less than 0.5 ohm?**	
Q3 CHECK PASSENGER SAFETY BELT BUCKLE SWITCH GROUND CIRCUIT FOR AN OPEN	
• Measure resistance between passenger safety belt buckle switch C3066-2, circuit GD145 (BK/BU), harness side and ground.  A0048711 • **Is resistance less than 5 ohms?**	**Yes** GO to Q4 . **No** REPAIR circuit GD145 (BK/BU). GO to Q8 .
Q4 CHECK PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO VOLTAGE	
• Disconnect: Passenger Seat Side Air Bag Module C3050 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between passenger safety belt buckle switch C3066-1, circuit CR203 (GY/VT), harness side and ground.  A0048712 • **Is any voltage present?**	**Yes** REPAIR circuit CR203 (GY/VT). GO to Q8 . **No** GO to Q5 .

Q5 CHECK THE SAFETY BELT BUCKLE SWITCH DTCs FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a and C310b . • Connect a fused jumper wire between passenger safety belt buckle switch C3066-1, circuit CR203 (GY/VT), harness side and C3066-2, circuit GD145 (BK/BU), harness side. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved. • **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2692 to B2438?**	**Yes** INSTALL a new passenger safety belt buckle assembly. REFER to Section 501-20A . GO to Q8 . **No** GO to Q6 .
Q6 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the fused jumper wire from passenger safety belt buckle switch	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to Q8 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to Q7 .

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C3066. • Connect: Passenger Safety Belt Buckle Switch C3066 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2692 retrieved on-demand during self-test?**	
Q7 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Passenger Seat Side Air Bag Module C3050 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2692 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Q2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to Q8 .
Q8 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints .	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

• **Are any RCM and/or OCSM DTCs indicating a fault?**	

Pinpoint Test R: DTC B2792

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) monitors all the deployable devices for a cross link between the circuits of another deployable device. If the RCM detects a short between the circuits of the deployable devices, it will store DTC B2792 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs [a]	Description	Fault Trigger Condition
2792_8_OD and 2792_8_CM	A-B or A-C pillar Curtain, Passenger Side	When the Restraints Control Module (RCM) detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_9_OD and 2792_9_CM	A-B or A-C pillar Curtain, Driver Side	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_12_OD and 2792_12_CM	Side Airbag Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_13_OD and 2792_13_CM	Side Airbag Driver	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_14_OD and 2792_14_CM	Airbag Adaptive Tether Front Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_16_OD and 2792_16_CM	Deployable Steering Column	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_17_OD and 2792_17_CM	Driver Seatbelt Load Limiter	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_18_OD and 2792_18_CM	Passenger Seatbelt Load Limiter	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_19_OD and 2792_19_CM	Passenger Airbag Front CAN Vent	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_20_OD and 2792_20_CM	Driver Airbag Front CAN Vent	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_26_OD and 2792_26_CM	Pretensioner Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_27_OD and 2792_27_CM	Pretensioner Driver	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_28_OD and 2792_28_CM	Airbag Passenger Front Loop #2	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_29_OD and 2792_29_CM	Airbag Passenger Front Loop #1	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_30_OD and 2792_30_CM	Airbag Driver Front Loop #2	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.

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2792_31_OD and 2792_31_CM	Airbag Driver Front Loop #1	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2792. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2792.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RCM

PINPOINT TEST R: DTC B2792

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

Test Step	Result / Action to Take
R1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2792 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2792 fault PIDs.	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to R2 . **No** This is an intermittent fault when present as a

• **Do any RCM on-demand 2792 fault PIDs indicate a fault?**	CMDTC only. The fault condition is not present at this time. GO to R4 .
R2 CHECK DEPLOYABLE CIRCUITS FOR A CROSS LINK FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Disconnect **ALL of the affected** deployable devices as indicated by the fault PIDs in Step R1. • Using the fault PIDs recorded and the following table, measure the resistance between the circuits of the affected deployable devices.	**Yes** GO to R3 . **No** REPAIR the affected circuits. GO to R5 .

Deployable Devices

Fault PID (loop/deployable device)	Connector - Pin	Circuit
2792_31_OD (Airbag Driver Front Loop #1)	• C310a-3 • C310a-4	• RR101 (YE/GN) • CR101 (VT/BN)
2792_30_OD (Airbag Driver Front Loop #2)	• C310a-15 • C310a-16	• RR102 (WH) • CR102 (BU)
2792_20_OD (Airbag Driver Front Can Vent)	• C310b-3 • C310b-4	• RR143 (BU/GN) • CR143 (VT)
2792_29_OD (Airbag Passenger Front Loop #1)	• C310a-1 • C310a-2	• CR103 (GY/BU) • RR103 (VT/GN)
2792_28_OD (Airbag Passenger Front Loop #2)	• C310a-5 • C310a-6	• CR104 (YE/GY) • RR104 (WH/BU)
2792_19_OD (Airbag Passenger Front Can Vent)	• C310b-5 • C310b-6	• CR144 (GY/OG) • RR144 (VT/GN)
2792_14_OD (Airbag Adaptive	• C310a-13 • C310a-14	• CR145 (WH/OG)

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Tether Front Passenger)		• RR145 (GY/YE)
2792_13_OD (Side Airbag Driver)	• C310b-7 • C310b-8	• RR105 (GY/YE) • CR105 (GN/BU)
2792_12_OD (Side Airbag Passenger)	• C310b-9 • C310b-10	• CR106 (VT/GY) • RR106 (YE/OG)
2792_9_OD (A-B or A-C pillar Curtain, Driver Side)	• C310b-21 • C310b-22	• CR109 (BN/BU) • RR109 (BU/GN)
2792_8_OD (A-B or A-C pillar Curtain, Passenger Side)	• C310b-1 • C310b-2	• CR111 (BN/WH) • RR111 (YE/VT)
2792_17_OD (Seatbelt load limiter - Driver)	• C310b-35 • C310b-36	• CR146 (GY/VT) • RR146 (BU/BN)
2792_18_OD (Seatbelt load limiter - Passenger)	• C310b-37 • C310b-38	• RR147 (YE/VT) • CR147 (GN/OG)
2792_27_OD (Pretensioner Driver)	• C310b-31 • C310b-32	• CR120 (BU/OG) • RR120 (BN/GN)
2792_26_OD (Pretensioner Passenger)	• C310b-33 • C310b-34	• RR122 (BN) • CR122 (WH/OG)
2792_16_OD (Deployable Steering Column)	• C310a-19 • C310a-20	• CR139 (VT/WH) • RR139 (YE)

- **Are resistances greater than 10,000 ohms between the affected circuits?**

R3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Connect: RCM C310a and C310b .	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to R5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and

• Connect: All Previously Disconnected SRS Components . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2792 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2792 fault PIDs. • **Does the original RCM on-demand 2792 fault PID indicate a fault?**	terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to R5 .
R4 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • If a cross link fault for driver air bag loop 1, loop 2 or canister vent is present continuous, remove the driver air bag module. Refer to Driver Air Bag Module in this section. • If a cross link fault for passenger air bag module loop 1 or loop 2 is present continuous, disconnect the passenger air bag module C256. • If a cross link fault for passenger air bag module canister vent is present continuous, disconnect the passenger air bag module canister vent electrical connector. • If a cross link fault for passenger air bag module adaptive tether is present continuous, disconnect the passenger air bag module adaptive tether electrical connector. • If a cross link fault for driver seat side air bag is present continuous, disconnect the driver seat side air bag module C3049. • If a cross link fault for passenger seat side air bag is present continuous, disconnect the passenger seat side air bag module C3050. • If a cross link fault for driver Safety Canopy® module is present continuous, disconnect the driver Safety Canopy® module C3213 (Explorer/Mountaineer)/C9006 (Explorer Sport Trac). • If a cross link fault for passenger Safety Canopy® module is present continuous,	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to R2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition frequently and rotating the steering wheel (driver air bag module fault). **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to R5 .

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disconnect the passenger Safety Canopy® module C3214 (Explorer/Mountaineer)/C9007 (Explorer Sport Trac). • If a cross link fault for driver safety belt buckle pretensioner is present continuous, disconnect the driver safety belt buckle pretensioner C3201. • If a cross link fault for passenger safety belt buckle pretensioner is present continuous, disconnect the passenger safety belt buckle pretensioner C3202. • If a cross link fault for deployable steering column is present continuous, disconnect the deployable steering column C2318. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • Enter the following diagnostic mode on the scan tool: DataLogger - RCM - View and Record All 2792 Fault PIDs . ♦ Refer to PID list in Normal Operation to view 2792 fault PIDs. • **Do any RCM on-demand 2792 fault PIDs indicate a fault?**	
R5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test S: DTC B2984/B2987

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), this vehicle is equipped a deployable steering column. The Restraints Control Module (RCM) will deploy (collapse) the steering column during a frontal collision when seat position information and other parameters reach predetermined limits. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The RCM continuously monitors the deployable steering column circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store a DTC (B2984, B2985, B2986 or B2987) in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors deployable steering column circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC B2984 or B2987 respectfully if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

- DTC B2984 (Deployable Steering Column Circuit Open) - If the RCM detects an open on the deployable steering column circuits, it will set this DTC.
- DTC B2987 (Deployable Steering Column Circuit Resistance Low on Squib) - If the RCM detects loop resistance less than 0.9 ohm on the deployable steering column circuits, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Deployable steering column
- RCM

PINPOINT TEST S: DTC B2984/B2987

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

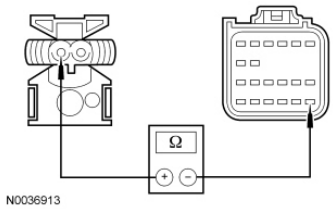
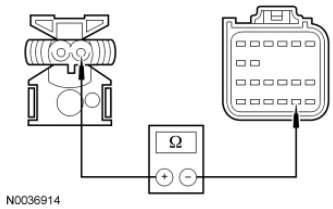
NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

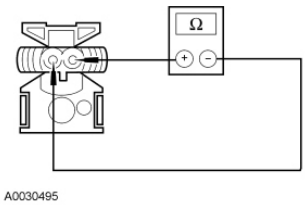
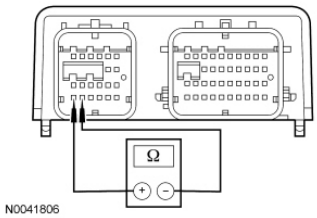
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Test Step	Result / Action to Take
S1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2984 or B2987 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to S2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to S10 .
S2 CHECK THE DEPLOYABLE STEERING COLUMN	
• Enter the following diagnostic mode on the scan tool: DataLogger - RCM - PID . • Enter the following diagnostic mode on the scan tool: COL_RES (Deployable Column Resistance) Resistance PID . • **Does the resistance PID value read between 1.31 and 4.29 ohms?**	**Yes** GO to S9 . **No** GO to S3 .
S3 CHECK THE COL_RES (DEPLOYABLE COLUMN RESISTANCE) RESISTANCE PID WHILE CARRYING OUT A HARNESS TEST	
NOTE: A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition. • Continue monitoring the COL_RES (Deployable Column Resistance) resistance PID while carrying out a harness test of the deployable column circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness. • **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**	**Yes** DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 5 , Connector Repair Procedures for schematic and connector information. GO to S11 . **No** If the deployable column resistance PID is less than 1.31 ohms, GO to S7 . If the deployable column resistance PID is greater than 4.29 ohms, GO to S4 .
S4 CHECK THE DEPLOYABLE COLUMN DTCs FOR A CHANGE IN FAULT STATUS	
	Yes INSTALL a new steering column assembly. REFER

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Deployable Steering Column C2318 . • Connect a fused jumper wire between deployable steering column C2318 pin-1, harness side and pin-2, harness side. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the deployable steering column circuits shorted together, a low resistance fault (B2987) would normally be retrieved. • **Did the RCM on-demand fault change from B2984 to B2987?**	to Section 211-04 . GO to S11 . **No** GO to S5 .
S5 CHECK DEPLOYABLE STEERING COLUMN CIRCUITS FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Remove the fused jumper wire from deployable steering column C2318. • Measure resistance between RCM C310a-19, circuit CR139 (VT/WH), harness side and deployable steering column C2318-1, circuit CR139 (VT/WH), harness side.	**Yes** GO to S6 . **No** REPAIR circuit CR139 (VT/WH) or RR139 (YE). GO to S11 .

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 N0036913 • Measure resistance between RCM C310a-20, circuit RR139 (YE), harness side and deployable steering column C2318-2, circuit RR139 (YE), harness side.  N0036914 • **Are resistances less than 0.5 ohm?**	
S6 CHECK CIRCUIT RR139 (YE) FOR AN OPEN	
• Measure resistance between RCM C310a-20, circuit RR139 (YE), harness side and deployable steering column C2318-2, circuit RR139 (YE), harness side. • **Is resistance less than 0.5 ohm?**	**Yes** GO to S9 . **No** REPAIR circuit RR139 (YE). GO to S11 .
S7 CHECK FOR A SHORT BETWEEN DEPLOYABLE STEERING COLUMN CIRCUITS	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Deployable Steering Column C2318 . • Measure resistance between the deployable steering column C2318-2, circuit RR139 (YE), harness side and C2318-1, circuit CR139 (VT/WH), harness side.	**Yes** INSTALL a new steering column assembly. REFER to Section 211-04 . GO to S11 . **No** GO to S8 .

 A0030495 • **Is resistance greater than 10,000 ohms?**	
S8 CHECK THE RCM FOR LOW RESISTANCE	
• Disconnect: RCM C310a and C310b . • Measure resistance between RCM C310a pin 19, component side and C310a pin 20, component side.  N0041806 • **Is resistance greater than 10,000 ohms?**	**Yes** REPAIR circuits CR139 (VT/WH) and RR139 (YE). GO to S11 . **No** GO to S9 .
S9 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Connect: Deployable Steering Column C2318 . • Connect: RCM C310a and C310b (if previously disconnected) . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2984 or B2987 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) . GO to S11 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to S11 .
S10 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2984 or B2987 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to S3 .

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	No CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to S11 .
S11 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test T: DTC B2985

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), this vehicle is equipped a deployable steering column. The Restraints Control Module (RCM) will deploy (collapse) the steering column during a frontal collision when seat position information and other parameters reach predetermined limits. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The RCM continuously monitors the deployable steering column circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store a DTC (B2984, B2985, B2986 or B2987) in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

As the RCM continuously monitors deployable steering column circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC B2984 or B2987

respectfully if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

- DTC B2985 (Deployable Steering Column Circuit Short to Battery) - If the RCM detects a short to voltage on the deployable steering column circuits, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Deployable steering column
- RCM

PINPOINT TEST T: DTC B2985

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

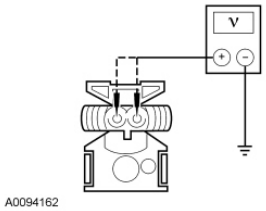
Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
T1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2985 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to T2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to T4 .
T2 CHECK DEPLOYABLE STEERING COLUMN CIRCUITS FOR A SHORT TO VOLTAGE	

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• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Deployable Steering Column C2318 . • Disconnect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between deployable steering column: ♦ C2318-1, circuit CR139 (VT/WH), harness side and ground. ♦ C2318-2, circuit RR139 (YE), harness side and ground.  A0094162 • **Is voltage present on either circuit?**	**Yes** REPAIR circuit CR139 (VT/WH) or RR139 (YE). GO to T5 . **No** GO to T3 .
T3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: Deployable Steering Column C2318 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2985 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) . GO to T5 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to T5 .
T4 CHECK FOR AN INTERMITTENT FAULT	

• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2985 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to T2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to T5 .
T5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test U: DTC B2986

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), this vehicle is equipped a deployable steering column. The Restraints Control Module (RCM) will deploy (collapse) the steering column during a frontal collision when seat position information and other parameters reach predetermined limits. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The RCM continuously monitors the deployable steering column circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store a DTC (B2984, B2985, B2986 or B2987) in memory if any of these conditions are detected. If the RCM detects a fault, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

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As the RCM continuously monitors deployable steering column circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 ohms or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC B2984 or B2987 respectfully if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

- DTC B2986 (Deployable Steering Column Circuit Short to Ground) - If the RCM detects a short to ground on the deployable steering column circuits, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Deployable steering column
- RCM

PINPOINT TEST U: DTC B2986

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

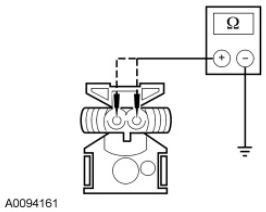
NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
U1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2986 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and DTC is no longer retrieved during the on-demand self test. GO to U2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to U5 .
U2 CHECK THE DEPLOYABLE STEERING COLUMN DTCs FOR A CHANGE IN FAULT STATUS	

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Deployable Steering Column C2318 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the deployable column disconnected, a open circuit fault would normally be retrieved. • **Did the deployable column on-demand DTC change from indicating B2986 to B2984?**	**Yes** INSTALL a new steering column assembly. REFER to Section 211-04 . GO to U6 . **No** GO to U3 .
U3 CHECK DEPLOYABLE STEERING COLUMN CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between deployable steering column: ♦ C2318-1, circuit CR139 (VT/WH), harness side and ground. ♦ C2318-2, circuit RR139 (YE), harness side and ground.	**Yes** GO to U4 . **No** REPAIR circuit CR139 (VT/WH) or RR139 (YE). GO to U6 .

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 • **Are resistances greater than 10,000 ohms?**	
U4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Connect: Deployable Steering Column C2318 . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2986 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) . GO to U6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to U6 .
U5 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC B2986 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to U2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to U6 .
U6 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No**

may result in serious personal injury or death in the event of an accidental deployment. • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test V: DTC B229A

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Occupant Classification System (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The Occupant Classification System Module (OCSM) monitors the 2 OCS rails (weight sensors) and circuity for faults. If the OCSM detects an object within the OCS rails, it will store DTC B229A in memory and send a message to the Restraints Control Module (RCM) which sends a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B229A (Occupant Classification System Contamination) - If the OCSM detects foreign object(s)/substance in one or both OCS rails (weight sensors), it will set this DTC.

This pinpoint test is intended to diagnose the following:
- A foreign object within an OCS rail
- OCS system component

PINPOINT TEST V: DTC B229A

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

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⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

Test Step	Result / Action to Take
V1 RETRIEVE OCSM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229A retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to V2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to V5 .
V2 INSPECT THE OCS RAIL	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the passenger seat. Refer to Section 501-10 . • Remove and inspect the affected OCS rail for the presence of any foreign objects. Refer to Occupant Classification Sensor in this section. • **Were any problems noted?**	**Yes** REPAIR as necessary. GO to V6 . **No** GO to V3 .
V3 INSTALL A NEW OCS RAIL	
• Install a new OCS rail. Refer to Occupant Classification Sensor in this section. • Install the passenger seat. Refer to Section 501-10 . • Repower the SRS . **Do not** prove out the SRS at this	**Yes** GO to V4 . **No** Fault corrected. GO to V6 .

time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229A retrieved on-demand during self-test?**	
V4 CONFIRM OCSM FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the passenger seat. Refer to Section 501-10 . • Install the original OCS rail. Refer to Occupant Classification Sensor in this section. • Install the passenger seat. Refer to Section 501-10 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229A retrieved on-demand during self-test?**	**Yes** INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section. GO to V6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to V6 .
V5 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229A retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to V2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by moving/positioning the passenger seat. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to V6 .

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V6 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test W: DTC B229B

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Occupant Classification System (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) in this section.

The Occupant Classification System Module (OCSM) monitors the 2 OCS rails (weight sensors) and circuity for faults. If the OCSM detects an obstruction of both OCS rails, it will store DTC B229B in memory and send a message to the Restraints Control Module (RCM) which sends a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC B229B (Occupant Classification System Obstruction) - If the OCSM detects a negative force on one or both OCS rails (weight sensors), it will set this DTC.

This pinpoint test is intended to diagnose the following:
- A foreign object placed under or contacting the passenger seat
- OCS system component(s)

PINPOINT TEST W: DTC B229B

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

Test Step	Result / Action to Take
W1 RETRIEVE OCSM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229B retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to W2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to W5 .
W2 INSPECT THE OCCUPANT CLASSIFICATION SENSOR	
• Ignition OFF. • Position the seat and inspect under the seat for the presence of any foreign objects contacting the under side of the seat. • **Were any problems noted?**	**Yes** REPAIR as necessary. GO to W6 . **No** GO to W3 .
W3 CHECK THE OCCUPANT CLASSIFICATION SENSOR	

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• Ignition ON. • Carry out the Zero Seat Weight Test procedure. **Do not carry out System Reset at this time.** Refer to Occupant Classification Sensor (OCS) System Zero Seat Weight Test in this section. • **Was DTC C1941 retrieved during the Zero Seat Weight Test?**	**Yes** INSTALL 2 new OCS rails. REFER to Occupant Classification Sensor in this section. GO to W6 . **No** GO to W4 .
W4 CONFIRM OCSM FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229B retrieved on-demand during self-test?**	**Yes** INSTALL a new OCSM . REFER to Occupant Classification System Module (OCSM) in this section. GO to W6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to W6 .
W5 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - OCSM . • **Was DTC B229B retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to W2 . **No** CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by moving/positioning the passenger seat. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to W6 .
W6 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

of an accidental deployment. • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	

Pinpoint Test X: DTC C1946

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicates to the Restraints Control Module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position, to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will store C1946 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC C1946 (Front Driver's Seat Track Position Switch Circuit Open) - If the RCM detects a open on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST X: DTC C1946

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

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⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

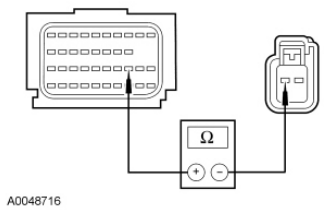
NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

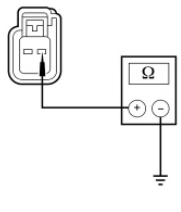
NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
X1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1946 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to X2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to X6 .
X2 CHECK DRIVER SEAT TRACK POSITION SENSOR CIRCUIT DTCs FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Seat Track Position Sensor C356 . • Connect a fused jumper wire between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and C356-1, circuit GD145 (BK/BU), harness side. • Repower the SRS . **Do not** prove out the system at this time. Refer to	**Yes** INSTALL a new seat track position sensor. REFER to Seat Position Sensor in this section. GO to X7 . **No** GO to X3 .

Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved. • **Did the driver seat track position switch on-demand DTC change from indicating C1946 to C1947?**	
X3 CHECK DRIVER SEAT TRACK POSITION SENSOR CIRCUIT FOR AN OPEN	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Remover the jumper wire from the driver seat track position sensor C356. • Measure resistance between RCM C310b-23, circuit VR215 (YE/VT), harness side and driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side.  A0048716 • **Is resistance less than 0.5 ohm?**	**Yes** GO to X4 . **No** REPAIR circuit VR215 (YE/VT). GO to X7 .
X4 CHECK DRIVER SEAT TRACK POSITION SENSOR GROUND CIRCUIT FOR AN OPEN	
• Measure resistance between driver seat track position sensor C356-1, circuit GD145 (BK/BU) and ground.	**Yes** GO to X5 . **No** REPAIR GD145 (BK/BU). GO to X7 .

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 • **Is resistance less than 5 ohms?**	
X5 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Connect: Driver Seat Track Position Sensor C356 . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1946 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to X7 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to X7 .
X6 CHECK FOR AN INTERMITTENT FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Side Air Bag Module C3049 . • Repower the SRS . **Do not** prove out the system at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1946 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to X2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to X7 .
X7 CHECK FOR ADDITIONAL SRS DTCs	

• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test Y: DTC C1947

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicates to the Restraints Control Module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position, to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will set a DTC.

If the RCM detects a short to ground, it will store DTC C1947 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

- DTC C1947 (Front Driver's Seat Track Position Switch Circuit Short to Ground) - If the RCM detects a short to ground on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

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PINPOINT TEST Y: DTC C1947

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

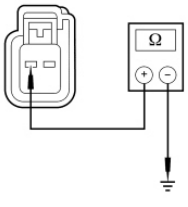
NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
Y1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1947 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Y2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to Y5 .
Y2 CHECK DRIVER SEAT TRACK POSITION SENSOR DTCs FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Seat Track Position Sensor C356 . • Repower the SRS . **Do not** prove out	**Yes** INSTALL a new driver seat track position sensor. REFER to Seat Position Sensor in this section. GO to Y6 . **No** GO to Y3 .

the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor disconnected, an open circuit fault would normally be retrieved. • **Did the driver seat track position switch on-demand DTC change from indicating C1947 to C1981?**	
Y3 CHECK THE DRIVER SEAT TRACK POSITION SENSOR CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Measure resistance between driver seat track position sensor C356-2, circuit VR215 (YE/VT) and ground.  N0056815 • **Is resistance greater than 10,000 ohms?**	**Yes** GO to Y4 . **No** REPAIR circuit VR215 (YE/VT). GO to Y6 .
Y4 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to Y6 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to Y5 .

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• Connect: Seat Track Position Sensor C356 . • Connect: RCM C310a and C310b . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1947 retrieved on-demand during self-test?**	
Y5 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1947 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Y2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to Y6 .
Y6 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints .	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

• **Are any RCM and/or OCSM DTCs indicating a fault?**	

Pinpoint Test Z: DTC C1948

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

NOTE: Due to the seat track position sensor being a Hall-effect type sensor, this pinpoint test will be diagnosing a current out of range fault instead of the current DTC definition for a resistance out of range fault.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicate to the Restraints Control Module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position, to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will set a DTC.

If the RCM detects a current out of range condition, it will store DTC C1948 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC C1948 (Front Driver's Seat Track Position Switch Circuit Resistance out of Range) - If the RCM detects a current out of range between forward and rearward on the driver seat track position switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST Z: DTC C1948

⚠ **WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

⚠ **WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.**

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and

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verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
Z1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1948 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Z2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to Z4 .
Z2 CHECK THE DRIVER SEAT TRACK POSITION SENSOR DTCs FOR A CHANGE IN FAULT STATUS	
NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: Driver Seat Track Position Sensor C356 . • Connect a fused jumper wire between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and C356-1, circuit GD145 (BK/BU), harness side. • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would	**Yes** INSTALL a new driver seat track position sensor. REFER to Seat Position Sensor in this section. GO to Z5 . **No** GO to Z3 .

normally be retrieved. • **Did the driver seat track position sensor on-demand DTC change from indicating C1948 to C1947?**	
Z3 CONFIRM THE RCM FAULT	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Remove the fused jumper wire from the driver seat track position sensor. • Connect: Driver Seat Track Position Sensor C356 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1948 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to Z5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to Z5 .
Z4 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1948 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to Z2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to Z5 .
Z5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

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• Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	

Pinpoint Test AA: DTC C1981

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the Supplemental Restraint System (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicate to the Restraints Control Module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position, to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will set a DTC.

If the RCM detects an open circuit or a short to battery on the driver seat track position sensor, it will store DTC C1981 in memory and send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC C1981 (Front Driver's Seat Track Position Switch Circuit Fault) - If the RCM detects a short to voltage on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- RCM

PINPOINT TEST AA: DTC C1981

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

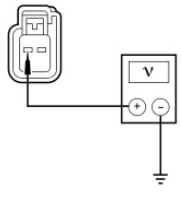
Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take
AA1 RETRIEVE RCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1981 retrieved on-demand during self-test?**	**Yes** The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to AA2 . **No** This is an intermittent fault when present as a CMDTC only. The fault condition is not present at this time. GO to AA4 .
AA2 CHECK DRIVER SEAT TRACK POSITION SENSOR CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect: RCM C310a and C310b . • Disconnect: Driver Seat Track Position Sensor C356 . • Disconnect: Driver Seat Side Air Bag Module C3049 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Measure voltage between driver seat track position sensor C356-2, circuit VR215 (YE/VT), harness side and ground.	**Yes** REPAIR circuit VR215 (YE/VT). GO to AA5 . **No** GO to AA3 .

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 • **Is any voltage present?**	
AA3 CONFIRM THE RCM FAULT	
NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, DTCs will be recorded. • Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Connect: RCM C310a and C310b . • Connect: Driver Seat Track Position Sensor C356 . • Repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1981 retrieved on-demand during self-test?**	**Yes** INSTALL a new RCM . REFER to Restraints Control Module (RCM) in this section. GO to AA5 . **No** In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. GO to AA4 .
AA4 CHECK FOR AN INTERMITTENT FAULT	
• Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1981 retrieved on-demand during self-test?**	**Yes** The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. GO to AA2 . **No** The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or

	connector concerns found. GO to AA5 .
AA5 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints . • **Are any RCM and/or OCSM DTCs indicating a fault?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. GO to the DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

Pinpoint Test AB: DTC B1317/B1318

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

NOTE: DTCs B1317, B1318 and B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

Normal Operation - Restraints Control Module (RCM)

The Restraints Control Module (RCM) continuously monitors the input voltage for correct operation. If the RCM detects input voltage below 9.5 volts, it will store DTC B1318 in memory. If the RCM detects input voltage of 20 volts, it will store DTC B1317 in memory. If the RCM sets DTC B1317 or B1318, it will send a message to the Instrument Cluster (IC) module to illuminate the air bag warning indicator.

Normal Operation - Occupant Classification System Module (OCSM)

The Occupant Classification System Module (OCSM) continuously monitors the input voltage for correct operation. If the OCSM detects input voltage below 8 volts, it will store DTC B1318 in memory. If the OCSM detects input voltage above 17.2 volts, it will store DTC B1317 in memory. If the OCSM sets DTC B1317 or B1318, it will send a fault message to the RCM . The RCM will then send a message to the IC module to illuminate the air bag warning indicator.

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DTC Description	Fault Trigger Condition
• B1317 - Battery Voltage High	If the Restraints Control Module (RCM) detects voltage above 16 volts with a Supplemental Restraint System (SRS) fault or above 20 volts without a SRS fault, it will set this DTC.
• B1317 - Battery Voltage High	If the Occupant Classification System Module (OCSM) detects voltage above 17.2 volts, it will set this DTC.
• B1318 - Battery Voltage Low	If the RCM detects voltage below 9.5 volts with a SRS fault, it will set this DTC.
• B1318 - Battery Voltage Low	If the OCSM detects voltage below 8 volts, it will set this DTC.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- RCM
- OCSM

PINPOINT TEST AB: DTC B1317/B1318

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

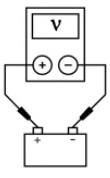
NOTICE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Test Step	Result / Action to Take

AB1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - ALL CMDTCs . • **Is DTC B1317, B1318 or B1676 present in one or more modules AND P0563, P0620, P0625, P0626 or P065B retrieved from the PCM?**	**Yes** REFER to Section 414-00 to diagnose the charging system. **No** GO to AB2 .
AB2 TEST BATTERY CONDITION	
NOTE: DTCs B1317, B1318 and B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on. • Ignition OFF. • Carry out the battery condition test. Refer to Section 414-01 . • **Did the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation. If the battery passed the condition test and did not require a recharge, GO to AB3 . **No** INSTALL a new battery. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). TEST the SRS for normal operation.
AB3 CHECK CHARGING SYSTEM VOLTAGE	
NOTE: Do not allow the engine speed to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine speed goes above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Measure voltage of the battery: ♦ For DTC B1317, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage. ♦ For DTC B1318, turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage.  AJ0210-A • **Is voltage between 13 and 15.2 volts?**	**Yes** For DTC B1318, GO to AB4 . For DTC B1317, GO to AB6 . **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the SRS for normal operation.

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AB4 CHECK FOR OPEN IGNITION CIRCUIT TO THE MODULE	
• Ignition OFF. • Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the module with the concern: ♦ For the RCM , disconnect C310a and C310b. ♦ For the OCSM , disconnect C3159. • Measure resistance of the ignition circuit: ♦ For the RCM , measure resistance between RCM C310a-24, circuit CBP17 (BN/GN), harness side and Smart Junction Box (SJB) fuse 17. ♦ For the OCSM , measure resistance between OCSM C3159-1, circuit CBP17 (BN/GN), harness side and SJB fuse 17. • **Is resistance less than 1 ohm?**	**Yes** GO to AB5 . **No** REPAIR the circuit as necessary. CLEAR all CMDTCs . TEST the SRS for normal operation.
AB5 CHECK FOR OPEN GROUND TO THE MODULE	
• Measure resistance of the ground circuit: ♦ For the RCM , measure resistance between the RCM case and a good ground. ♦ For the OCSM , measure the resistance between OCSM C3159-14, circuit GD145 (BK/BU), harness side and ground. • **Is resistance less than 5 ohms?**	**Yes** GO to AB6 . **No** For the RCM , MAKE SURE there is no corrosion between the RCM case and mounting. MAKE SURE the fasteners are clean and tightened to specification with no corrosion. REPAIR as necessary. For the OCSM , REPAIR circuit GD145 (BK/BU)) as necessary. CLEAR all CMDTCs . TEST the SRS for normal operation.
AB6 CHECK FOR MODULE OPERATION	
• Depower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Disconnect the module with the concern: ♦ For the RCM , disconnect C310a and C310b. ♦ For the OCSM , disconnect C3159. • Check for the following: ♦ corrosion. ♦ damaged pins. ♦ pushed-out pins. • Connect the RCM C310a and C310b or OCSM C3159 and make sure the connector seats correctly. • Repower the SRS . Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.	**Yes** INSTALL a new module. REFER to Restraints Control Module (RCM) or Occupant Classification System Module (OCSM) in this section. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR

• Operate the system and verify the concern is still present. • **Is concern still present?**	all CMDTCs . TEST the SRS for normal operation.

Pinpoint Test AC: DTC C1414 - Incorrect Module Design Level (Incorrect Vehicle Application)

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

When the ignition is turned ON, the Restraints Control Module (RCM) compares information with the Occupant Classification System Module (OCSM). If the RCM and OCSM information do not match, DTC C1414 will be set.

This pinpoint test is intended to diagnose the following:
- OCSM
- RCM

PINPOINT TEST AC: DTC C1414 - INCORRECT MODULE DESIGN LEVEL (INCORRECT VEHICLE APPLICATION)

⚠ **WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.**

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

NOTE: Supplemental Restraint System (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS .

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford Catalog AdvantageTM or equivalent to make sure the correct component is being installed. If an incorrect SRS component is installed, DTCs may set.

Test Step	Result / Action to Take
AC1 RETRIEVE RCM DTCs	
• Ignition ON. • Connect the scan tool. • Enter the following diagnostic mode on the scan tool: Self Test - RCM . • **Was DTC C1414 retrieved on-demand during the self-test?**	**Yes** GO to AC2 . **No** The fault is not present at this time. GO to AC4 .
AC2 CHECK THE OCSM PART NUMBER	
• Enter the following diagnostic mode on the scan tool:	**Yes** GO to AC3 .

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Log Viewer. • Retrieve and record the OCSM part number from Log Viewer. • Check the OCSM part number against the part number listed in the Ford Catalog AdvantageTM or equivalent. • **Does the OCSM part number match the listed part number?**	**No** INSTALL the correct OCSM . REFER to Occupant Classification System Module (OCSM) in this section. GO to AC4 .
AC3 CHECK THE RCM PART NUMBER	
• Retrieve and record the RCM part number from Log Viewer. • Check the RCM part number against the part number listed in the Ford Catalog AdvantageTM or equivalent. • **Does the RCM part number match the listed part number?**	**Yes** CONFIGURE the RCM using as-built data. REFER to Section 418-01 . GO to AC4 . **No** INSTALL the correct RCM . REFER to Restraints Control Module (RCM) in this section. GO to AC4 .
AC4 CHECK FOR ADDITIONAL SRS DTCs	
• Ignition OFF. • ⚠ **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.** • Reconnect all SRS components (if previously disconnected). • If previously directed to depower the SRS , repower the SRS . **Do not** prove out the SRS at this time. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - Restraints. • **NOTE:** When selecting Restraints from the Self Test menu, DTCs will be retrieved from the RCM and OCSM . • **Are any RCM and/or OCSM DTCs retrieved on-demand during self-test?**	**Yes** Do not clear any DTCs until all DTCs have been resolved. REFER to DTC Charts in this section for pinpoint test direction. **No** CLEAR all RCM and OCSM CMDTCs . PROVE OUT the SRS . Repair is complete. RETURN the vehicle to the customer.

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Supplemental Restraint System (SRS) Depowering and Repowering

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Depowering Procedure

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

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

⚠ WARNING: To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch to OFF.
3. At the Smart Junction Box (SJB), located below the LH side of the instrument panel, remove the cover and the RCM fuse 17 (10A) from the SJB . For additional information, refer to the Wiring Diagram manual.
4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.
5. Turn the ignition to OFF.

6. ⚠ **WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

   Refer to the Description and Operation portion of Section 501-20B for location of the RCM and impact sensor(s).

   To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

   Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

   Disconnect the battery ground cable and wait at least one minute. For additional information, refer to Section 414-01 .

Repowering Procedure

1. Turn the ignition switch from OFF to ON.

2. Install RCM fuse 17 (10A) to the SJB and close the cover.

3. ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

   Connect the battery ground cable.

4. Prove out the SRS as follows:
   Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will:
   - fail to light.
   - remain lit continuously.
   - flash at a 5 Hz rate (RCM not configured).

   The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS . If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.
   Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM) using a scan tool.

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Supplemental Restraint System (SRS) Deactivation and Reactivation

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Deactivation

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

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

⚠ WARNING: To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch OFF.
3. At the Smart Junction Box (SJB), located below the LH side of the instrument panel, remove the cover and RCM fuse 17 (10A) from the SJB . For additional information, refer to the Wiring Diagram manual.

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4. Turn the ignition switch ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. ⚠ **WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

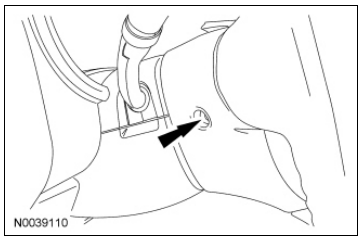
   Refer to the Description and Operation portion of Section 501-20B for location of the RCM and impact sensor(s).

   To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

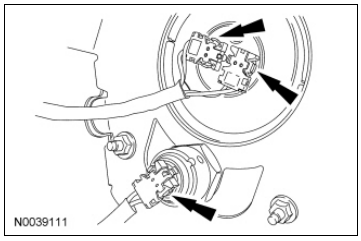
   Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

   Disconnect the battery ground cable and wait at least one minute. For additional information, refer to Section 414-01 .

7. Remove the 2 driver air bag module bolts (1 shown).

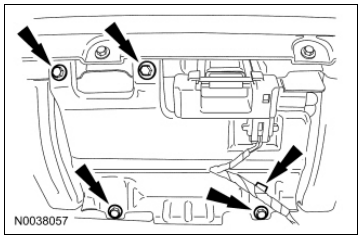


8. Disconnect the 3 driver air bag module electrical connectors and remove the driver air bag module.



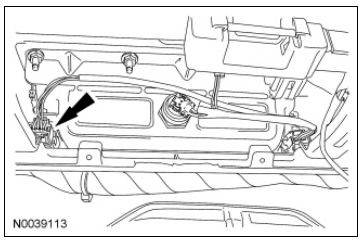
9. Open and lower the glove compartment door.

10. Detach the wiring retainer, remove the 4 bolts and passenger air bag module heat shield.

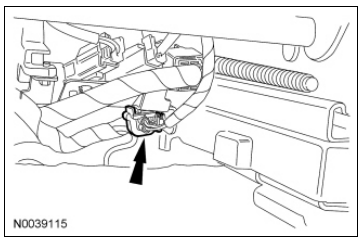


11. **NOTE:** The canister vent and adaptive tether do not require deactivation.

    Disconnect the LH side passenger air bag module electrical connector.

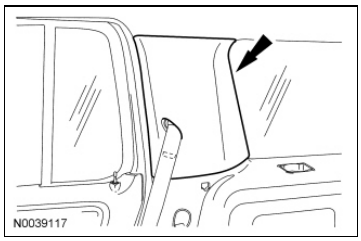


12. Under the rear of the passenger seat, detach the passenger seat side air bag module electrical connector from the seat track bracket. Disengage the passenger seat side air bag module electrical connector locking clip, release the tab and disconnect the passenger seat side air bag module electrical connector.

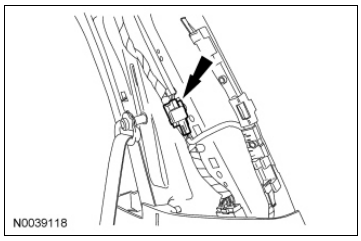


Explorer and Mountaineer vehicles

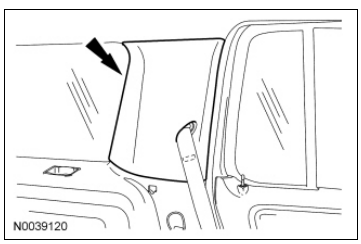
13. Release and position aside the passenger side C-pillar trim panel.



14. Disconnect the passenger side Safety Canopy® module electrical connector.

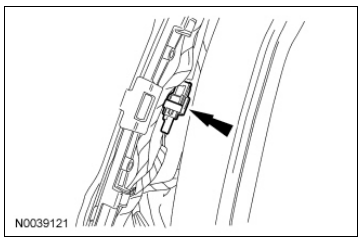


15. Release and position aside the driver side C-pillar trim panel.



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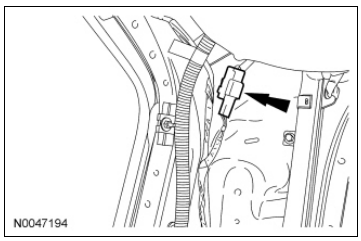
16. Disconnect the driver side Safety Canopy® module electrical connector.



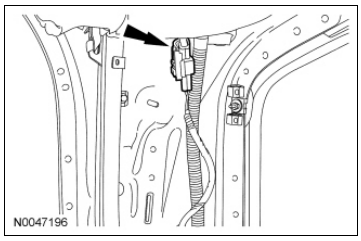
Explorer Sport Trac vehicles

17. Remove the driver and passenger side upper C-pillar trim panels. For additional information, refer to Section 501-05 .

18. Disconnect the passenger side Safety Canopy® module electrical connector.

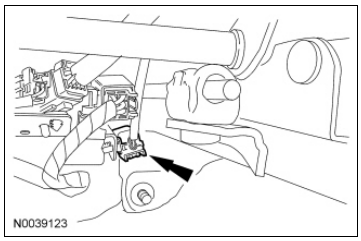


19. Disconnect the driver side Safety Canopy® module electrical connector.



All vehicles

20. Under driver seat, the rear of the slide and disengage the driver seat side air bag module electrical connector locking clip, release the tab and disconnect the driver seat side air bag module electrical connector.



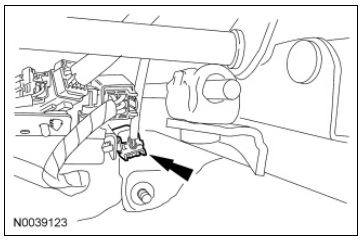
21. Install the RCM fuse 17 (10A) to the SJB .

22. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Reactivation

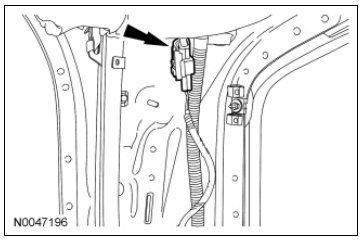
All vehicles

1. Remove the RCM fuse 17 (10A) from the SJB .
2. Disconnect the battery ground cable and wait at least one minute.
3. Connect the driver seat side air bag module electrical connector and engage the seat side air bag electrical connector locking clip.

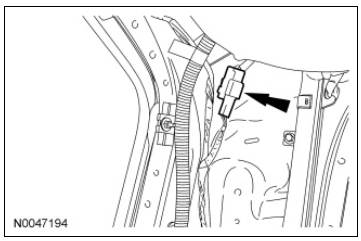


Explorer Sport Trac vehicles

4. Connect the driver side Safety Canopy® module electrical connector.



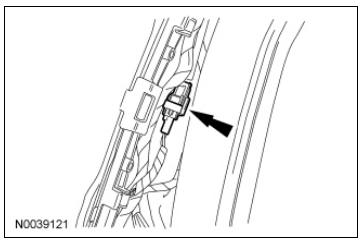
5. Connect the passenger side Safety Canopy® module electrical connector.



6. Install the driver and passenger upper C-pillar trim panels. For additional information, refer to Section 501-05 .

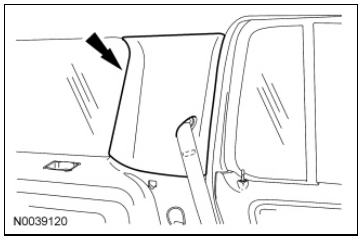
Explorer and Mountaineer vehicles

7. Connect the driver side Safety Canopy® module electrical connector.

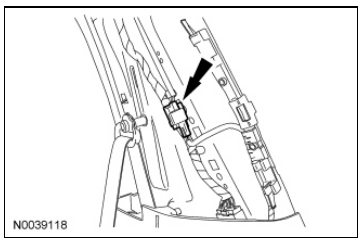


8. Install the driver side C-pillar trim panel.
    - Verify the safety belt retractor operates without excessive effort or binding.

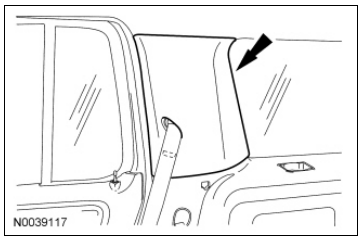
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9. Connect the passenger side Safety Canopy® module electrical connector.

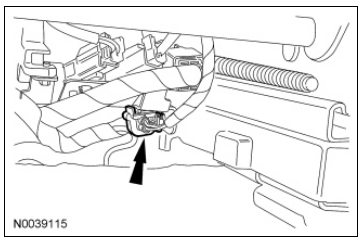


10. Install the passenger side C-pillar trim panel.
    - Verify the safety belt retractor operates without excessive effort or binding.

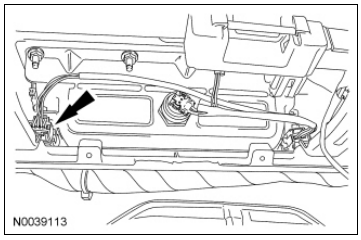


All vehicles

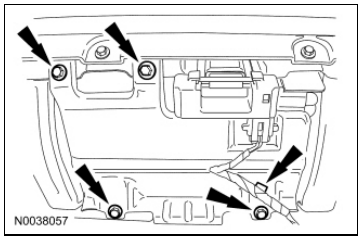
11. Connect the passenger seat side air bag module electrical connector and engage the seat side air bag electrical connector locking clip. Attach the passenger seat side air bag module electrical connector to the seat track bracket.



12. Connect the LH side passenger air bag module electrical connector.

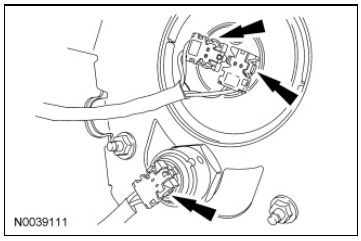


13. Install the passenger air bag module heat shield and 4 bolts. Attach the wiring retainer.

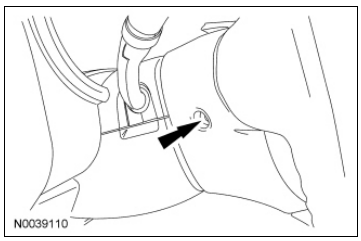


14. ***NOTICE:*** **The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.**

    Connect the driver air bag module electrical connectors as noted in removal.



15. Install the 2 driver air bag module bolts (1 shown).
    - Tighten to 7 Nm (62 lb-in).



16. Turn the ignition switch from OFF to ON.

17. Install RCM fuse 17 (10A) to the SJB and install the cover.

18. ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

    Connect the battery ground cable.

19. Prove out the SRS as follows:
    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will:
    - fail to light.
    - remain lit continuously.
    - flash at a 5 Hz rate (RCM not configured).

    The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS . If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS

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fault discovered must be diagnosed and repaired.
Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM) using a scan tool.

Rivet Nut Replacement

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

NOTICE: **If the Safety Canopy®/side air curtain module has deployed, the tether cord rivet nut must be inspected and replaced if damaged before installing a new Safety Canopy®.**

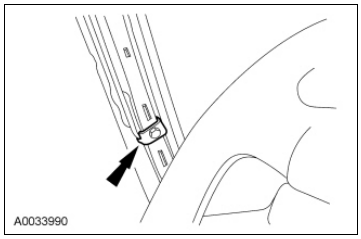
NOTE: A typical rivet nut replacement is shown that is similar for all vehicles.

NOTE: LH shown, RH similar.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in this section.

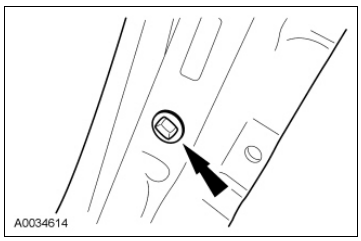
2. Remove the necessary trim panel(s). For additional information, refer to Section 501-05 .

3. Remove the bolt and bracket for the tether cord (if present).



4. If needed, position and secure the Safety Canopy®/side air curtain tether cord and bracket assembly aside.

5. Using the appropriate service tool, sand the rivet nut shoulder until the shoulder surface is removed.



6. Punch the remaining portion of the rivet nut through the rivet nut hole.

7. **NOTE:** Use only Ford Motor Company factory-authorized replacement parts for rivet nut repair procedure.

   Obtain the correct square shank rivet nut for the vehicle application from the Ford Catalog AdvantageTM or equivalent and insert it into the rivet nut hole.

8. Using a suitable rivet nut installing tool, install the rivet nut. For additional information, refer to the tool manufacturer's operating instructions.

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9. If present, position the tether cord. Install the bolt. See the appropriate component removal and installation procedure or Specifications for the correct torque specification.

10. **NOTE:** The tether cord must be positioned correctly in place before installing the A-pillar trim panel.

    Install the necessary trim panel(s). For additional information, refer to Section 501-05 .

Inspection and Repair After a Supplemental Restraint System (SRS) Deployment

⚠ **WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.**

NOTE: After diagnosing or repairing a Supplemental Restraint System (SRS), the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.

NOTE: Deployable devices (such as air bag modules, pretensioners) may deploy alone or in various combinations depending on the impact event.

NOTE: Always refer to the appropriate workshop manual procedures prior to carrying out vehicle repairs affecting the SRS and safety belt system.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. **NOTE:** Refer to the correct removal and installation procedure for all SRS components being installed.

   When any deployable device or combination of devices have deployed and/or the Restraints Control Module (RCM) has DTC B1231/B1193:00 (Event Threshold Exceeded) in memory, the repair of the vehicle SRS is to include the removal of all deployed devices and the installation of new deployable devices, the removal and installation of new impact sensors and the removal and installation of a new RCM . DTCs must be cleared from all required modules after repairs are carried out.

Vehicles with Occupant Classification System (OCS) system

2. **NOTE:** After installation of new Occupant Classification System (OCS) components, carry out the Occupant Classification System (OCS) System Reset procedure as instructed in the workshop manual. Refer to the appropriate workshop manual for OCS system removal and installation procedure.

   When a vehicle has been involved in a collision and the Occupant Classification System Module (OCSM) has DTC B1231/B1193:00 stored in memory, the repair of the OCS system is to include the following procedures for the specified system:

   - For rail-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install new OCS system rails. Do not install a new OCSM unless DTC B1231 cannot be cleared.
   - For weight sensor bolt-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install a new seat track with OCS system weight sensor bolts. DTC must be cleared from the OCSM before carrying out Occupant Classification System (OCS) System Reset. Do not install a new OCSM unless DTC B1231/B1193:00 cannot be cleared.
   - For bladder-type OCS system, inspect for damage and repair as necessary. If installation of an OCS system component is required, an OCS system service kit must be installed.

All vehicles

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3. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting hardware as needed.

4. When the driver air bag module has deployed, a new clockspring must be installed.

5. New driver and/or front passenger safety belt systems (including retractors, buckles and height adjusters) must be installed if the vehicle is involved in a collision that results in deployment of the driver and/or front passenger safety belt pretensioners. For additional information, refer to Section 501-20A .

6. Inspect the entire vehicle for damage, including the following components:
    - Steering column (deployable column if equipped)
    - Instrument panel knee bolsters and mounting points
    - Instrument panel braces and brackets
    - Instrument panel and mounting points
    - Seats and seat mounting points
    - Safety belts, safety belt buckles and safety belt retractors. For additional information, refer to Section 501-20A .
    - SRS wiring, wiring harnesses and connectors

7. After carrying out the review and inspection of the entire vehicle for damage, repair or install new components as needed.

Occupant Classification Sensor (OCS) System Reset

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

System Reset

⚠ WARNING: Make sure the front passenger seat is correctly installed and fastened to the vehicle. Do not force the alignment to the floorpan mounting holes. If the seat does not align to the floorpan mounting holes, repair the seat or floorpan as needed. Failure to follow these instructions may result in incorrect operation of the occupant classification system (OCS) and increase the risk of serious personal injury or death in a crash.

NOTE: The System Reset active command should only be carried out as directed by the workshop manual.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. **⚠ WARNING: The following precautions must be taken before carrying out the following procedure on the front passenger seat:**

    - Park the vehicle on level ground.
    - Make sure the occupant classification system (OCS) is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.
    - Make sure the front passenger seat is empty and dry.
    - Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.
    - Make sure the front passenger seat occupant classification system (OCS) sensor rail shields are correctly installed.
    - Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.
    - Make sure nothing is underneath the front passenger seat.
    - Make sure the under-seat body wiring harness and seat wiring harness are not twisted or pinched between the electrical bracket and the No. 2 crossmember, or are not twisted or pinched between the electrical bracket and the floor.
    - Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS. Refer to the Owner's Literature.
    - Make sure the seat is correctly installed in the vehicle.

    Failure to follow these instructions may result in incorrect operation of the OCS and increases the risk of serious personal injury or death in a crash.Make sure the front passenger seat is empty, there is nothing underneath the seat, remove any items from the seat that were not factory installed, and make sure that the seat is correctly installed in the vehicle.

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2. Position the front passenger seat.
    - Position the seat in the middle of seat track travel.
    - Position the seat backrest in the most forward position.
    - Position the seat height to its lowest position (power seat only).

3. ⚠ **WARNING: Remove binding or resistance between all components of the front passenger seat as directed in the following procedure. Failure to follow this instruction may result in incorrect operation of the occupant classification system (OCS) and increases the risk of serious personal injury or death in a crash.**

   Remove hysteresis from the front passenger seat by firmly hitting the back of the seat head restraint 3 times.

4. ⚠ **WARNING: Make sure nothing is placed on the front passenger seat during the following procedure. Do not press, touch or lay anything on the front passenger seat until the following procedure has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification system (OCS) and increase the risk of serious personal injury or death in a crash.**

   NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition ON before carrying out the System Reset active command.

   Turn the ignition ON, wait 8 seconds and carry out the System Reset active command using the scan tool.

5. **NOTE:** The ignition must be cycled after carrying out the System Reset active command.

   Cycle the ignition from ON to OFF.

6. ⚠ **WARNING: Make sure nothing is placed on the front passenger seat during the following procedure. Do not press, touch or lay anything on the front passenger seat until the following procedure has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification system (OCS) and increase the risk of serious personal injury or death in a crash.**

   NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition ON before carrying out the Zero Seat Weight Test.

   Turn the ignition switch ON, wait 8 seconds and carry out the Zero Seat Weight Test using the scan tool.

    1. If the scan tool responds with system passed, the repair is complete. GO to Step 7.
    2. If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), carry out the following steps.
        - ♦ Cycle the ignition OFF then ON, wait 8 seconds and carry out the System Reset active command using the scan tool.
        - ♦ Cycle the ignition OFF then ON and wait 8 seconds.
        - ♦ Carry out the Zero Seat Weight Test using the scan tool.
            - ♦ If the system passed, the repair is complete.
            - ♦ If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), install 2 new Occupant Classification System (OCS) rails and carry out the System Reset procedure. For additional information, refer to Occupant Classification Sensor and Occupant Classification Sensor (OCS) System Reset in this section.

7. Prove out the SRS as follows:
   Turn the ignition from ON to OFF. Wait 10 seconds, then turn the ignition back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will:
   - fail to light.
   - remain lit continuously.
   - flash at a 5 Hz rate (Restraints Control Module (RCM) not configured).
   The air bag warning indicator might not light until approximately 30 seconds after the ignition has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS . If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.
   Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM).

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Occupant Classification Sensor (OCS) System Zero Seat Weight Test

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Zero Seat Weight Test

⚠ WARNING: Make sure nothing is placed on the front passenger seat during the following procedure. Do not press, touch or lay anything on the front passenger seat until the following procedure has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification system (OCS) and increase the risk of serious personal injury or death in a crash.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. **⚠ WARNING: The following precautions must be taken before carrying out the following procedure on the front passenger seat:**

    - Park the vehicle on level ground.
    - Make sure the occupant classification system (OCS) is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.
    - Make sure the front passenger seat is empty and dry.
    - Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.
    - Make sure the front passenger seat occupant classification system (OCS) sensor rail shields are correctly installed.
    - Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.
    - Make sure nothing is underneath the front passenger seat.
    - Make sure the under-seat body wiring harness and seat wiring harness are not twisted or pinched between the electrical bracket and the No. 2 crossmember, or are not twisted or pinched between the electrical bracket and the floor.
    - Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS. Refer to the Owner's Literature.
    - Make sure the seat is correctly installed in the vehicle.

   Failure to follow these instructions may result in incorrect operation of the OCS and increases the risk of serious personal injury or death in a crash.Make sure the front passenger seat is empty, there is nothing underneath the seat, remove any items from the seat that were not factory installed, and make sure that the seat is correctly installed in the vehicle.

2. Position the front passenger seat.
    - Position the seat in the middle of seat track travel.

- Position the seat backrest in the most forward position.
- Position the seat height to its lowest position (power seat only).

3. ⚠ **WARNING: Remove binding or resistance between all components of the front passenger seat as directed in the following procedure. Failure to follow this instruction may result in incorrect operation of the occupant classification system (OCS) and increases the risk of serious personal injury or death in a crash.**

   Remove hysteresis from the front passenger seat by firmly hitting the back of the seat head restraint 3 times.

4. **NOTE:** Make sure a minimum 8-second time period has passed after cycling the ignition ON before carrying out the Zero Seat Weight Test.

   NOTE: If the scan tool responds with system passed, do not carry out the System Reset active command.

   Cycle the ignition ON, wait 8 seconds and carry out the Zero Seat Weight Test using the scan tool.

   - If the system passed, the repair is complete. GO to Step 7.
   - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), repeat Steps 1 through 4. If the system did not pass the second Zero Seat Weight Test, proceed to the next step.

5. **NOTE:** Make sure a minimum 8-second time period has passed after cycling the ignition ON before carrying out the Zero Seat Weight Test.

   Cycle the ignition OFF then ON, wait 8 seconds and carry out the System Reset active command using the scan tool.

6. Cycle the ignition switch OFF then ON, wait 8 seconds and carry out the Zero Seat Weight Test using the scan tool.
   - If the system passed, the repair is complete. Proceed to Step 7.
   - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), install 2 new OCS rails and carry out the System Reset procedure. For additional information, refer to Occupant Classification Sensor and Occupant Classification Sensor (OCS) System Reset in this section.

7. Prove out the SRS as follows:
   Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will:
   - fail to light.
   - remain lit continuously.
   - flash at a 5 Hz rate (Restraints Control Module (RCM) not configured).

   The air bag warning indicator might not light until approximately 30 seconds after the ignition has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS . If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.
   Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM).

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Pyrotechnic Device Disposal

Disposal of Deployable Devices and Pyrotechnic Devices That are Undeployed/Inoperative

NOTE: All inoperative air bag modules and safety belt pretensioners have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the undeployed/inoperative device. For additional information, refer to the appropriate procedure in this section or Section 501-20A .

3. **NOTE:** When installing a new air bag module, a prepaid return postcard is provided with the replacement air bag module. The serial number for the new part and the Vehicle Identification Number (VIN) must be recorded and sent to Ford Motor Company.

   If installing a new air bag module, record the necessary information and return the inoperative air bag module to Ford Motor Company.

Disposal of Deployable Devices and Pyrotechnic Devices That Are Deployed

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the deployed device. For additional information, refer to the appropriate procedure in this section or Section 501-20A .

3. **NOTE:** If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to the Description and Operation portion of this section.

   Dispose of the deployed device in the same manner as any other part to be scrapped.

Disposal of Deployable Devices and Pyrotechnic Devices That Require Manual Deployment

1. Safety and environmental concerns require consideration and treatment of restraints system deployable and pyrotechnic devices when disposing of vehicles, deployable devices or pyrotechnic devices. Deploying deployable and pyrotechnic devices before scrapping a vehicle or the device eliminates the potential for hazardous exposures or reactions during processing. If special handling procedures are followed, deployable and pyrotechnic devices can be deployed safely and recycled with the vehicle, shipped separately to a recycling facility or disposed of safely.

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NOTE: To determine the deployable devices a vehicle is equipped with, refer to the Description and Operation portion of this section.

A vehicle equipped with any of the following deployable devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

- Driver air bag module
- Passenger air bag module
- Seat side air bag modules
- Safety Canopy® modules
- Side air curtain modules

2. **NOTE:** To determine the pyrotechnic devices a vehicle is equipped with, refer to the Description and Operation portion of this section.

   A vehicle equipped with any of the following pyrotechnic devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

   - Safety belt buckle pretensioners
   - Safety belt retractor pretensioners
   - Adaptive load-limiting retractors
   - Deployable steering column

3. **NOTE:** To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to the Description and Operation portion of this section.

   If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. For additional information, refer to Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules - Remote Deployment in this procedure.

Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules - Remote Deployment

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Always carry or place a live Safety Canopy®, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is

required. Failure to follow these instructions may result in serious personal injury.

NOTE: For air bag modules with multiple loops, all the loops on the air bag module must be deployed.

NOTE: Some driver and passenger front air bags have 2 deployment stages. After a collision it is possible that Stage 1 has deployed and Stage 2 has not.

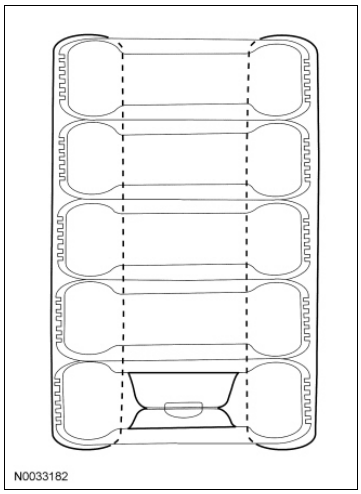
If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

NOTE: A typical air bag disposal is shown that is similar for all vehicles.

All driver, passenger and seat side air bag modules

1. Make a container to house the air bag module for deployment.
   - **NOTE:** The tires must be of sufficient size to accommodate the air bag module.

     Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
   - With the tire and wheel assembly on the bottom, stack the tires.
   - Securely tie all of the tires together.



2. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the air bag module. For additional information, refer to the appropriate procedure in this section.

4. **NOTE:** If the air bag module does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the air bag module.

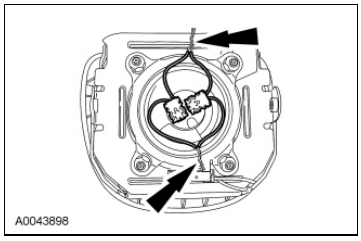
   Cut each of the air bag module wires near the electrical connector that connects to the vehicle wire harness.

5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

6. **NOTE:** Typical driver air bag module with 2 loops shown, other air bag modules with multiple loops similar.

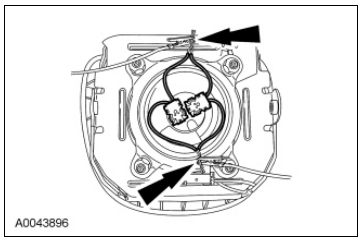
   For air bag modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.

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7. Make a jumper harness to deploy the air bag module.
    - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
    - At one end of the jumper harness, connect the wires together.

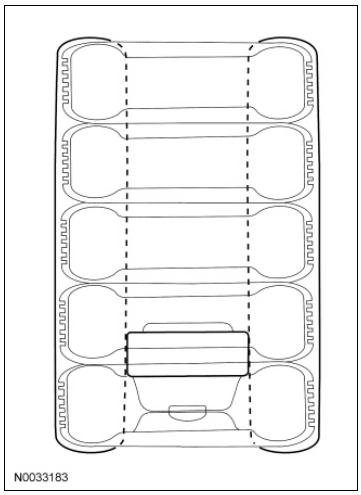
8. Using the end of the jumper harness where the wires are not connected together, attach each wire of the jumper harness to each wire of the air bag module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.



Driver air bag modules

9. **NOTE:** Make sure to maintain the connections to the air bag module.

    With the stack of tires upright and the wheel on the bottom, carefully place the driver air bag module, with the trim cover facing up, on the wheel.

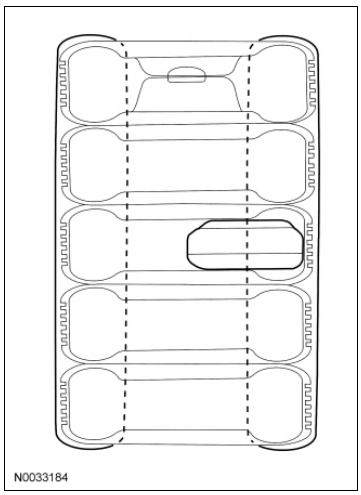


Passenger and seat side air bag modules

10. **NOTE:** Make sure to maintain the connections to the air bag module.

    Tip the stack of tires on its side and place the air bag module inside the center tire, making sure that there are 2 tires beneath the tire containing the air bag module and 2 tires (including the tire and wheel assembly) above the tire containing the air bag module.

11. Place the tire stack upright, with the wheel on top.



All driver, passenger and seat side air bag modules

12. Remain at least 9.14 m (30 ft) away from the air bag module.

13. From the end of the jumper harness that is not connected to the air bag module, disconnect the 2 wires of the jumper harness from each other.

14. Deploy the air bag module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

15. To allow for cooling, wait at least 10 minutes before approaching the deployed air bag module.

16. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Adaptive Load Limiting Safety Belt Retractors - Remote Deployment

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

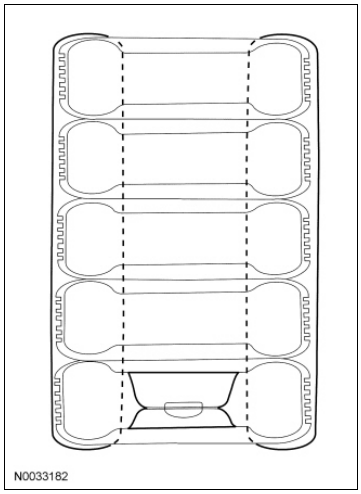
⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Make a container to house the safety belt buckle or retractor for deployment.
   - **NOTE:** The tires must be of sufficient size to accommodate the safety belt buckle or retractor.

     Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
   - With the tire and wheel assembly on the bottom, stack the tires.
   - Securely tie all of the tires together.

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2. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the safety belt buckle or retractor. For additional information, refer to the appropriate procedure in Section 501-20A .
   - When deploying a safety belt buckle pretensioner, install a nut and bolt of sufficient length and of the same diameter as was used to retain it to the seat.

4. **NOTE:** If the safety belt buckle or retractor does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the safety belt buckle or retractor.

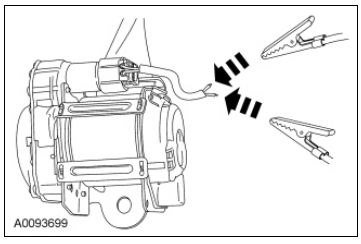
   Cut each of the safety belt buckle or retractor wires near the electrical connector that connects to the vehicle wire harness.

5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

6. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

7. **NOTE:** Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load-limiting retractors similar.

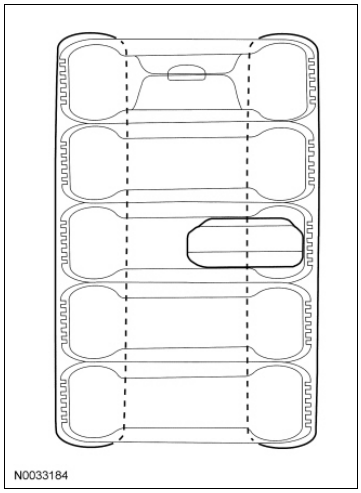
   Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.



8. **NOTE:** Make sure to maintain the connections to the safety belt buckle or retractor.

Tip the stack of tires on its side and place the safety belt buckle or retractor inside the center tire, making sure that there are 2 tires beneath the tire containing the safety belt buckle or retractor and 2 tires (including the tire and wheel assembly) above the tire containing the safety belt buckle or retractor.

9. Place the tire stack upright, with the wheel on top.



10. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.

11. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.

12. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

13. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

14. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Load Limiting Safety Belt Retractors - In-Vehicle Deployment

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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2. Access the safety belt buckle or retractor electrical connectors. For additional information, refer to Section 501-20A .

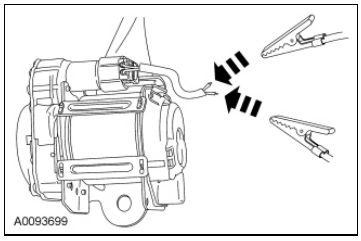
3. Cut each of the safety belt buckle or retractor wires, leaving at least 101.6 mm (4 in) to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

5. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

6. **NOTE:** Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load-limiting retractors are similar.

   Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.



7. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.

8. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

11. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Canopy® Modules and Side Air Curtain Modules - In-Vehicle Deployment

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: The Safety Canopy® module deployment for a scrapped vehicle will occur in its installed position in the vehicle.

NOTE: A typical Safety Canopy® module disposal is shown that is similar for all vehicles.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

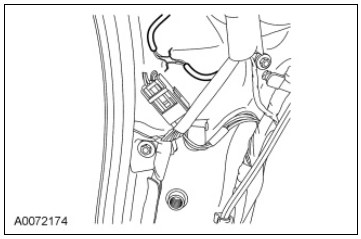
2. Access the Safety Canopy®/side air curtain module electrical connectors. For additional information, refer to the appropriate procedure in this section.

3. Cut each of the Safety Canopy®/side air curtain module wires leaving at least 101.6 mm (4 in) to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

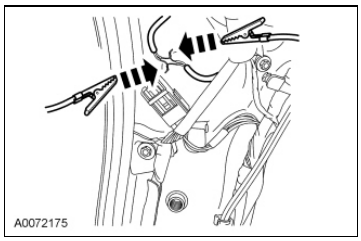
5. **NOTE:** Typical Safety Canopy®/side air curtain module with 2 loops shown, other Safety Canopy®/side air curtain modules with 2 loops are similar.

   For Safety Canopy®/side air curtain modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.



6. Make a jumper harness to deploy the Safety Canopy®/side air curtain module.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

7. Using the end of the jumper harness where the wires are not connected together, attach each wire of the jumper harness to each wire of the Safety Canopy®/side air curtain module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.



8. From the end of the jumper harness that is not connected to the Safety Canopy®/side air curtain module, disconnect the 2 wires of the jumper harness from each other.

9. Deploy the Safety Canopy®/side air curtain module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed Safety Canopy®/side air curtain module.

11. Dispose of the deployed Safety Canopy®/side air curtain module in the same manner as any other part to be scrapped.

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Deployable Steering Column - In-Vehicle Deployment

⚠ WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. **NOTE:** It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering column electrical connector.

   Access the deployable steering column electrical connector.

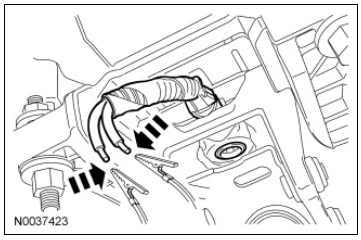
3. **NOTE:** If the deployable steering column does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the deployable steering column.

   Cut each of the deployable steering column wires, leaving at least 101.6 mm (4 in) to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

5. Make a jumper harness to deploy the deployable steering column.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

6. Using the end of the jumper harness where the wires are not connected together, attach each wire of the jumper harness to each wire of the deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.



7. Remain at least 9.14 m (30 ft) away from the deployable steering column.

8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from each other.

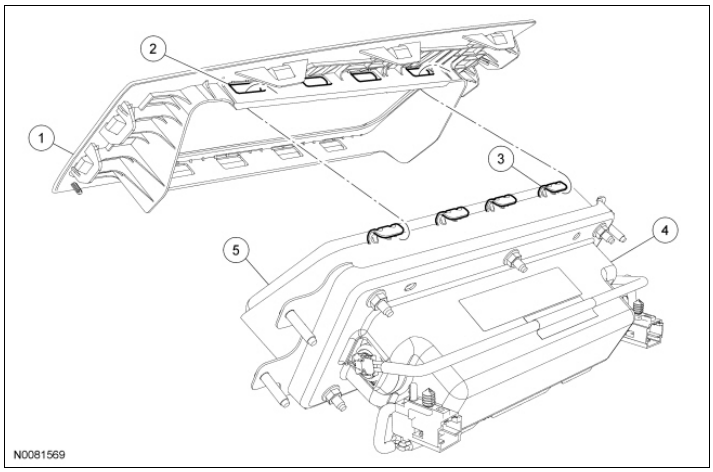
9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column.

11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.

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Air Bag Trim Cover - Passenger



Item	Part Number	Description
1	04338	Passenger air bag cover (part of kit)
2	-	Passenger air bag cover window (part of passenger air bag cover)
3	-	Passenger air bag canister hook (part of canister)
4	-	Passenger air bag canister (part of 044A74)
5	-	Passenger air bag soft pack (part of 044A74)

Removal

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Do not use any sharp tools to separate the passenger air bag module trim cover from the passenger air bag module canister. Sharp tools may damage the passenger air bag module. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

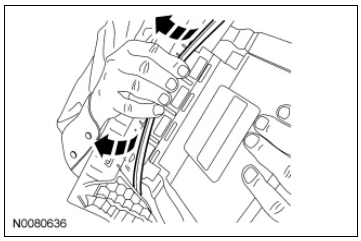
⚠ WARNING: Do not unpack or unroll the passenger air bag module soft pack. If the soft pack becomes unpacked or unrolled, install a new passenger air bag module assembly. Failure to follow these instructions may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Do not manipulate or compromise the passenger air bag module hooks during the removal or installation procedure. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

1. Remove the passenger air bag module. For additional information, refer to Passenger Air Bag Module in this section.

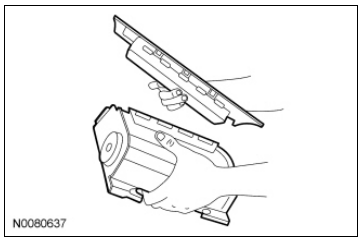
2. Place a mark on top of the passenger air bag module canister for correct installation.

3. Carefully lift the passenger air bag module cover from the bottom of the air bag module canister, separating the windows from the canister hooks.



4. **NOTE:** Place an X mark on the old air bag cover to avoid reinstalling.

   Remove the passenger air bag cover from the canister, separating the top windows from the canister hooks.



Installation

1. Place the passenger air bag cover on a clean work surface once it is removed from the shipping package.

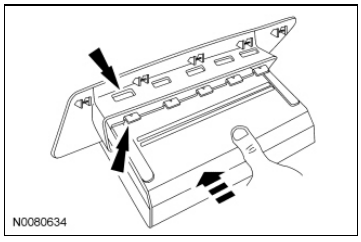
2. ⚠ **WARNING: Carefully inspect the passenger air bag trim cover, canister and soft pack before assembly. If any foreign objects are found, remove them before attaching the passenger air bag trim cover to the canister. If the canister or soft pack is damaged, install a new passenger air bag module assembly. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

   Match the number of cover windows to the number of canister hooks before attaching the passenger air bag cover to the canister.

3. Match the top of the passenger air bag cover with the canister mark from the removal procedure.

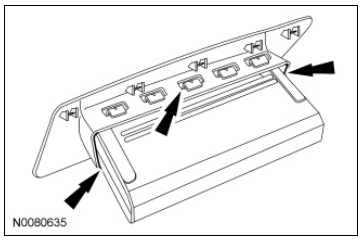
4. Position the canister onto the passenger air bag cover and engage the bottom hooks into the air bag cover windows.

5. Push the top of the passenger air bag cover to engage the top canister hooks.



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6. Inspect the passenger air bag cover windows-to-canister hooks to verify that every window has a hook installed and the sides are not tucked or folded against the air bag canister.

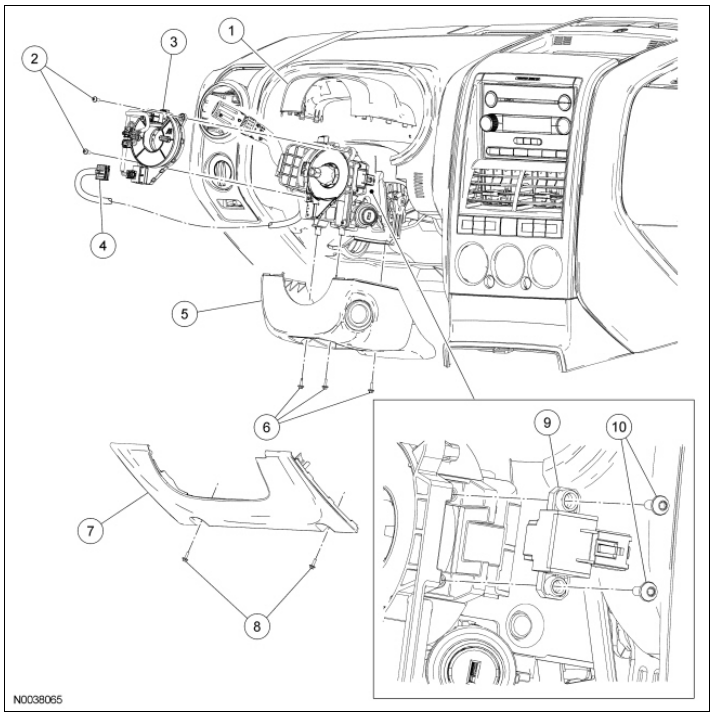


7. Install the passenger air bag module. For additional information, refer to Passenger Air Bag Module in this section.

8. **NOTE:** The video procedure utilizes a Fusion/Milan passenger air bag module assembly. It also applies to vehicles with similar passenger air bag module designs.

   An animated version of this procedure is available on-line.

Clockspring



Item	Part Number	Description
1	3530	Upper steering column shroud
2	W506942	Clockspring screws
3	14A644	Clockspring
4	-	Clockspring electrical connector (part of 14401)
5	3K512	Lower steering column shroud
6	W707658	Lower steering column shroud screws
7	04459	Instrument panel lower steering column opening cover
8	-	Instrument panel lower steering column opening cover screws
9	3F818	Steering wheel rotation sensor
10	W506942	Steering wheel rotation sensor screws

Removal

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the driver air bag module. For additional information, refer to Driver Air Bag Module in this section.

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2. Remove the steering wheel. For additional information, refer to Section 211-04 .
3. Remove the 2 screws and instrument panel lower steering column opening cover.
4. Remove the 3 screws and lower steering column shroud.
5. Remove the upper steering column shroud.
6. Disconnect the clockspring electrical connector.
7. Remove the 2 screws and position aside the steering wheel rotation sensor.
8. Remove the 2 clockspring screws and remove the clockspring.

Installation

1. ***NOTICE:*** **If installing a new clockspring, do not remove the clockspring anti-rotation key until the steering wheel is installed. If the anti-rotation key has been removed before installing the steering wheel, the clockspring must be centered. Failure to follow this instruction may result in component damage and/or system failure.**

   Install the clockspring and 2 screws.
2. Install the steering wheel rotation sensor and 2 screws.
3. Connect the clockspring electrical connector.
4. Install the upper steering column shroud.
5. Install the lower steering column shroud and 3 screws.
6. Install the instrument panel lower steering column opening cover and 2 screws.
7. ⚠ **WARNING: If the clockspring is not correctly centralized, it may fail prematurely. If in doubt, repeat the centralizing procedure. Failure to follow these instructions may increase the risk of serious personal injury or death in a crash.**

   NOTICE: **To prevent component damage and/or system failure, when reusing a clockspring it must be centered.**

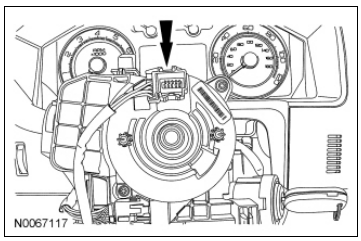
   NOTICE: **Do not over-rotate the clockspring inner rotor. The internal ribbon wire is connected to the clockspring rotor. The internal ribbon wire acts as a stop and can be broken from its internal connection. Failure to follow this instruction may result in component damage and/or system failure.**

   If a new clockspring was installed and the anti-rotation key has not been removed, **GO to Step 9.**
   If a new clockspring was installed and the anti-rotation key has been removed before the steering wheel is installed or the same clockspring is being installed, rotate the clockspring inner rotor **counterclockwise** and carefully feel for the ribbon wire to run out of length with slight resistance. Stop rotating the clockspring inner rotor at this point.
8. Starting with the clockspring inner rotor, wiring and connector in the 12 o'clock position, rotate the inner rotor **clockwise** through 2 revolutions to center the clockspring.
   - The clockspring inner rotor, wiring and connector must be in the 12 o'clock position.

9. *NOTICE:* **To prevent damage to the clockspring, make sure the road wheels are in the straight-ahead position.**

   NOTE: The clockspring inner rotor, wiring and connector must be in the 12 o'clock position to install the steering wheel.

   Install the steering wheel. For additional information, refer to Section 211-04 .



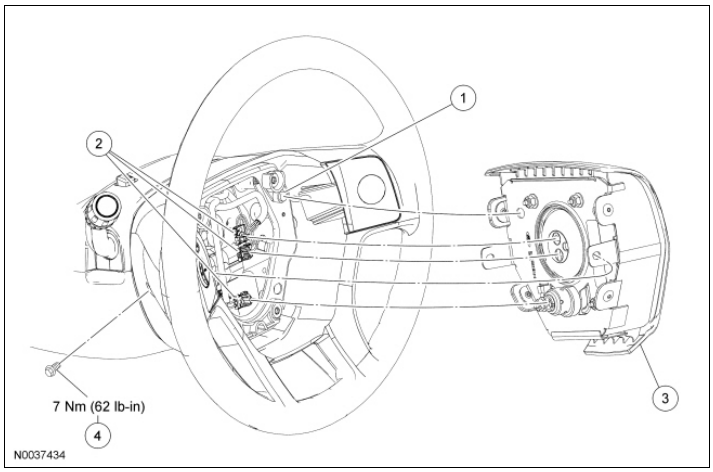
10. If a new clockspring was installed, remove the anti-rotation key.

11. Install the driver air bag module. For additional information, refer to Driver Air Bag Module in this section.

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Driver Air Bag Module



Item	Part Number	Description
1	-	Steering wheel locator pin
2	-	Electrical connectors (part of 14A664) (3 required)
3	043B13	Driver air bag module
4	-	Driver air bag module bolt (2 required)

Removal

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the 2 driver air bag module bolts.
   - To install, tighten to 7 Nm (62 lb-in).

3. **NOTE:** Match the position of the locator holes in the back of the driver air bag module and locator tabs on the steering wheel for installation.

   Disconnect the 3 electrical connectors and remove the driver air bag module.

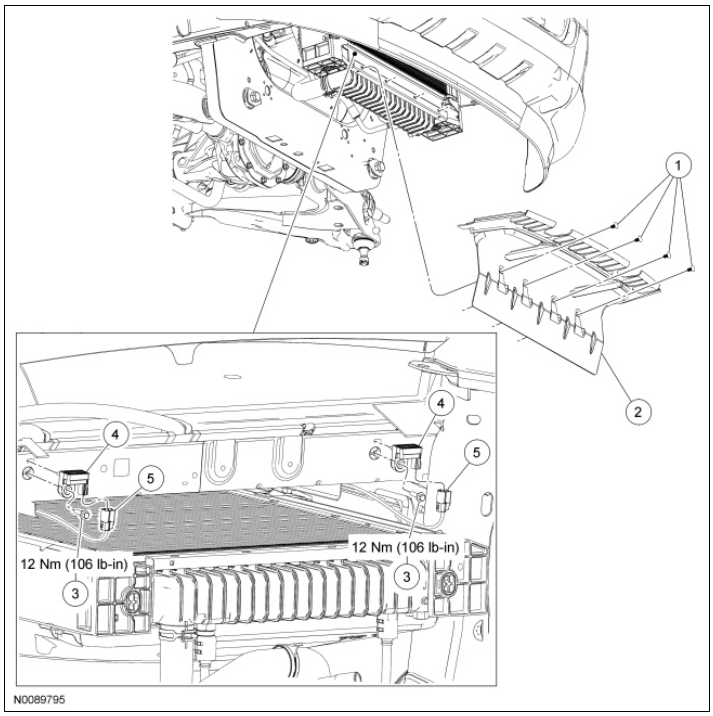
4. To install, reverse the removal procedure.

5. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Front Impact Severity Sensor



Item	Part Number	Description
1	W705589	Pin-type retainers
2	8349	Lower radiator air deflector
3	W505256	Bolts
4	14B004	Front impact severity sensors
5	-	Electrical connectors (part of 14398)

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

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the 4 pin-type retainers and lower radiator air deflector.

3. Disconnect the electrical connector.

4. ⚠ **WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

   NOTE: Make sure the radiator support and front impact severity sensor mating surfaces are clean and free of foreign material.

   Remove the bolt and front impact severity sensor.

   - To install, tighten to 12 Nm (106 lb-in).

5. To install, reverse the removal procedure.

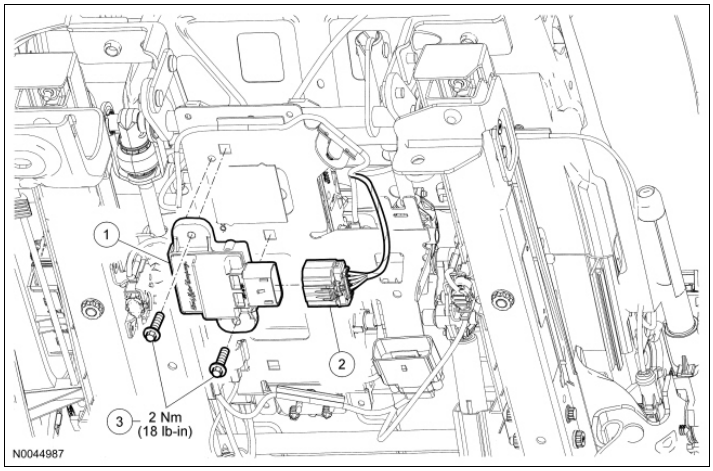
6. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Occupant Classification System Module (OCSM)

NOTE: Power seat shown, manual seat similar.



Item	Part Number	Description
1	14B422	Occupant Classification System Module (OCSM)
2	-	OCSM electrical connector (part of 14A699)
3	-	OCSM screws

Removal

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Disconnect the Occupant Classification System Module (OCSM) electrical connector underneath the front of the passenger seat.

3. **NOTE:** Note the position of the locator tab on the OCSM for installation.

   Remove the 2 screws and the OCSM .

4. To install, reverse the removal procedure.

5. Repower the SRS . **Do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

6. Carry out the appropriate procedure after installation of an Occupant Classification System (OCS) system component.

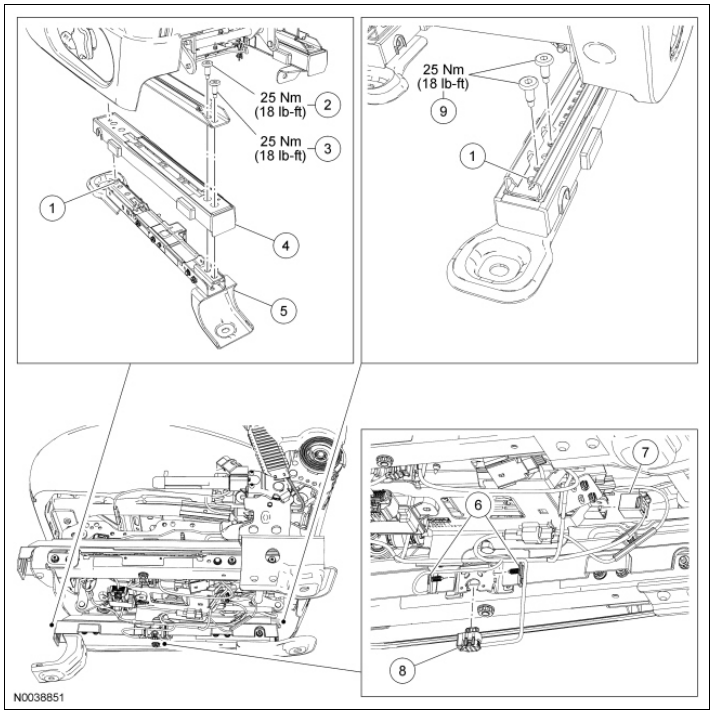
- If installing the original OCS system component, carry out the OCS System Zero Seat Weight Test and prove out the SRS . For additional information, refer to Occupant Classification Sensor (OCS) System Zero Seat Weight Test in this section.
- If installing a new OCS system component, carry out the OCS Reset and prove out the SRS . For additional information, refer to Occupant Classification Sensor (OCS) System Reset in this section.

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Occupant Classification Sensor

NOTE: Outboard Occupant Classification System (OCS) rail shown, inboard similar.



Item	Part Number	Description
1	-	Occupant Classification System (OCS) rail locator tab (part of 61708)
2	-	OCS rail front mounting position rear bolt (part of 61708)
3	-	OCS rail front mounting position front bolt (part of 61708)
4	62126	OCS rail shield
5	61708	OCS rail
6	-	OCS rail wiring retainers (part of 14A699)
7	-	Power seat track motor electrical connector (part of 14A699)
8	-	OCS rail electrical connector (part of 14A699)
9	-	OCS rail rear bolts (part of 61708)

Removal

⚠ WARNING: Use care when handling an Occupant Classification System (OCS) sensor rail before and after it is installed to the front passenger seat or seat track assembly. Dropping or subjecting the rails to impact may cause the OCS sensor rails to operate incorrectly. Failure to follow these instructions may result in incorrect operation of the OCS and increase the risk of serious personal injury or death in a crash.

⚠ WARNING: Do not disassemble the occupant classification system (OCS) sensor rail or tighten or loosen any of the nuts and bolts installed to the OCS rail body. Only the 8 bolts that attach the 2 OCS sensor rails to the seat track may be removed and installed. Failure to follow these instructions may result in incorrect operation of the OCS and increase the risk of serious personal injury or death in a crash.

⚠ WARNING: Never allow oil, grease, water or foreign contaminants to get on/in the occupant classification system (OCS) components or electrical connectors. Failure to follow this instruction may result in incorrect operation of the OCS and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification system (OCS) and increases the risk of serious personal injury or death in a crash.

NOTICE: **Prevent oil and/or grease from getting on the Occupant Classification System (OCS) rail bolts as this can lead to tightening beyond the specified torque value. Failure to follow this instruction may result in damaged or broken OCS rail bolts.**

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

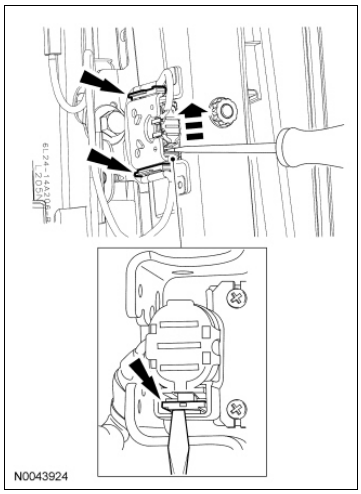
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the front passenger seat. For additional information, refer to Section 501-10 .

2. *NOTICE:* **Before releasing the Occupant Classification System (OCS) rail electrical connector, push only on the tip of the connector release tab to release the electrical connector. Do not insert the tool too deep into the OCS rail electrical connector or damage to the electrical connector may occur.**

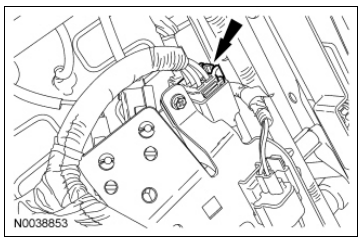
   NOTE: Note the Occupant Classification System (OCS) rail position, electrical wiring routing, wiring, connector and wiring retainers for installation.

   On the affected side, detach the 2 OCS rail wiring retainers and using a suitable tool, release the tab and disconnect the OCS rail electrical connector.

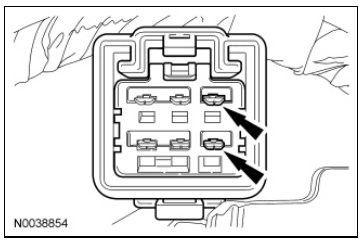


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3. If equipped, disconnect the power seat track motor electrical connector.

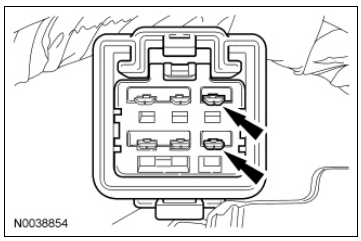


4. Move the seat to the forward stop position.
   - If equipped with a power seat track, apply power and ground to the pins shown.



5. Remove the 2 rear bolts from the OCS rail.

6. Move the seat to the rearward stop position.
   - If equipped with a power seat track, apply power and ground to the pins shown.



7. **NOTE:** Note the locator tab position where the OCS rail goes through the rail shield and into the rear seat track mounting point for installation.

   Remove the 2 front bolts and OCS rail and shield.

Installation

NOTE: If installing a new seat track, position the seat track where the seat will be in the full rearward position before installing the OCS rails.

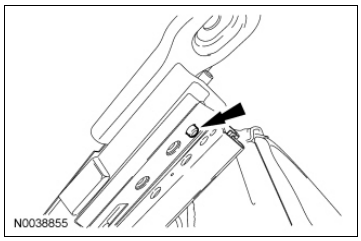
NOTE: To make sure of correct installation, the OCS rail bolts must be installed in the sequence shown.

1. ⚠ **WARNING: To prevent foreign material and contaminants from entering the occupant classification system (OCS) sensor rail, make sure the OCS rail shield is present, is not damaged and is correctly installed to the OCS rail. Failure to follow these instructions may result in incorrect operation of the OCS and increases the risk of serious personal injury or death in a crash.**

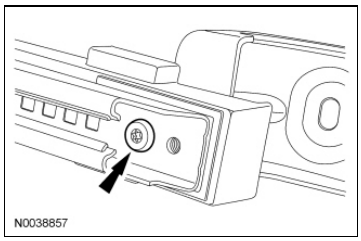
   NOTICE: **Prevent oil and/or grease from getting on the Occupant Classification System (OCS) rail bolts as this can lead to tightening beyond the specified torque value. Failure to follow this instruction may result in damaged or broken OCS rail bolts.**

NOTE: Make sure the OCS rail shield is seated correctly on the OCS rail.

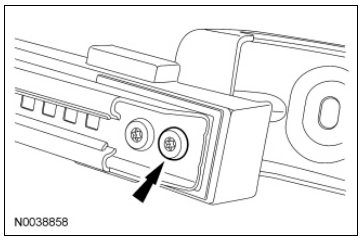
Install the shield on the OCS rail, and install the OCS rail and shield on the seat track with the locator tab aligned correctly as shown.



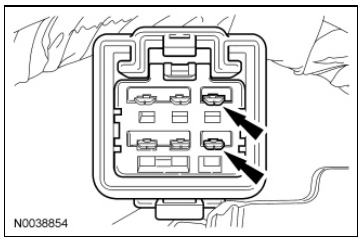
2. Hold the OCS rail and shield firmly in position and install the front mounting position rear bolt.
   - Tighten to 25 Nm (18 lb-ft).



3. Hold the OCS rail and shield firmly in position and install the front mounting position front bolt.
   - Tighten to 25 Nm (18 lb-ft).



4. Move the seat to the forward stop position.
   - If equipped with a power seat track, apply power and ground to the pins shown.



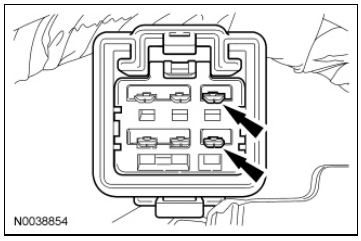
5. Install the 2 rear OCS rail bolts.
   - Tighten to 25 Nm (18 lb-ft).

6. **NOTE:** Make sure to route the OCS rail wiring and install the 2 wiring retainers as noted during removal.

   Connect the OCS rail electrical connector, route the wiring and attach the 2 wiring retainers.

7. Center the seat track to the seat cushion frame.
   - If equipped with a power seat track, apply power and ground to the pins shown.

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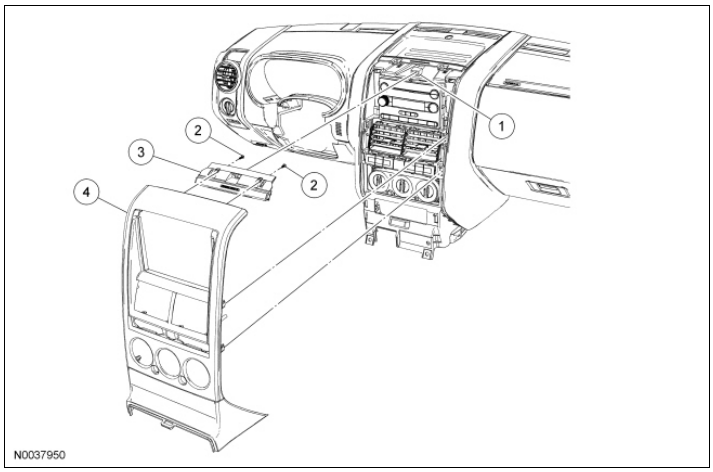


8. If equipped, connect the power seat track motor electrical connector.

9. Install the passenger seat. **Do not prove out the SRS at this time.** For additional information, refer to Section 501-10 .

10. Carry out the appropriate procedure after installation of an OCS system component.
    - If installing the original OCS system component, carry out the Occupant Classification System (OCS) System Zero Seat Weight Test and prove out the SRS . For additional information, refer to Occupant Classification Sensor (OCS) System Zero Seat Weight Test in this section.
    - If installing a new OCS system component, carry out the Occupant Classification System (OCS) System Reset procedure and prove out the SRS . For additional information, refer to Occupant Classification Sensor (OCS) System Reset in this section.

Passenger Air Bag Deactivation (PAD) Indicator



Item	Part Number	Description
1	-	Electrical connector (part of 14401)
2	W711659	Passenger Air Bag Deactivation (PAD) indicator screws
3	14B418	PAD indicator
4	4302	Instrument panel center finish panel

Removal and Installation

1. **NOTE:** Ignition must be OFF if disconnecting the Passenger Air Bag Deactivation (PAD) indicator electrical connector. Otherwise, a DTC will be set in the Restraints Control Module (RCM) memory and must be cleared before releasing the vehicle.

   Turn the ignition OFF and wait at least one minute.

2. Remove the floor console. For additional information, refer to Section 501-12 .

3. Gently pull outward to release the clips on the instrument panel center finish panel.

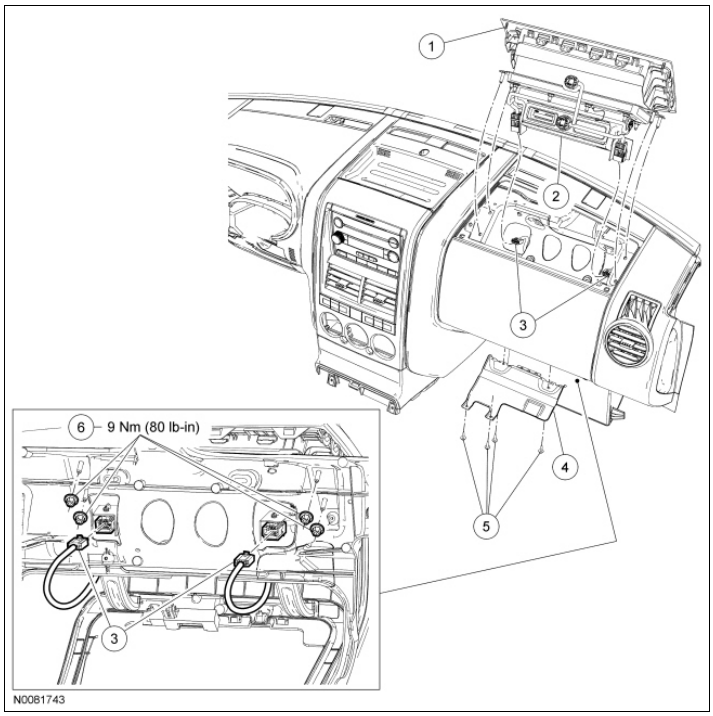
4. Disconnect the PAD indicator electrical connector.

5. Remove the 2 screws and PAD indicator.

6. To install, reverse the removal procedure.

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Passenger Air Bag Module



Item	Part Number	Description
1	04338	Passenger air bag cover
2	044A74	Passenger air bag module assembly
3	-	Passenger air bag module electrical connectors (part of 14401) (2 required)
4	-	Passenger air bag module heat shield
5	N807122	Passenger air bag module heat shield bolts
6	-	Passenger air bag module nuts

Removal and Installation

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTICE: **Do not install a new passenger air bag module assembly due to a damaged or discolored passenger air bag cover. The passenger air bag cover can be serviced separately from the passenger air bag module assembly. For additional information, refer to Air Bag Trim Cover - Passenger in this section.**

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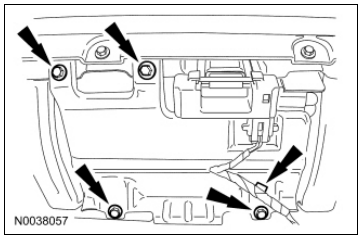
NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

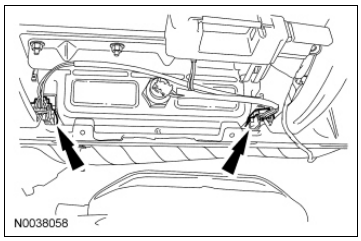
1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Open and lower the glove compartment door.

3. Release the wiring retainer, 4 bolts and passenger air bag module heat shield.



4. Disconnect the 2 passenger air bag module electrical connectors.



5. Remove the 4 passenger air bag module nuts.
   - To install, tighten to 9 Nm (80 lb-in).

6. ***NOTICE:*** **Do not handle the passenger air bag module by grabbing the edges of the passenger air bag cover. Damage to the air bag module may occur.**

   Push up to release the passenger air bag cover clips from the instrument panel and remove the passenger air bag module.

7. **NOTE:** During passenger air bag module installation, make sure all of the air bag trim cover clips are fully seated into the instrument panel.

   To install, reverse the removal procedure.

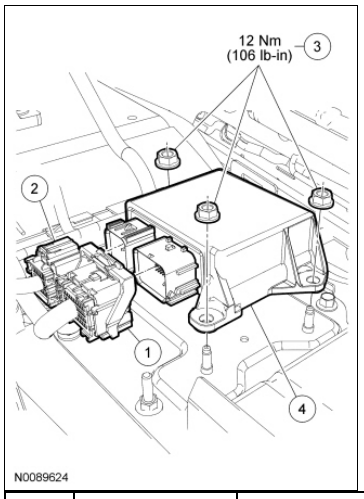
8. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Restraints Control Module (RCM)

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool



Item	Part Number	Description
1	-	Large Restraints Control Module (RCM) electrical connector (part of 14A488)
2	-	Small RCM electrical connector (part of 14401)
3	W701838	RCM nuts
4	14B321	RCM

Removal

⚠ WARNING: Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

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

NOTICE: **When installing a new Restraints Control Module (RCM), it is necessary to carry out Programmable Module Installation (PMI). For additional information, refer to Section 418-01 . Failure to follow these instructions may result in component damage and/or system failure.**

NOTE: When installing a new Restraints Control Module (RCM), always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.

NOTE: The air bag warning indicator illuminates when the correct RCM fuse is removed and the ignition is ON.

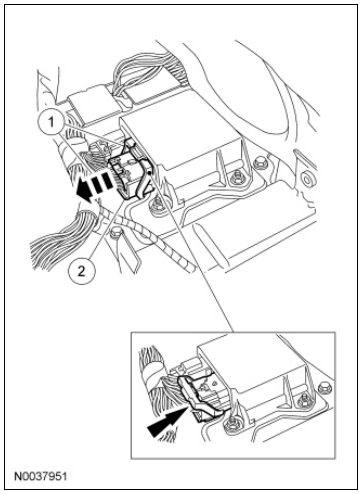
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. If installing a new RCM , carry out the steps necessary to prepare for Programmable Module Installation (PMI). For additional information, refer to Section 418-01 .

2. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Remove the front floor console. For additional information, refer to Section 501-12 .

4. Disconnect the large RCM electrical connector.
    1. Pinch the thumb tab and pivot the large RCM electrical connector position assurance lever all the way back until it stops.
    2. Pull out and disconnect the large RCM electrical connector.



5. Press to release the locking tab and disconnect the small RCM electrical connector.

6. Remove the 3 RCM nuts.

7. Remove the RCM .

Installation

1. Install the RCM .

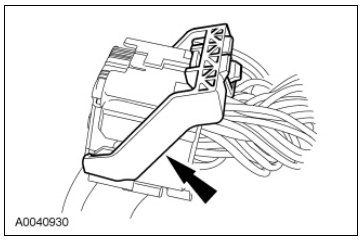
2. Install the 3 RCM nuts.
    - Tighten to 12 Nm (106 lb-in).

3. Connect the small RCM electrical connector.

4. **NOTE:** The RCM has been removed for clarity.

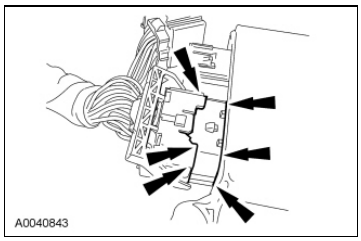
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On the large RCM electrical connector, place the connector position assurance lever in the full release position.



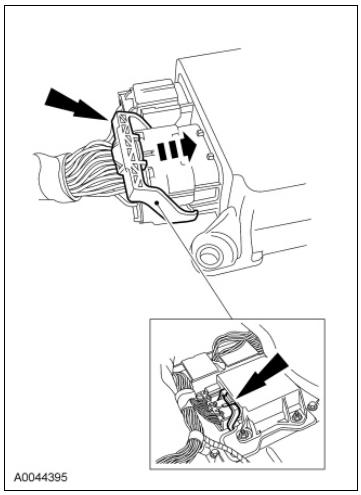
5. ***NOTICE:*** **Putting the large electrical connector into the Restraints Control Module (RCM) on an angle may cause bad electrical connections and damage components.**

   Position the large electrical connector into the RCM .



6. Connect the large RCM connector.
   - ***NOTICE:*** **Do not push the connector to the point where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the Restraints Control Module (RCM), before using the lever to fully seat the connector. Damage to the connector or component may occur.**

     With the large electrical connector uniformly aligned to the RCM , lightly push in until a subtle audible click is heard and a slight resistance is felt.
   - Using the connector position assurance lever, pivot it toward the RCM , drawing the connector into the RCM . Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.



7. Install the front floor console. For additional information, refer to Section 501-12 .

8. Repower the SRS . **Do not** prove out the SRS at this time. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

9. When installing a new RCM , carry out the steps necessary to complete Programmable Module Installation (PMI). For additional information, refer to Section 418-01 .

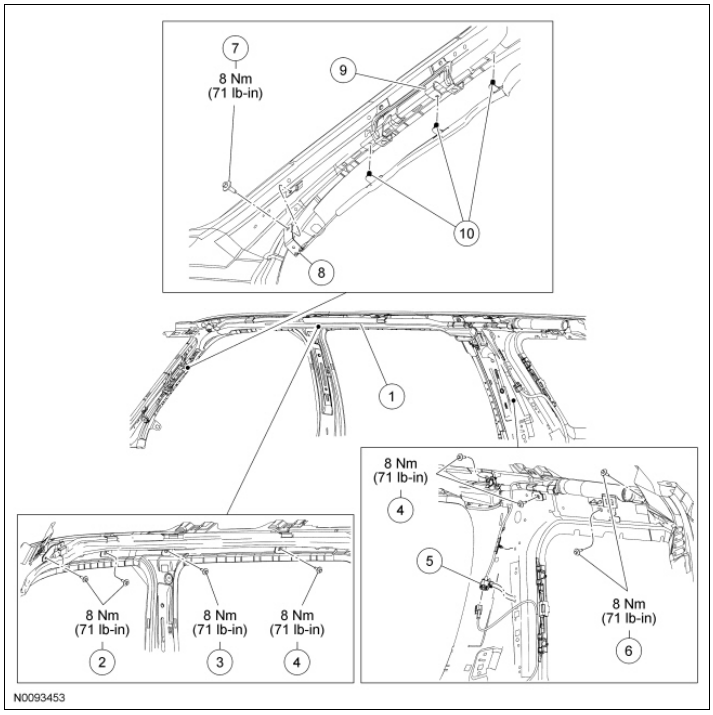
10. Prove out the SRS as follows:
    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will:
    - fail to light.
    - remain lit continuously.
    - flash at a 5 Hz rate (RCM not configured).
    The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS . If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.
    Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM) using a scan tool.

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Safety Canopy Module - Explorer, Mountaineer

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	042D94	Safety Canopy® module
2	W503924	Safety Canopy® module front bolts
3	W503924	Safety Canopy® module B-pillar bolt
4	W503924	Safety Canopy® module C-pillar bolts
5	-	Safety Canopy® module electrical connector (part of 042D94)
6	W503924	Safety Canopy® module rear bracket bolts
7	W503924	Safety Canopy® module front tether bracket bolt
8	-	Safety Canopy® module front tether bracket (part of 042D94)
9	-	A-pillar trim bracket
10	-	Front tether pin-type retainers (part of 042D94)

Removal

⚠ WARNING: Anytime the Safety Canopy® or side air curtain module has deployed, a new headliner and new A-, B-, C- and D-pillar upper trim panels and attaching hardware must be installed. Remove any other damaged components and hardware and install new components and hardware as needed. Failure to follow these instructions may result in the Safety Canopy® or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Always carry or place a live Safety Canopy®, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: Do not obstruct or place objects in the deployment path of the Safety Canopy® or side air curtain module. Failure to follow this instruction may result in the Safety Canopy® or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

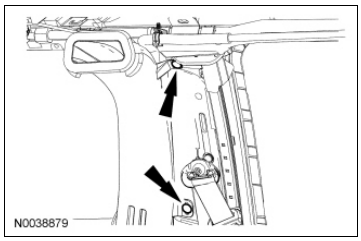
All vehicles

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the headliner. For additional information, refer to Section 501-05 .

Vehicles with auxiliary climate control

3. Remove the 2 retainers and auxiliary climate control headliner duct from the C-pillar.



All vehicles

4. **NOTE:** Note the Safety Canopy® module wiring harness routing for installation.

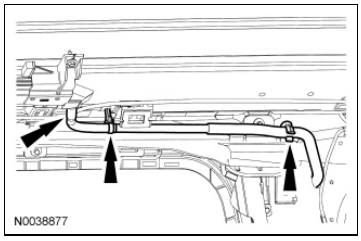
   Disconnect the Safety Canopy® module electrical connector and detach the connector and wiring pin-type retainers from the C-pillar.

Vehicles with moon roof

5. **NOTE:** Note the position of the 2 rear moon roof drain hose routing clips for installation.

   Disconnect the rear moon roof drain tube and detach the 2 rear moon roof drain hose routing clips.

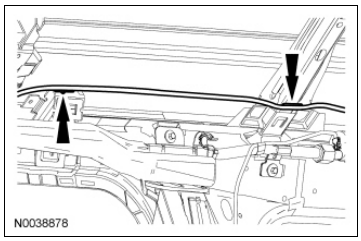
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Vehicles with entertainment system

6. **NOTE:** Note the position and routing of the entertainment system wiring for installation.

   Detach the 2 entertainment system wiring retainers and position wiring aside.



All vehicles

7. **NOTE:** Note the locator tab on the front tether anchor bracket to the A-pillar sheet metal for installation.

   Remove the bolt and front tether anchor bracket.

8. Detach the 3 Safety Canopy® module front tether pin-type retainers from the A-pillar.

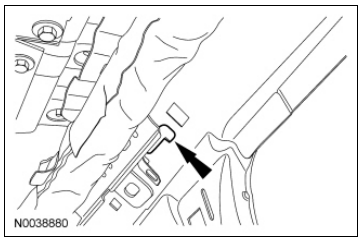
9. Remove the Safety Canopy® module front 2 bolts.

10. Remove the Safety Canopy® module 3 bolts near the C-pillar.

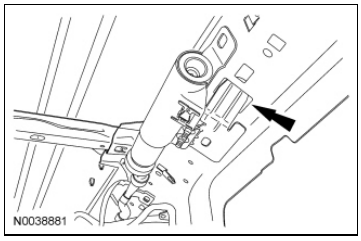
11. Remove the Safety Canopy® module 2 rear bracket bolts.

12. Remove the Safety Canopy® module bolt at the B-pillar.

13. Gently lift the Safety Canopy® module up and inward at the B-pillar to release the bracket hook from the sheet metal.



14. Move the Safety Canopy® module forward to release the rear bracket hook from the sheet metal and remove the Safety Canopy® module.



Installation

⚠ WARNING: Never put any type of fastener or tie strap around any part of a Safety Canopy® module, side air curtain module or interior trim panel. This will prevent the Safety Canopy® or side air curtain module from deploying correctly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

⚠ WARNING: Always carry or place a live Safety Canopy®, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: When installing a new headliner on a vehicle equipped with Safety Canopy® or side air curtain modules, make sure the headliner has the word AIRBAG on the headliner where it meets each B-pillar trim panel. Otherwise, you have the wrong headliner. Failure to follow this instruction may result in the Safety Canopy® or side air curtain module not deploying or deploying incorrectly, increasing the risk of personal injury or death in a crash.

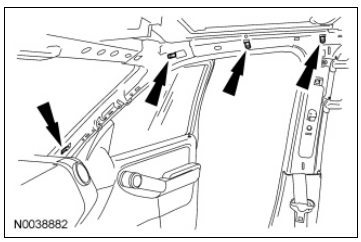
⚠ WARNING: Always use new torque-prevailing type J-nuts when installing the Safety Canopy® in the vehicle. Use of these J-nuts is mandatory to reduce the risk of loss of fastener effectiveness. Failure to follow this instruction may result in the Safety Canopy® module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Before installing a Safety Canopy® or side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners if damaged and remove foreign material. Failure to follow these instructions may result in the Safety Canopy® or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Inspect a Safety Canopy® or side air curtain module before installation. If the module is damaged, the cover has separated or the Safety Canopy® or side air curtain material has been exposed, install a new module. Do not attempt to repair the module. Failure to follow these instructions may result in the Safety Canopy® or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

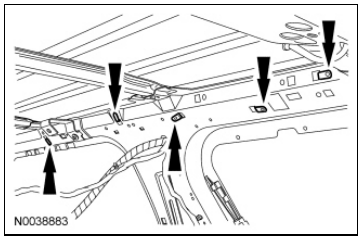
All vehicles

1. Remove the 4 front J-nuts and install new.

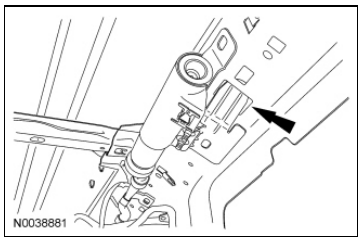


2. Remove the 5 rear J-nuts and install new.

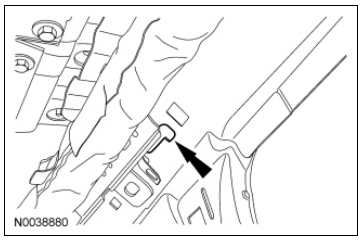
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3. Position Safety Canopy® module by moving it rearward installing the rear bracket hook in the sheet metal.



4. Install the Safety Canopy® module B-pillar bracket hook in the sheet metal.



5. **NOTE:** Make sure all Safety Canopy® module bolt holes line up with all J-clips.

   Install the Safety Canopy® module front 2 bolts with the forward most bolt first.

   - Tighten to 8 Nm (71 lb-in).

6. Install the Safety Canopy® module B-pillar bolt.
   - Tighten to 8 Nm (71 lb-in).

7. Install the 3 C-pillar Safety Canopy® module bolts.
   - Tighten to 8 Nm (71 lb-in).

8. Install the 2 Safety Canopy® module rear bracket bolts.
   - Tighten to 8 Nm (71 lb-in).

9. Attach the 3 Safety Canopy® module front tether pin-type retainers to the A-pillar.

10. **NOTE:** Make sure the Safety Canopy® module front tether bracket locator tab is correctly installed in the A-pillar sheet metal.

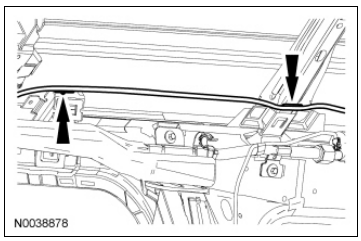
    Install the Safety Canopy® module front tether bracket and bolt.

    - Tighten to 8 Nm (71 lb-in).

Vehicles with entertainment system

11. **NOTE:** Make sure to route the entertainment system wiring as noted during removal.

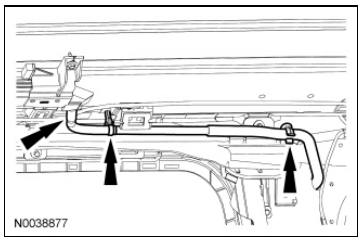
Attach the 2 entertainment system wiring retainers.



Vehicles with moon roof

12. **NOTE:** Make sure to route the moon roof drain hose as noted during removal.

    Connect the rear moon roof drain tube and attach the 2 rear moon roof drain hose clips.



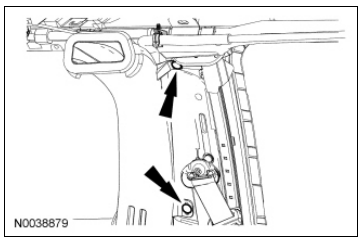
All vehicles

13. **NOTE:** Make sure to route the Safety Canopy® module wiring harness as noted during removal.

    Connect the Safety Canopy® module electrical connector and attach the connector and wiring pin-type retainers to the C-pillar.

Vehicles with auxiliary climate control

14. Install the auxiliary climate control headliner duct and 2 retainers to the C-pillar.



All vehicles

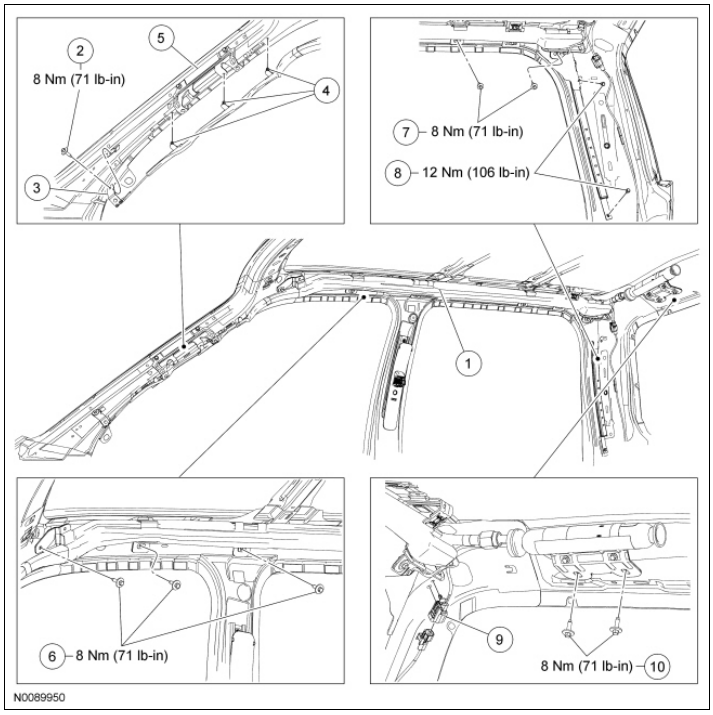
15. Install the headliner. For additional information, refer to Section 501-05 .

16. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Safety Canopy Module - Explorer Sport Trac

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	042D94	Safety Canopy® module
2	W503924	Safety Canopy® module front tether bracket bolt
3	-	Safety Canopy® module front tether bracket (part of 042D94)
4	-	Front tether pin-type retainers (part of 042D94)
5	-	A-pillar trim bracket
6	W503924	Safety Canopy® module front bolts
7	W503924	Safety Canopy® module C-pillar bolts
8	-	Safety Canopy® module C-pillar tether bracket bolts (part of 042D94)
9	-	Safety Canopy® module electrical connector (part of 042D94)
10	W503924	Safety Canopy® module rear bracket bolts

Removal

⚠ WARNING: Anytime the Safety Canopy® or side air curtain module has deployed, a new headliner and new A-, B-, C- and D-pillar upper trim panels and attaching hardware must be installed. Remove any other damaged components and hardware and install new components and hardware as needed. Failure to follow these instructions may result in the Safety Canopy® or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

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⚠ WARNING: Always carry or place a live Safety Canopy®, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: Do not obstruct or place objects in the deployment path of the Safety Canopy® or side air curtain module. Failure to follow this instruction may result in the Safety Canopy® or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

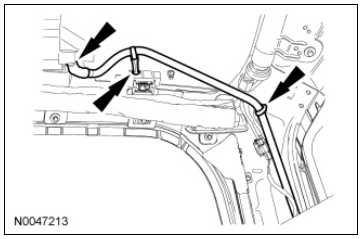
1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the headliner. For additional information, refer to Section 501-05 .

Vehicles with moon roof

3. **NOTE:** Note the position of the 2 rear moon roof drain hose routing clips for installation.

   Disconnect the rear moon roof drain tube and detach the 2 rear moon roof drain hose routing clips.



All vehicles

4. Disconnect the Safety Canopy® module electrical connector and detach the connector pin-type retainer from the C-pillar.

5. **NOTE:** Note the locator tab on the front tether anchor bracket to the A-pillar sheet metal for installation.

   Remove the bolt and the front tether anchor bracket.

6. Detach the 3 Safety Canopy® module front tether pin-type retainers from the A-pillar.

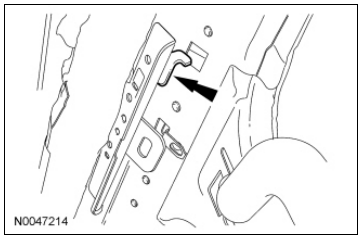
7. Remove the 3 front bolts from the Safety Canopy® module.

8. Remove the 2 rear bracket bolts from the Safety Canopy® module.

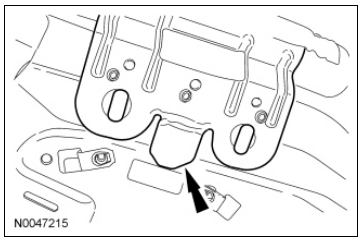
9. Remove the 2 bolts and the Safety Canopy® module C-pillar tether bracket.

10. Remove the 2 Safety Canopy® module bolts near the C-pillar.

11. Gently lift the Safety Canopy® module up and inward at the B-pillar to release the bracket hook from the sheet metal.



12. Move the Safety Canopy® module forward to release the rear bracket hook from the sheet metal and remove the Safety Canopy® module.



Installation

⚠ WARNING: Never put any type of fastener or tie strap around any part of a Safety Canopy® module, side air curtain module or interior trim panel. This will prevent the Safety Canopy® or side air curtain module from deploying correctly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

⚠ WARNING: When installing a new headliner on a vehicle equipped with Safety Canopy® or side air curtain modules, make sure the headliner has the word AIRBAG on the headliner where it meets each B-pillar trim panel. Otherwise, you have the wrong headliner. Failure to follow this instruction may result in the Safety Canopy® or side air curtain module not deploying or deploying incorrectly, increasing the risk of personal injury or death in a crash.

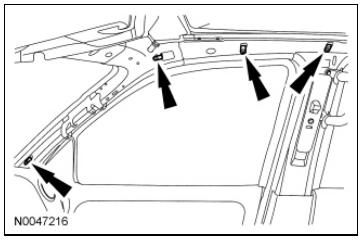
⚠ WARNING: Always use new torque-prevailing type J-nuts when installing the Safety Canopy® in the vehicle. Use of these J-nuts is mandatory to reduce the risk of loss of fastener effectiveness. Failure to follow this instruction may result in the Safety Canopy® module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Before installing a Safety Canopy® or side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners if damaged and remove foreign material. Failure to follow these instructions may result in the Safety Canopy® or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

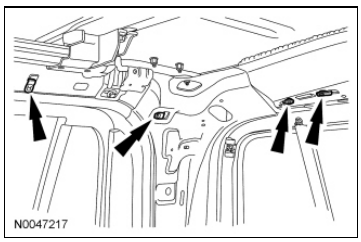
All vehicles

1. Remove the front 4 J-nuts and install new.

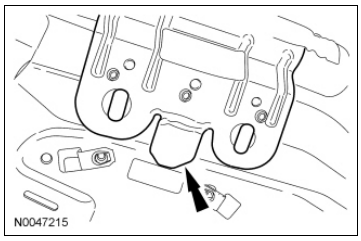
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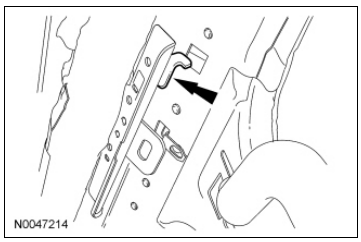
2. Remove the rear 4 J-nuts and install new.



3. Position the Safety Canopy® module by moving it rearward, installing the rear bracket hook in the sheet metal.



4. Install the Safety Canopy® module B-pillar bracket hook in the sheet metal.



5. **NOTE:** Make sure all Safety Canopy® module bolt holes line up with all J-clips.

   Install the 2 Safety Canopy® module bolts near the C-pillar.

   - Tighten to 8 Nm (71 lb-in).

6. Install the Safety Canopy® module C-pillar tether bracket and the 2 bolts.
   - Tighten to 12 Nm (106 lb-in).

7. Install the 2 Safety Canopy® module rear bracket bolts.
   - Tighten to 8 Nm (71 lb-in).

8. Install the Safety Canopy® module front 3 bolts.
   - Tighten to 8 Nm (71 lb-in).

9. Attach the 3 Safety Canopy® module front tether pin-type retainers to the A-pillar.

10. **NOTE:** Make sure the Safety Canopy® module front tether bracket locator tab is correctly installed in the A-pillar sheet metal.

    Install the Safety Canopy® module front tether bracket and bolt.

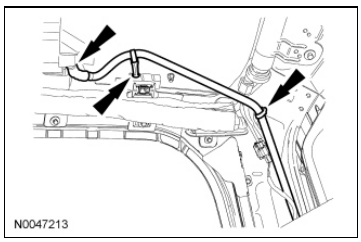
    - Tighten to 8 Nm (71 lb-in).

11. Connect the Safety Canopy® module electrical connector and attach the connector pin-type retainer to the C-pillar.

Vehicles with moon roof

12. **NOTE:** Make sure to route the moon roof drain hose as noted during removal.

    Connect the rear moon roof drain tube and attach the 2 rear moon roof drain hose clips.



All vehicles

13. Install the headliner. For additional information, refer to Section 501-05 .

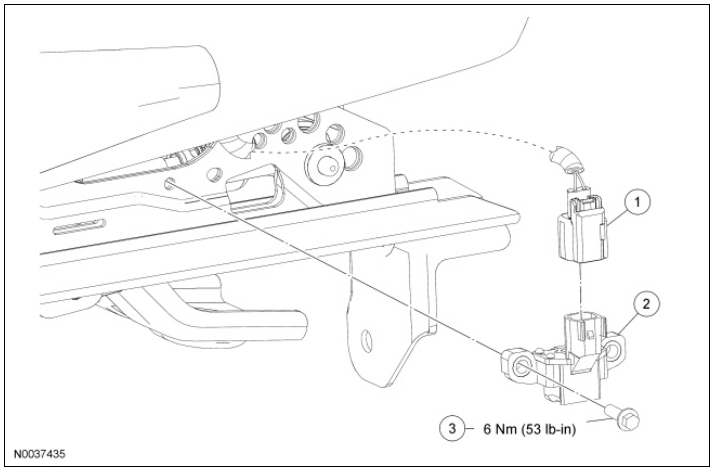
14. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Seat Position Sensor

NOTE: Power seat shown, manual seat similar.



Item	Part Number	Description
1	-	Seat position sensor electrical connector (part of 14C719)
2	14B416	Seat position sensor
3	-	Seat position sensor bolt

⚠ WARNING: Never disassemble or tamper with safety belt buckle/retractor pretensioners, adaptive load limiting retractors, safety belt inflators, or probe the electrical connectors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners, adaptive load limiting retractors, or safety belt inflators, which increases the risk of serious personal injury or death.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the front seat to the rearmost and upward position.

2. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

3. Disconnect the seat position sensor electrical connector.

4. **⚠ WARNING: Always tighten the seat position sensor retaining bolt to specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

Remove the bolt and seat position sensor.

- To install, tighten to 6 Nm (53 lb-in).

5. To install, reverse the removal procedure.

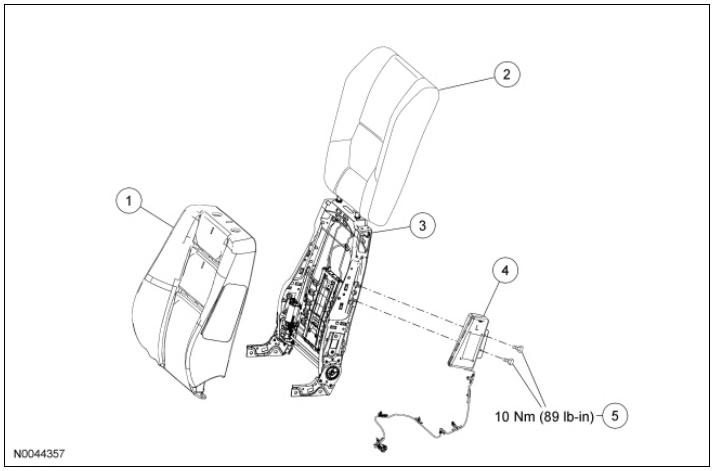
6. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Side Air Bag Module

NOTE: Driver seat shown, passenger similar.



Item	Part Number	Description
1	64811	Seat backrest foam pad
2	62901	Seat backrest trim cover
3	61018	Seat backrest frame
4	611D11	Side air bag module
5	-	Side air bag module bolts

Removal

⚠ WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.

NOTICE: **Use care when handling the seat and track assembly. Dropping the assembly or sitting on a seat not secured in the vehicle may result in damaged components.**

NOTE: When replacing the side air bag after deployment, refer to Section 501-10 for additional information concerning the installation of a new side air bag module.

The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

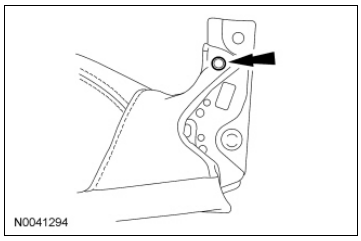
NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the front seat. For additional information, refer to Section 501-10 .

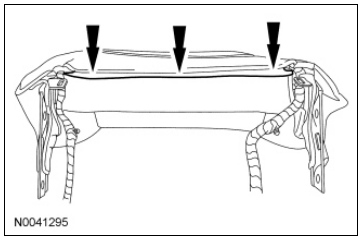
2. Remove the seat backrest. For additional information, refer to Section 501-10 .

3. **NOTE:** RH shown, LH similar.

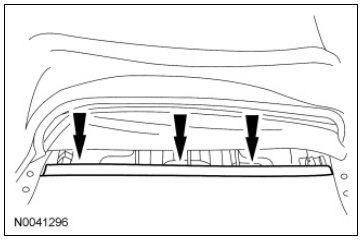
   Remove the 2 plastic rivets attaching the backrest trim cover to the inboard and outboard recliners on the seat backrest frame.



4. Release the seat back lower outer trim cover J-clip.



5. Release the seat back lower inner trim cover J-clip.



6. ⚠ **WARNING: Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

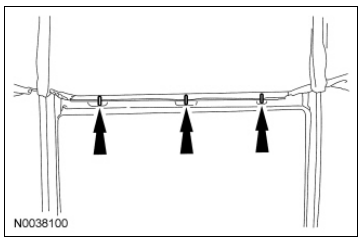
   NOTICE: **Use care when separating the seat backrest trim cover from the hook-and-loop strips, or the hook-and-loop strip can be torn from the seat backrest foam pad.**

   Place a hand between the seat backrest trim cover and foam pad and carefully separate the hook-and-loop strips, then carefully roll up the seat back trim cover in an inside out fashion to the first

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row of hog rings in the front.

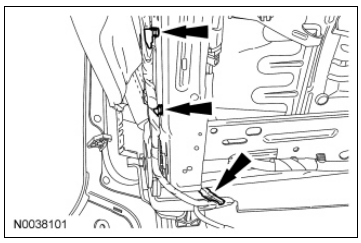
7. Remove the first row of hog rings.



8. Detach the hook-and-loop strips and invert the seat backrest trim cover up enough to expose the side air bag.

9. **NOTE:** Note the position and the routing of the side air bag module wiring harness for installation.

   Detach the side air bag wiring harness retainers from the seat backrest frame.



10. Position out the seat backrest foam pad.

11. Remove the 2 bolts and the side air bag module.

Installation

⚠ WARNING: Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.

⚠ WARNING: Before installing the seat side air bag module/deployment chute assembly:

- Inspect the side air bag module and mounting surfaces for any damage or foreign material.
- Remove any foreign material from the mounting surfaces of the deployment chute, the seat backrest frame mounting bracket and the air bag module cavity in the seat backrest foam pad.
- Install new parts if damaged.

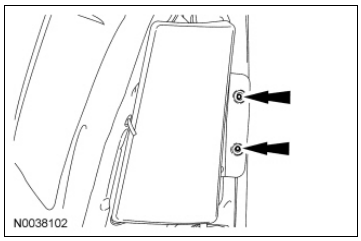
Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

⚠ WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

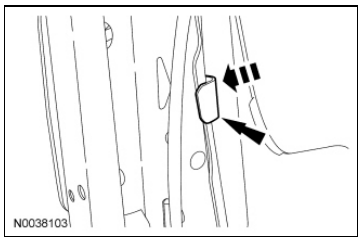
NOTICE: **Make sure the side air bag module wiring harness is not pinched between the side air bag**

module and the backrest frame. Damage to the wire harness may occur.

1. Align the holes of the side air bag module bracket to the U-nuts on the backrest frame.
   - Install new U-nuts if installing a new side air bag module.



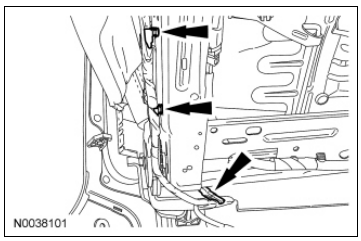
2. Slide the side air bag module onto the backrest frame so the bracket hook wraps around the backrest frame.



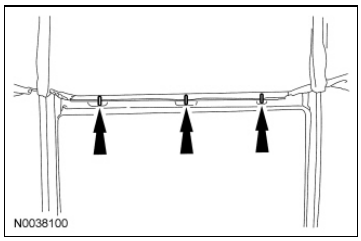
3. Install the side air bag module and the bolts.
   - Tighten to 10 Nm (89 lb-in).

4. Position back the seat backrest foam pad.

5. Attach the side air bag wiring harness retainers to the seat backrest frame.

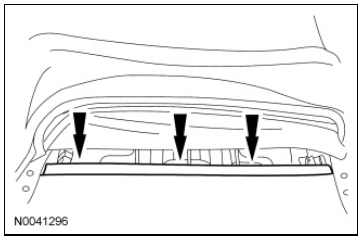


6. Attach the hook-and-loop strips, and roll the seat back trim cover down and install the first row of hog rings.

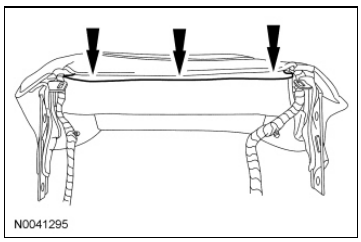


7. Attach the hook-and-loop strips, and roll the seat back trim cover down and attach the seat back lower inner trim cover J-clip.

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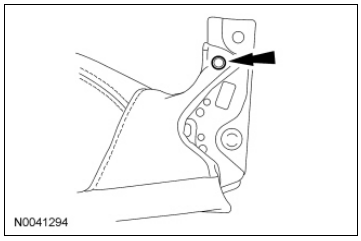


8. Attach the seat back lower outer trim cover J-clip.



9. **NOTE:** RH shown, LH similar.

   Fold the backrest trim cover over on each side of the inboard and outboard recliner. Install the plastic rivets attaching the backrest trim cover to the inboard and outboard recliners on the seat backrest frame.



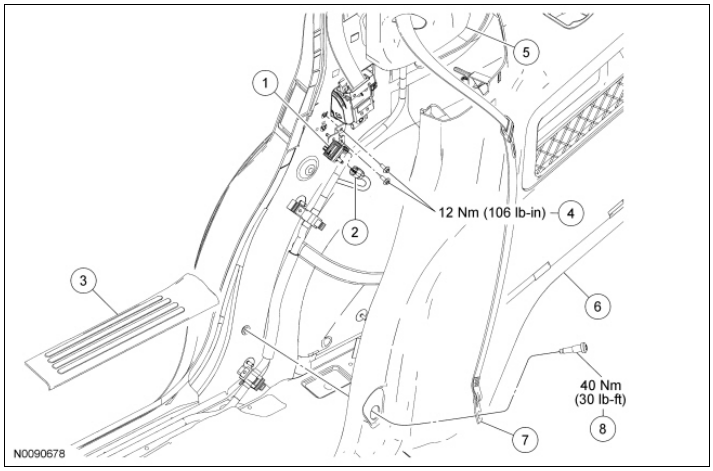
10. Install the seat backrest. For additional information, refer to Section 501-10 .

11. Install the front seat. For additional information, refer to Section 501-10 .

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Side Impact Sensor - C-Pillar, Explorer, Mountaineer

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	14B345	Side impact sensor and bracket assembly
2	-	Electrical connector (part of 14A488)
3	13229	Rear door scuff plate
4	W707722	C-pillar side impact sensor bolts
5	31004	Upper C-pillar trim panel
6	31012	Quarter trim panel
7	-	Safety belt anchor (part of 611B68)
8	W708473	Safety belt anchor bolt

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

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The LH and RH C-pillar mounted side impact sensors are not interchangeable.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the rear door scuff plate.

3. Remove the bolt and safety belt anchor.
   - To install, tighten to 40 Nm (30 lb-ft).

4. Detach the upper C-pillar trim panel and position aside.

5. Position aside the quarter trim panel.
   - Pull out on the quarter trim panel at the C-pillar to release the retaining clips and access the C-pillar side impact sensor.

6. Disconnect the electrical connector.

7. **NOTE:** Note the position of the sensor and bracket locating tab for installation.

   NOTE: Make sure the C-pillar and side impact severity sensor mating surfaces are clean and free of foreign material.

   Remove the 2 bolts and side impact sensor.

   - To install, tighten to 12 Nm (106 lb-in).

8. ⚠ **WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

   NOTE: Make sure the safety belt webbing is not twisted prior to installation.

   To install, reverse the removal procedure.

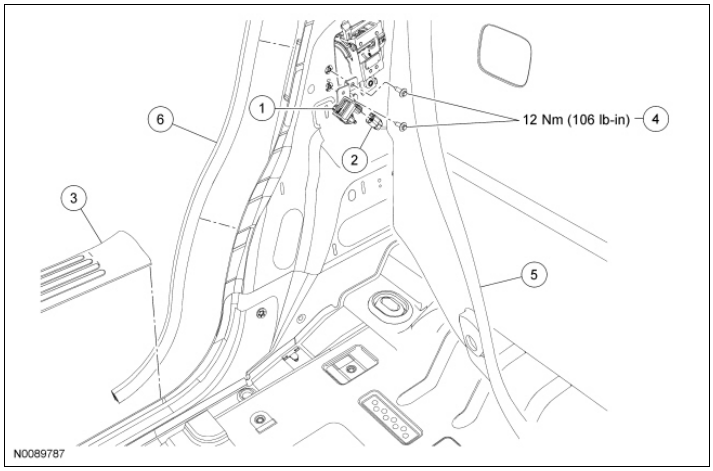
9. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Side Impact Sensor - C-Pillar, Explorer Sport Trac

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	14B345	Side impact sensor assembly
2	-	Electrical connector (part of 14A488)
3	13228	Rear door scuff plate
4	W707722	C-pillar side impact sensor bolts
5	253A10	Lower C-pillar trim panel
6	-	Rear door weatherstrip

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

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

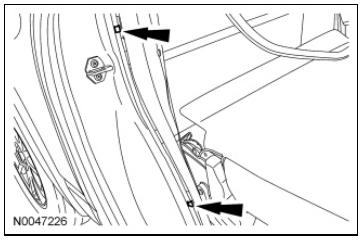
NOTE: The RH and LH C-pillar mounted side impact sensors are not interchangeable.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

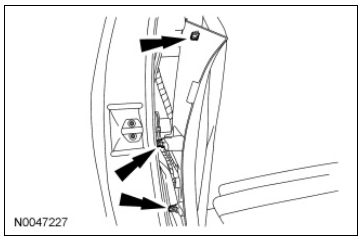
2. Remove the rear door scuff plate.

3. Detach the rear door weatherstrip.

4. Remove the 2 lower C-pillar trim panel retaining clips from the rear door opening sheet metal.



5. Position aside the lower C-pillar trim panel.
    - Pull out on the quarter trim panel at the C-pillar to release the 3 retaining clips and access the C-pillar side impact sensor.



6. **NOTE:** Note the position of the sensor and bracket locating tab for installation.

   NOTE: Make sure the C-pillar and side impact sensor mating surfaces are clean and free of foreign material.

   Remove the 2 bolts from the side impact sensor and bracket assembly.

    - To install, tighten to 12 Nm (106 lb-in).

7. Disconnect the electrical connector and remove the side impact sensor.

8. ⚠ **WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

   To install, reverse the removal procedure.

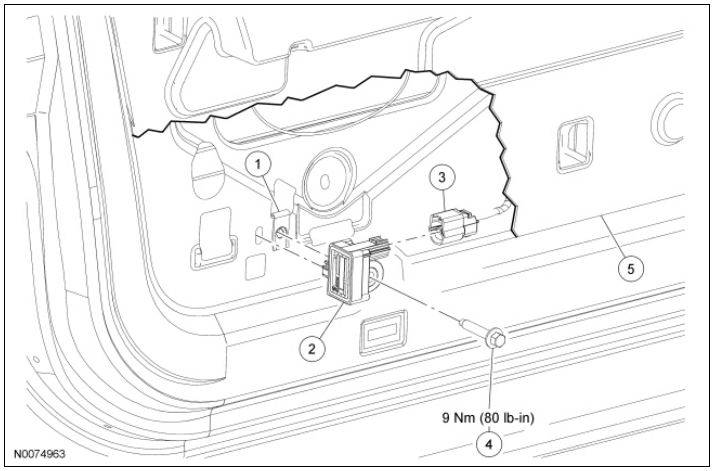
9. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

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Side Impact Sensor - Front Door

NOTE: LH side shown, RH similar.



Item	Part Number	Description
1	W705958	J-clip retaining nut
2	14B345	Side impact sensor (pressure sensor)
3	-	Electrical connector (part of 14631)
4	W500300	Side impact sensor bolt
5	237A05	Weathershield

Removal and Installation

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

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

2. Remove the front interior door trim panel. For additional information, refer to Section 501-05 .

3. Detach the rearward lower corner of the weathershield on the door to access the side impact sensor (pressure sensor).

4. Disconnect the electrical connector.

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5. Remove the bolt and side impact sensor.
    - To install, tighten to 9 Nm (80 lb-in).

6. ⚠ **WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

   To install, reverse the removal procedure.

7. Repower the SRS . For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of this section.

Material

Item	Specification	Fill Capacity
Clear Silicone Rubber TA-32	ESB-M4G92-A	-
Metal Bonding Adhesive TA-1	-	-
Motorcraft® Acid Neutralizer ZC-1-A	-	-
Motorcraft® Alkaline Neutralizer ZC-2-A	-	-
3MTM Perfect-ItTM Show Car Liquid Wax 39026	-	-
Motorcraft® Detail Wash ZC-3-A	-	-
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Premium Undercoating ValuGardTM VG101, VG101A (aerosol)	-	-
Rust Inhibitor ValuGardTM VG104, VG104A (aerosol)	-	-
Plastic Bonding Adhesive TA-9	-	-
Roof Ditch Sealer Fusor® 122EZ, 3MTM 08307	-	-
Seam Sealer TA-2	-	-
Trim and Weatherstrip Adhesive Permatex® 81850 or equivalent	-	-

General Specifications

Item	Specification
Wax and Grease Remover	-

General Equipment

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3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

General Specifications -Welding Specifications

Item	Specification
Plug Weld Hole	8 mm (0.31 in)
Weld Wire ER70S-3 or equivalent	0.9-1.1 mm (0.035-0.045 in)

Weld Nugget Chart

Test Thickness of Metal (mm)	Nugget Size
0.7 + 0.7	4.3 mm (0.16 in)
0.7 + 0.7 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9	4.7 mm (0.18 in)
0.9 + 0.9 + 0.9	4.7 mm (0.18 in)
1.0 + 1.0	5.2 mm (0.2 in)
1.0 + 1.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0	7.1 mm (0.27 in)
2.0 + 2.0 + 2.0	7.1 mm (0.27 in)
3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 0.7	4.3 mm (0.16 in)
0.7 + 3.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9 + 2.0	4.7 mm (0.18 in)
2.0 + 0.9 + 1.0	5.2 mm (0.2 in)
1.0 + 3.0 + 1.0	5.2 mm (0.2 in)

3.0 + 1.0 + 2.0	7.1 mm (0.27 in)
0.9 + 0.7 + 0.9	4.3 mm (0.16 in)

Descriptions of Ford Steel Families

Grade	Alloy Content	Heat Treatment	Typical Applications	Comments
Mild steel, bake hardened, solid solution strengthened	Low	Fully annealed/dead soft	Body panels (closures, floor pan, dash panel)	-
High-Strength Low Alloy (HSLA)	Low	Fully annealed/dead soft	Rails, structural members	Strengthened with fine particles and small grain size
Dual Phase	Medium (Manganese Silicon, Molybdenum Chromium)	Fully annealed/partially hardened	Rails, structural members	15-50% of structure is hard martensite
Ultra High Strength Steel (UHSS) (Martensitic, Boron)	Low	Fully hardened	Rocker reinforcements, door beams, bumper beams	100% of structure is hard martensite
Transformation Induced Plasticity steel	High (Manganese, Phosophorus, Silicon, Aluminum)	Fully annealed/ partially hardened	To be determined	Complex microstructure for high strength and ductility

Ford Recommended Steel Repairability Matrix

Grade	Trade Descrip-tions	Welding Method			Cold Repairs	Use of Heat for Repair	Temp-erature Range	Max-imum Heat
		Metal Inert Gas (MIG)	Squeeze-Type Resist-ance Spot Welding (STRW)	MIG Braze				
Mild Steel	Mild	Yes	Yes	NA	Yes [a]	Yes	Up to 650°C (1,200°F)	90 sec. x 2
Laminate Steel	Quiet Steel	No	Yes	No	Yes [a]	NA	NA	NA
Bake Hardened	BH 180, BH210, BH 250, BH 280	Yes	Yes	Yes	Yes [a]	Yes	Up to 650°C (1,200°F)	90 sec. x 2
Solid Solution Strength- ened	-	Yes	Yes	Yes	Yes [a]	Yes	Up to 650°C (1200°F)	90 sec. x 2
		Yes	Yes	Yes	Yes [a]	Yes		

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High- Strength Low Alloy (HSLA)	HSLA 250, HSLA 350, HSLA 550						Up to 650°C (1200°F)	90 sec. x 2
Dual Phase = 600 MPa Ultimate Tensile Strength (UTS)	DP 500, DP 600	Yes	Yes	Yes	Yes [a]	No	NA	NA
Dual Phase = 600 MPa Ultimate Tensile Strength (UTS) particular to 780 and 980 grades) [b]	DP 700, DP 780, DP 900	Yes [c]	Yes	Yes	No	No	NA	NA
Ultra High Strength Steel (UHSS) (Martensitic, Boron) [d]	Boron	Yes [a]	Yes	Yes	No	No	NA	NA
Trans- formation Induced Plasticity Steel (TRIP)	TRIP 590, TRIP 780, TRIP 980	NA	NA	NA	NA	NA	NA	NA

[a] Cold repairs can be performed if damage excludes kinks. May section only if approved procedure in workshop manual.

[b] Dual phase steels DP 700, DP 780 and DP 980 must be replaced at factory joints, no sectioning unless approved procedure in workshop manual.

[c] For DP 980, use MIG plug welding only, no stitch welding.

[d] Boron components must be replaced at factory joints, no sectioning allowed.

Body

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

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

The body consists of the following:

- Body-on full-frame design
- High-Strength Low Alloy (HSLA), High-Strength Steel (HSS) and mild steels
- Explorer hood constructed of aluminum
- Mountaineer hood constructed of lightweight steel
- Steel radiator support
- Lightweight steel welded panel construction
- Bolted, removable front fenders, hinged doors, liftgate and hood
- Mountaineer fenders constructed of Sheet-Molded Composite (SMC)
- Explorer and Mountaineer have unique headlamp assemblies and grille
- Explorer and Mountaineer have unique front fascias
- Bolt-on HSS front bumper beam
- Welded-on HSS rear bumper beam
- Steel liftgate
- Explorer Sport Trac hood constructed of aluminum
- Explorer Sport Trac front structure common with Explorer
- Explorer Sport Trac has modified roof line aft of the B-pillar
- Explorer Sport Trac pick-up box has SMC inner and outer panel construction
- Explorer Sport Trac fenders constructed of steel
- Fascias constructed of Thermoplastic Olefin (TPO)
- Explorer Sport Trac tailgate constructed of steel

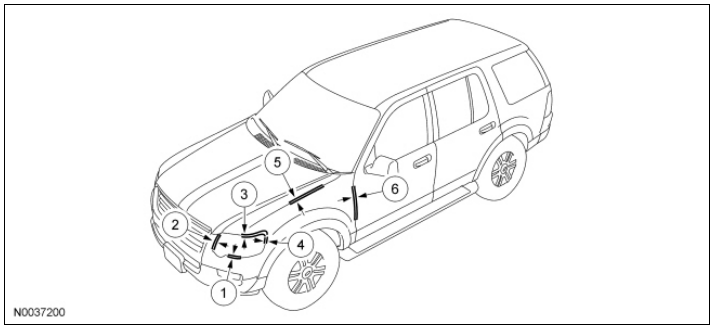
For dimensional information, refer to the following illustrations:

Body Margins - Explorer/Mountaineer

NOTE: Explorer shown, Mountaineer similar.

NOTE: Dimensions apply to right and left side.

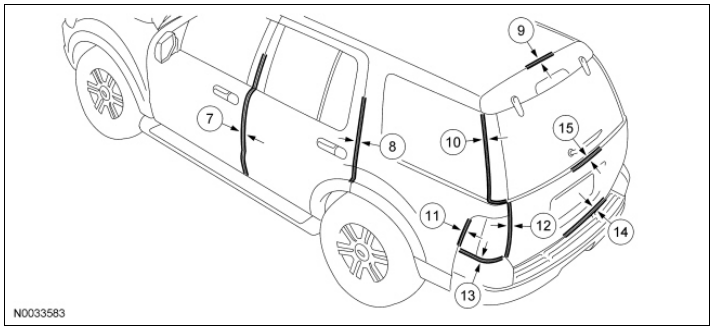
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Item	Description	Specification	Flushness Specification
1	Lamp assembly to fascia	6.0 mm (0.23 in) ± 3.0 mm (0.11 in)	-
2	Lamp assembly to upper fascia	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)	-
3	Lamp assembly to hood	7.0 mm (0.27 in) ± 3.0 mm (0.11 in)	0.0 mm (in) ± 1.5 mm (0.059 in)
4	Lamp assembly to fender	3.0 mm (0.11 in) ± 2.0 mm (0.07 in)	1.5 mm (0.059 in) ± 1.5 mm (0.059 in)
5	Fender to hood	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)	-
6	Fender to door	5.0 mm (0.19 in) ± 2.0 mm (0.07 in)	0.5 mm (0.019 in) ± 1.0 mm (0.039 in)

Body Margins - Explorer/Mountaineer

NOTE: Dimensions apply to right and left side.

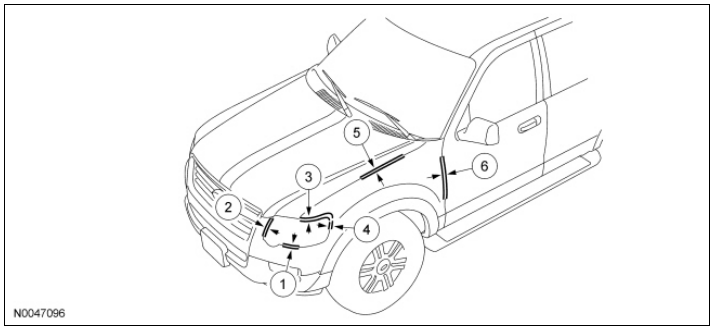


Item	Description	Specification	Flushness Specification
7	Front door to rear door	5.0 mm (0.19 in) ± 1.0 mm (0.03 in)	-
8	Rear door to quarter panel	5.0 mm (0.19 in) 1.0 mm (0.03 in)	-
9	Liftgate to roof	7.0 mm (0.27 in) ± 2.0 mm (0.07 in)	1.5 mm (0.059 in) ± 1.5 mm (0.059 in)
10	Rear corner applique to side glass	5.0 mm (0.19 in) ± 2.0 mm (0.07 in)	-1.5 mm (-0.059 in) ± 2.0 mm (0.078 in)
11	Lamp assembly to quarter panel	2.0 mm (0.07 in) ± 2.0 mm (0.07 in)	2.0 mm (0.078 in) ± 1.5 mm (0.059 in)

12	Lamp assembly to liftgate	6.0 mm (0.23 in) ± 2.0 mm (0.07 in)	1.5 mm (0.059 in) ± 1.5 mm (0.059 in)
13	Lamp assembly to rear fascia	5.0 mm (0.19 in) ± 2.0 mm (0.07 in)	-
14	Liftgate to bumper	10.0 mm (0.39 in) ± 3.0 mm (0.11 in)	-
15	Liftgate glass to liftgate assembly	5.0 mm (0.19 in) ± 2.0 mm (0.07 in)	5.5 mm (0.216 in) ± 2.0 mm (0.078 in)

Body Margins - Explorer Sport Trac

NOTE: Dimensions apply to right and left side.

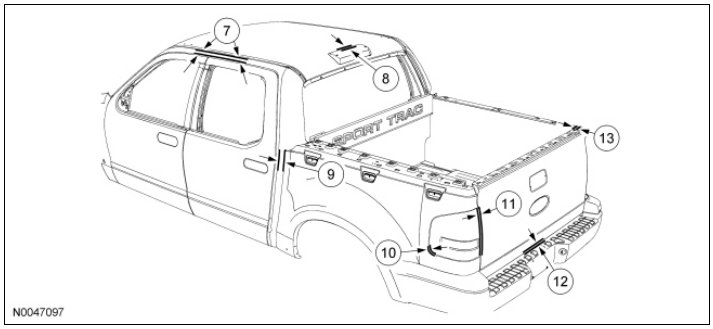


Item	Description	Specification	Flushness Specification
1	Lamp assembly to fascia	6.0 mm (0.23 in) ± 3.0 mm (0.11 in)	-
2	Lamp assembly to upper fascia	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)	-
3	Lamp assembly to hood	7.0 mm (0.27 in) ± 3.0 mm (0.11 in)	0.0 mm (in) ± 1.5 mm (0.059 in)
4	Lamp assembly to fender	3.0 mm (0.11 in) ± 2.0 mm (0.07 in)	1.5 mm (0.059 in) ± 1.5 mm (0.059 in)
5	Fender to hood	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)	-
6	Fender to door	5.0 mm (0.19 in) ± 2.0 mm (0.07 in)	0.5 mm (0.019 in) ± 1.0 mm (0.039 in)

Body Margins - Explorer Sport Trac

NOTE: Dimensions apply to right and left side.

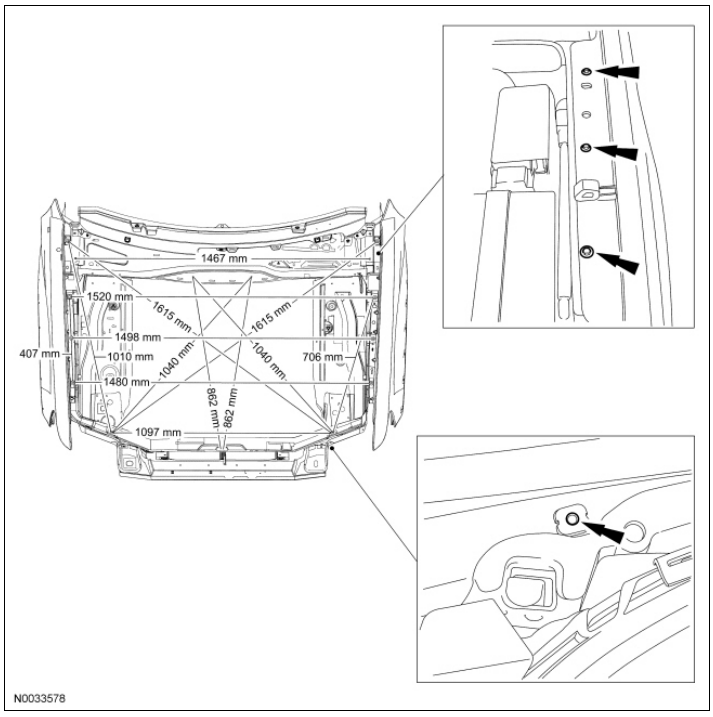
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Item	Description	Specification	Flushness Specification
7	Door(s) to roof	5.0 mm (0.19 in) ± 1.0 mm (0.03 in)	-
8	Center high-mount stop lamp to roof	2.0 mm (0.07 in) ± 1.0 mm (0.03 in)	2.0 mm (0.078 in) ± 1.5 mm (0.059 in)
9	Box to cab	29.0 mm (1.14 in) ± 7.0 mm (0.27 in)	0.0 mm (in) ± 1.0 mm (0.039 in)
10	Lamp assembly to quarter panel	2.0 mm (0.07 in) ± 2.0 mm (0.07 in)	-
11	Lamp assembly to tailgate	6.0 mm (0.23 in) ± 3.0 mm (0.11 in)	-1.5 mm (-0.059 in) ± 2.5 mm (0.098 in)
12	Tailgate outer to step pad	28.0 mm (1.1 in) ± 5.0 mm (0.19 in)	-
13	Tailgate moulding to box moulding	9.0 mm (0.35 in) ± 7.0 mm (0.27 in)	0.0 mm (in) ± 3.5 mm (0.137 in)

Underhood Dimensions - Explorer/Mountaineer, Explorer Sport Trac

NOTE: Measurements are obtained on center, unless otherwise indicated.

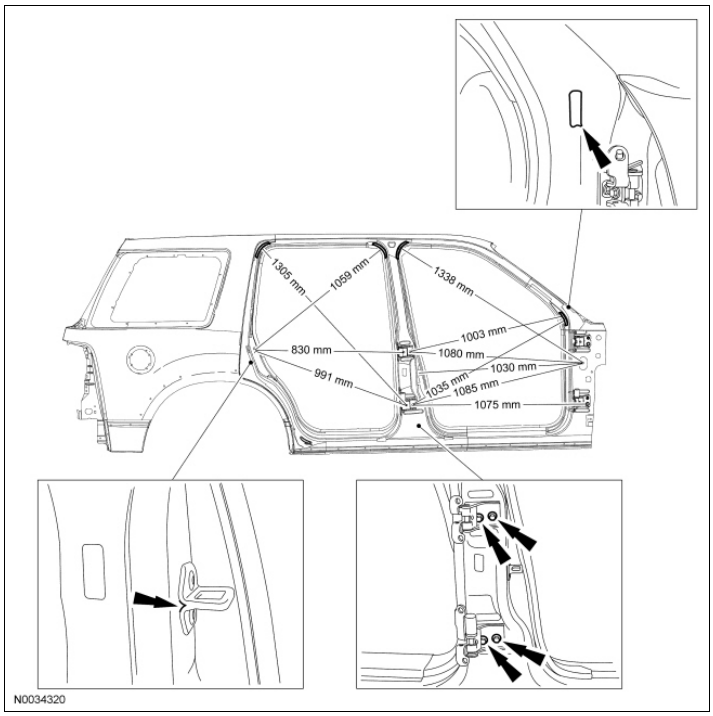


Body Side Dimensions - Explorer/Mountaineer

NOTE: Measurements are obtained on center, unless otherwise indicated.

NOTE: Explorer shown, Mountaineer similar.

NOTE: Dimensions apply to right and left side.

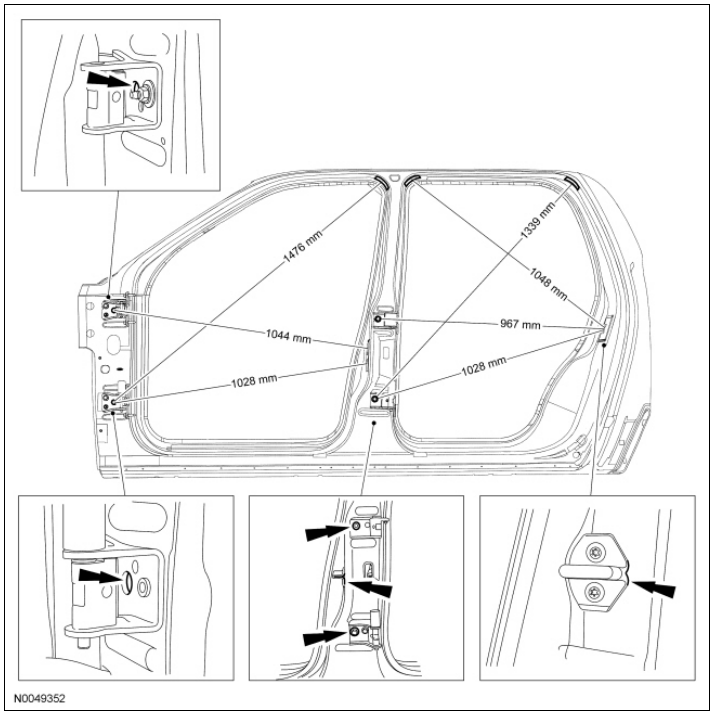


Body Side Dimensions - Explorer Sport Trac

NOTE: Measurements are obtained on center, unless otherwise indicated.

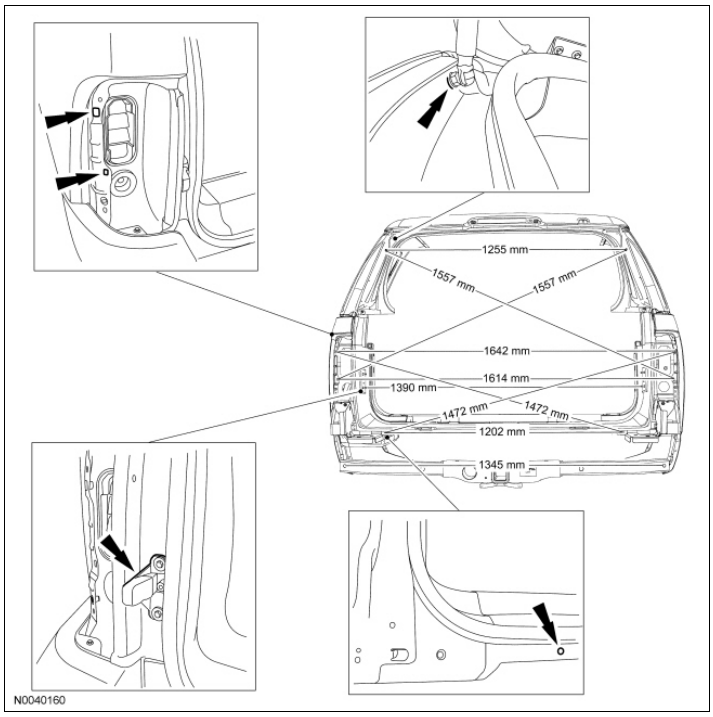
NOTE: Dimensions apply to right and left side.

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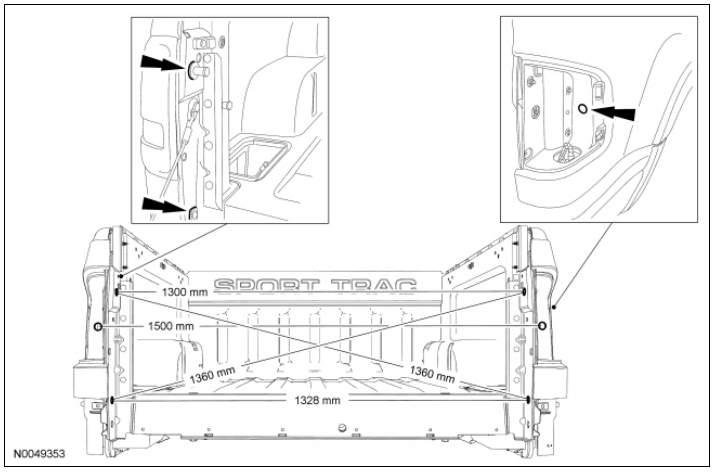
Body Rear Opening Dimensions - Explorer/Mountaineer

NOTE: Measurements are obtained on center, unless otherwise indicated.



Tailgate Opening Dimensions - Explorer Sport Trac

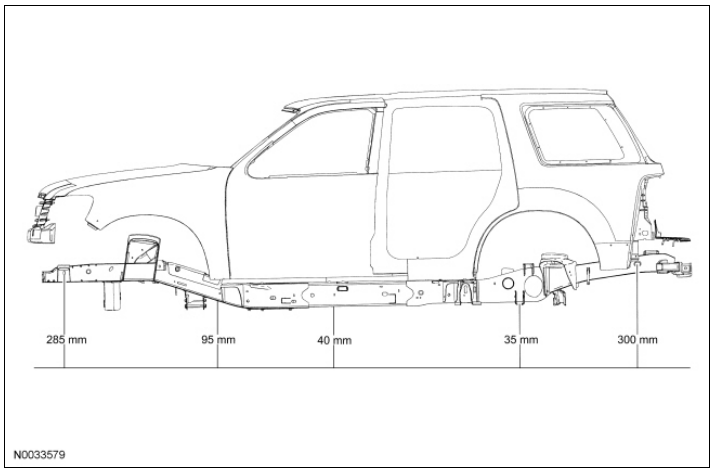
NOTE: Measurements are obtained on center, unless otherwise indicated.



Underbody Dimensions

Frame Datum Height - Explorer/Mountaineer

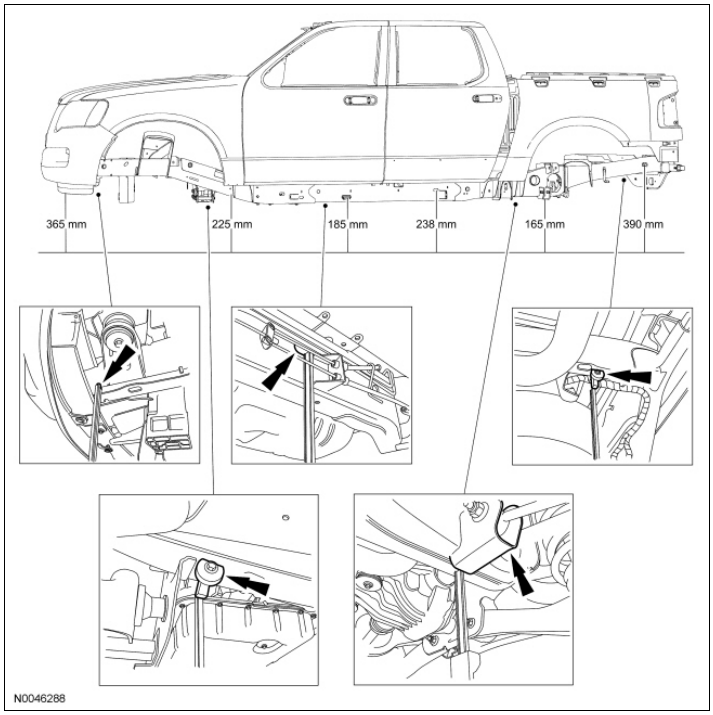
NOTE: The gauge for the No. 2 datum measurement is located 90 mm (3.54 in) from the front transmission crossmember flange. The gauge for the No. 3 datum measurement is located 610 mm (24.01 in) from the rear transmission mount, rear bolt (on center). Measurements indicated from the front (No. 1) to the rear (No. 5).



Frame Datum Height - Explorer Sport Trac

NOTE: Measurements indicated from the front (No. 1) to the rear (No. 6). No. 2 measurement obtained on frame at No. 2 crossmember flange.

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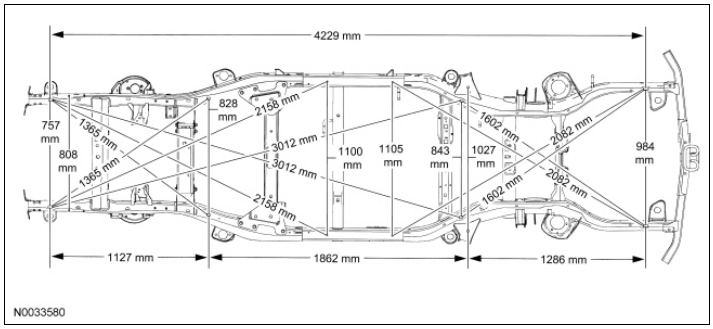


Frame Dimensions - Explorer/Mountaineer

⚠ WARNING: Frame rail crush zones absorb crash energy during a collision and must be replaced if damaged. Prior to replacement of frame rail crush zones, straighten damaged frame rails to correct frame dimensions. Failure to follow these instructions may adversely affect frame rail crush zone performance and may result in serious personal injury to vehicle occupants in a crash.

NOTE: A structural frame rail service kit is available for this vehicle. It is mandatory to carry out repairs per the instructions in the Frame Members procedure and instruction kit supplied with the service replacement part. The frame must maintain original dimensions. Refer to Frame Members in this section.

NOTE: Measurements are obtained on center, unless otherwise indicated.



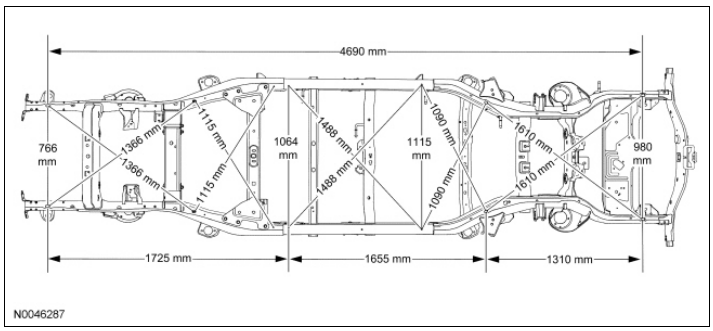
Frame Dimensions - Explorer Sport Trac

⚠ WARNING: Frame rail crush zones absorb crash energy during a collision and must be replaced if damaged. Prior to replacement of frame rail crush zones, straighten damaged frame rails to correct frame dimensions. Failure to follow these instructions may adversely affect frame rail crush zone performance and may result in serious personal injury to vehicle occupants in a crash.

NOTE: A structural frame rail service kit is available for this vehicle. It is mandatory to repair per the instructions in the procedure and instruction kit supplied with the service replacement part. The frame must

maintain original dimensions. Refer to Frame Members in this section.

NOTE: Measurements are obtained on center, unless otherwise indicated.



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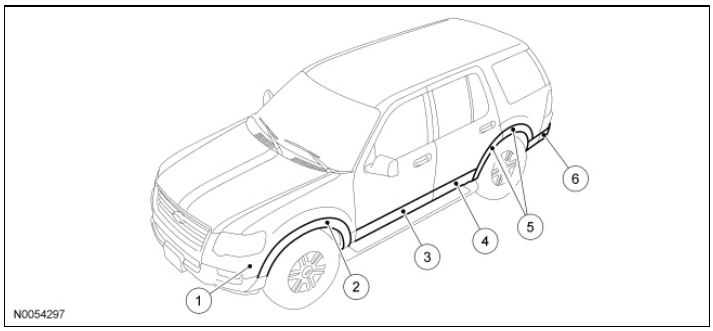
Plastic Components

Exterior Plastic Components - Painted

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

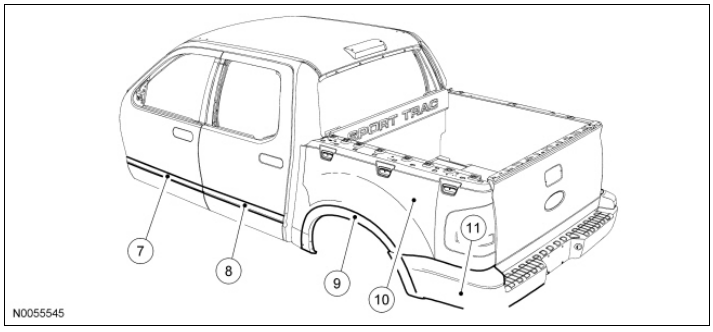
NOTE: The following illustration(s) are not all-inclusive of trim levels available. The actual trim level of the vehicle will determine the viability of carrying out a plastic repair.

NOTE: Explorer/Mountaineer shown, front bumper cover common with Explorer Sport Trac.



Item	Part Number	Description
1	17D957A	Bumper cover (front) - Thermoplastic Olefin (TPO)
2	16039 A/B LH/ 16038 A/B RH	Wheel arch moulding (front) - TPO
3	20879 LH/ 20878 RH	Door moulding (front) - TPO
4	25557 LH/ 25556 RH	Door moulding (rear) - TPO
5	29165 LH/ 29164 RH	Wheel arch moulding (rear) - TPO
6	17K835	Bumper cover (rear) - TPO

Explorer Sport Trac



Item	Part Number	Description
7	20879 LH/ 20878 RH	Door moulding (front) - TPO
8	25557 LH/ 25556 RH	Door moulding (rear) - TPO
9	29165 A/B LH/ 29164 A/B RH	Wheel arch moulding (rear) - TPO
10	27841 LH/ 27840 RH	Body side panel assembly - Sheet-Molded Composite (SMC)
11	17K835	Bumper cover (rear) - TPO

Several considerations will determine viability of plastic repair procedure(s):

- Is the damage cosmetic or structural?
- Can the repair be carried out on the vehicle?
- Is the part readily available?
- Is component repair the most cost effective method?
- Can the component be economically restored to original strength and appearance?
- Will the repair provide for the fastest, highest quality repair?

Several types of plastic are in use for automotive application. However, all plastics will fall into 2 primary categories of thermoplastic or thermosetting plastic.

Thermosetting Plastic

Generally, thermosetting plastics are made with 2-part thermosetting resins. When mixed together, heat is generated, producing a cure that is irreversible. Because of this, thermosetting plastics will require the use of a 2-part adhesive for repair.

Sheet-Molded Composite (SMC)

Sheet-Molded Composite (SMC) is a type of thermosetting plastic that uses glass fibers or nylon fibers in combination with thermosetting polyester resins. When fully cured, SMC is strong and rigid.

SMC is similar to, but not identical to fiberglass. Ford Motor Company uses SMC in components such as fenders, hoods and liftgates.

Thermoplastic Compounds

Thermoplastic compounds are manufactured by a process that is reversible. Thermoplastics can be remolded repeatedly by reheating. This characteristic of thermoplastics makes plastic welding a possible repair alternative. A repair of thermoplastic compounds is still possible through the use of 2-part adhesive and filler repair materials and reinforcements as needed. Thermoplastics are widely used in interior trim components, wheel flares, body side cladding and bumper covers.

Polyolefin

Polyolefins fall into the family of thermoplastics with one unique characteristic: An oily or waxy feel to the material when sanded or ground. Polyolefin lends itself very well to remolding through the use of heat. Because of this, components made of this material lend themselves well to the possibility of plastic welding. Most adhesive repair materials and paint will not bond to surface of a polyolefin unless an adhesion promoter specially formulated for plastic is first applied to the exposed raw surface. Otherwise, polyolefins are repaired like most other thermoplastics. Some typical uses of polyolefins are:

- bumper covers.
- fan shrouds.
- wheel housings.

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Proper identification of the various types of plastic is necessary to select the appropriate repair method(s) to carry out high quality plastic repairs. Refer to Plastics Identification in this section.

Welding Precautions - Steel

Material

Item	Specification
Motorcraft Premium Undercoating PM-25-A	-
Motorcraft Rust Inhibitor Aerosol PM-24-A	-

General Specifications -Welding Specifications

Item	Specification
Plug Weld Hole	8 mm (0.31 in)
Weld Wire ER70S-3 or equivalent	0.9-1.1 mm (0.035-0.045 in)

General Equipment
3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

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

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

⚠ WARNING: On vehicles equipped with Safety Canopy® options, prior to carrying out any sectioning repairs near the roof line or sail panel areas of the vehicle, remove the Safety Canopy® module and related components. Failure to comply may result in accidental deployment or damage to the Safety Canopy®. Refer to Section 501-20B . Failure to follow these instructions may result in serious injury to technician or vehicle occupant(s).

NOTICE: **Disconnect the instrument cluster module, Powertrain Control Module (PCM), Engine Control Module (ECM), fuel pump driver module (gas only), Anti-lock Brake System (ABS) module and diesel Fuel Injection Control Module (FICM), if equipped. Electronic modules and related wiring may be damaged when exposed to heat from welding procedures.**

NOTE: When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding in this section.

The correct equipment and settings must be used when welding mild or high-strength steel. Metal Inert Gas (MIG) and Squeeze-Type Resistance Spot Welding (STRW) are the preferred methods. Surfaces must be clean and free of foreign materials.

- Do not use gas welding equipment.
- Adequate ventilation must be provided to avoid accumulation of poisonous gases.
- A test weld should always be carried out on a test sample. Refer to the Weld Nugget Chart in Specifications for Ford-approved weld nugget information.
- Use cleaning brushes and abrasive grinding wheels dedicated to the type of materials being welded.
- Follow the equipment manufacturer's prescribed procedures and equipment settings for the type of welder being used. ER70S-2 or ER70S-6 wire are typically used for MIG welding steel.
- Disconnect the battery(s). Refer to Section 414-01 .
- Replace spot-welded components by spot welding where possible.
- Corrosion protection must be restored whenever bare metal repairs are made. Refer to Restoring Corrosion Protection Following Repair in this section.
- Adequate power supply needs to be used to make sure of correct equipment performance.
- Factory spot welds may be substituted with either STRW or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

- Components made of high-strength steel should not be heated to straighten or repair. If components are severely bent or kinked, new components should be installed.

When MIG or arc welding frame components, the following guidelines should be followed:

NOTICE: **When welding low carbon steel side rails (35,000 psi yield strength), emphasis should be placed upon weld application techniques to avoid excessive heat affected zones that may adversely affect frame operating stresses. When welding within 100 mm (3.93 in) of any crossmember that contains rivets, remove the rivets and install new SAE grade 8 bolts/nuts.**

NOTE: Do not weld on any reinforcement. Use compression type fasteners when attaching any component to the frame in the reinforcement area.

- A temperature indicating crayon calibrated below 650°C (1,200°F) should be used to avoid overheating and weakening the metal.
- Attach the ground clamp as close as possible to the work area.
- Choose welding electrodes according to the type of steel, thickness and polarity of the arc welder AC

or DC.

- Do not use water or compressed air to cool welding. This can cause the metal to become brittle and weak.
- Where frame wax coating and the bracket E-coat have been removed, apply anti-corrosion coating to all affected surfaces of the frame, bracket and weld areas.
- Clean the welded areas with a wire brush.
- Use a wax and grease remover for a final cleaning of the weld areas.

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Sealers

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

The correct sealing of joints is essential to repairing the vehicle correctly. Sealers are used to prevent wind noise, water leaks, exhaust fumes and dust from entering the vehicle. They also provide anti-corrosion barriers. Sealers are applied to areas such as door and rear compartment hem flanges, wheelhouse, quarter outer, floor, cowl, roof and other panel-to-panel attaching points. The following joint sealers are recommended for use depending upon the application:

- Brushable Seam Sealer - A sealer intended to restore the original brushed seam appearance. It is used to seal lap joints in sheet metal that are spot welded (for example, floorpans and cowls). Use a product obtained locally.
- Roof Ditch Sealer - A self-leveling sealer used for drip rails, roof seams, quarter panels to rear deck and for water leaks.
- Seam Sealer - Heavy-bodied, non-sag adhesive/sealer for use on standing cosmetic seams, truck bed seams, tooled door skin seams and floor pans. Also used for water leaks and noise concerns.

Sealers should remain flexible after curing and must be paintable. Follow the manufacturer's directions for correct application of these materials.

Any damage to originally sealed joints should be repaired by resealing. Along with attaching points of new panels, open joints that require bridging of sealer to close a gap should be sealed using a heavy-bodied sealer.

Sound Deadeners and Insulators

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

NOTICE: **Mastic is made of a combustible material and should be removed prior to carrying out welding procedures to the area. Heat zones from welding near the mastic may cause the mastic material to burn.**

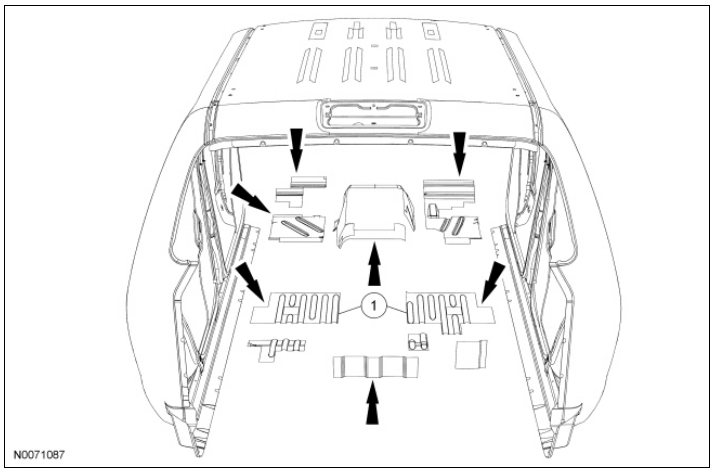
NOTICE: **Corrosion protection must be restored to the area AFTER the mastic material is applied. Corrosion protection products may be wax based and loss of adhesion may occur.**

NOTE: The following illustrations serve as a reference to indicate mastic patch (butyl pad) locations. Additional insulators and sound deadeners are used beyond those indicated in the illustration.

NOTE: To restore the vehicle to design intent, missing or damaged sound deadeners and insulators should be installed new with the correct service replacement component.

Explorer Sport Trac

NOTE: Mastic material is applied from the factory in a pumpable form. All locations indicated in the illustration are this material with a common base part number.

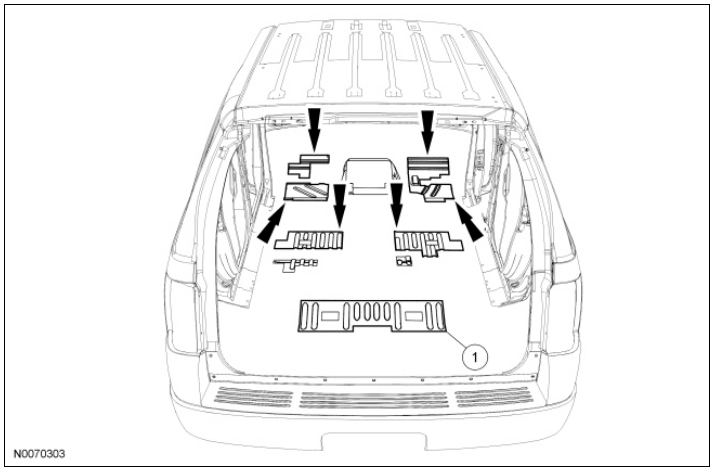


Item	Part Number	Description
1	99P30A2	Mastic insulators

Explorer/Mountaineer

NOTE: Mastic material is applied from the factory in a pumpable form. All locations indicated in the illustration are this material with a common base part number.

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Item	Part Number	Description
1	99P30A2	Mastic insulators

1. **NOTE:** In applications where mastic material is applied as a pumpable material at the factory, replacement of missing or damaged mastic is acceptable in the form of cut-to-fit butyl pad(s) or pumpable mastic material(s) when carrying out repairs.

   Whenever replacement of an existing mastic insulator is carried out, the surface must be thoroughly cleaned to make sure correct adhesion will occur. The surface should be 10°C (50°F) or greater before applying the mastic. The use of a heat gun to warm the metal surface will aid in adhesion.

Adhesives

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Metal Bonding Adhesive TA-1	-
Plastic Bonding Adhesive TA-9	-
Trim and Weatherstrip Adhesive TA-14-A	-

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

Adhesives are used in a variety of applications. Typical uses for adhesives include roof panels, door skins and quarter panels. Trim applications include body side mouldings, emblems, stationary glass and weatherstripping. Combination sealer/adhesives are also used. Surface preparation is critical to a high quality repair. Following the label instructions for the product is essential.

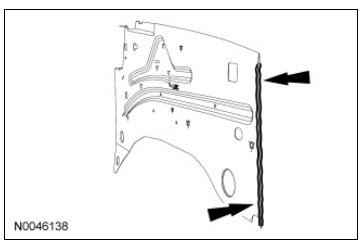
Work in a well-ventilated area and protect adjacent surfaces when working with adhesives. The use of eye protection and protective clothing is also recommended when working with adhesives. Carry out a trial fit, mark and align the surfaces before bonding the materials together.

Seam sealers and corrosion protection may be necessary once the adhesive(s) has cured, depending on the application. The following is a list of adhesives recommended for certain types of applications:

- Metal Bonding Adhesive - For bonding cold-rolled steel, galvanized steel, aluminum and correctly prepared E-coat. It is used for door skin and roof panel replacement and OEM structural adhesive replacement.
- Plastic Bonding Adhesive - For bonding a variety of plastics to plastics and plastics to primed, painted or E-coated metals. Also for general purpose bonding of trim components.
- Trim and Weatherstrip Adhesive - For use on body side moulding, emblems, trim, bumper impact strips and carpeting.
- Clear Silicone Rubber - Used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

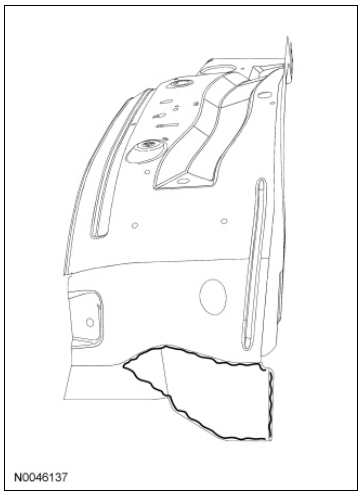
NOTE: The following illustrations identify structural adhesive locations.

Inner Fender - Explorer/Mountaineer, Explorer Sport Trac

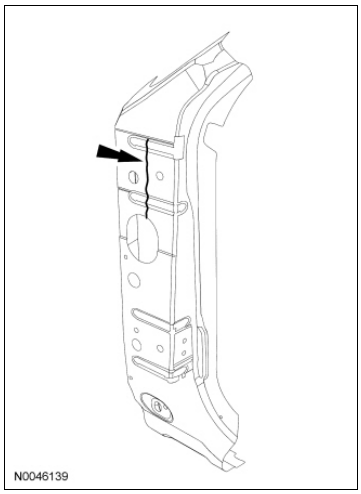


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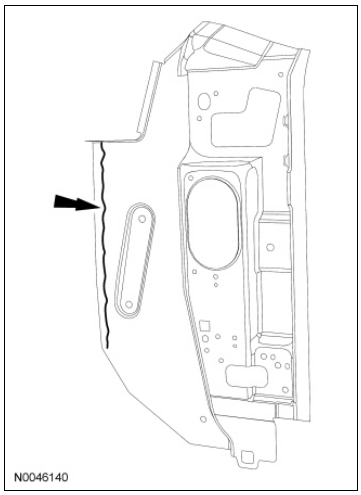
Inner Fender, Lower - Explorer/Mountaineer, Explorer Sport Trac



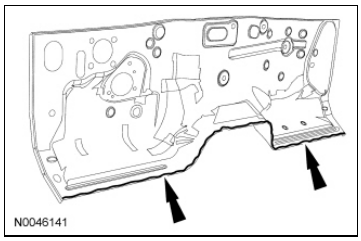
A-Pillar Reinforcement - Explorer/Mountaineer, Explorer Sport Trac



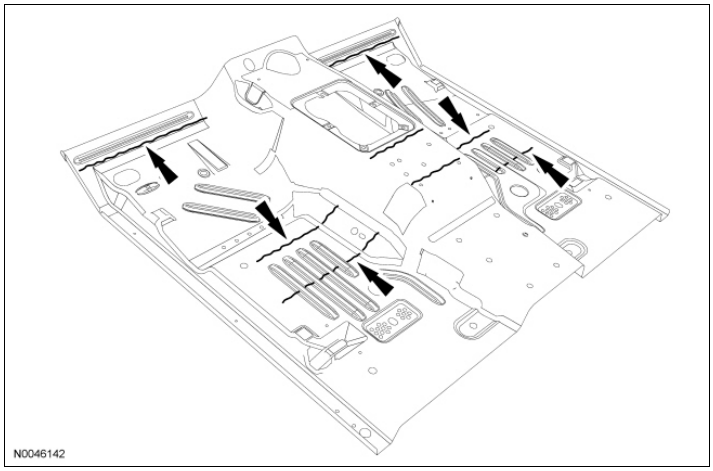
Cowl Side Panel - Explorer/Mountaineer, Explorer Sport Trac



Dash Panel - Explorer/Mountaineer, Explorer Sport Trac

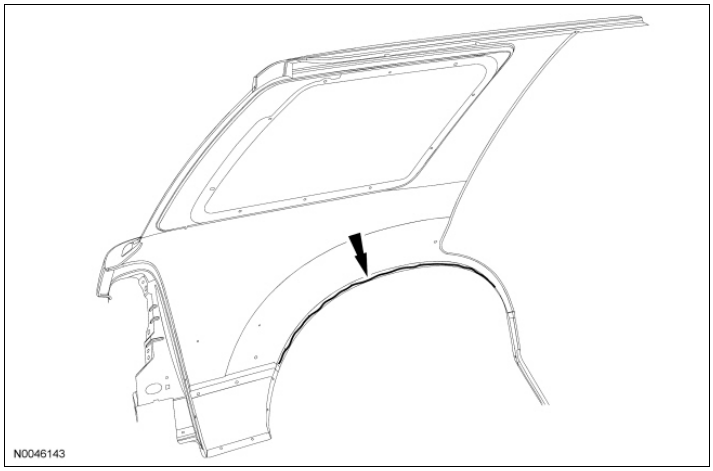


Front Floor Pan - Explorer/Mountaineer, Explorer Sport Trac



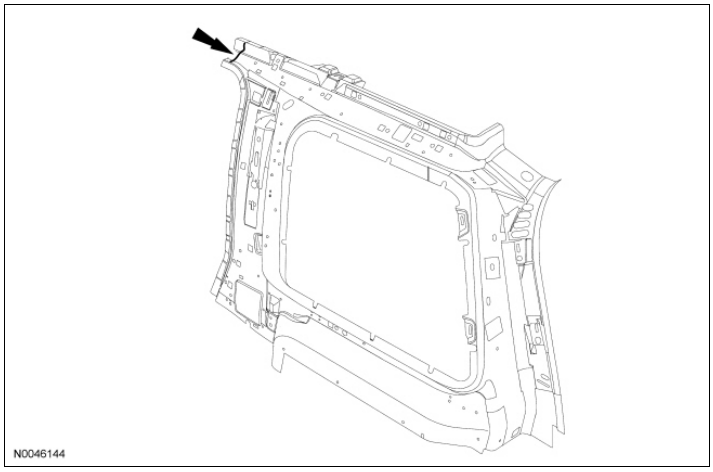
Quarter Panel - Explorer/Mountaineer

NOTE: Viewed from inside.



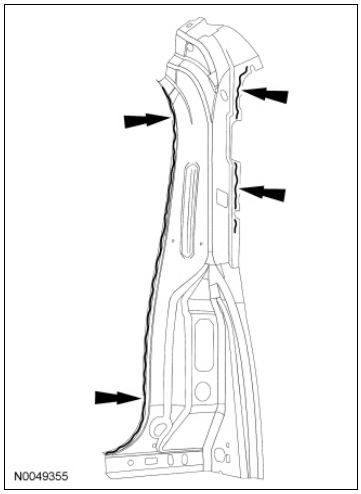
Back Inside Panel - Explorer/Mountaineer

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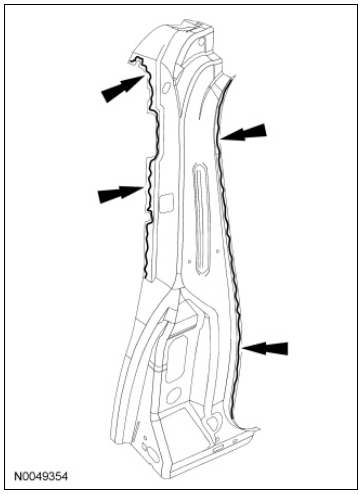
Rear Corner Pillar - Explorer/Mountaineer

NOTE: Inner edge.

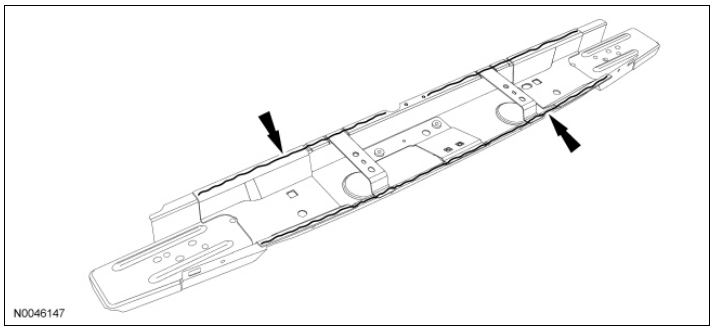


Rear Corner Pillar - Explorer/Mountaineer

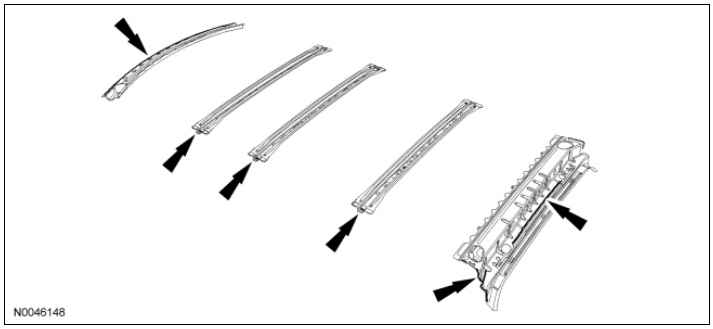
NOTE: Outer edge.



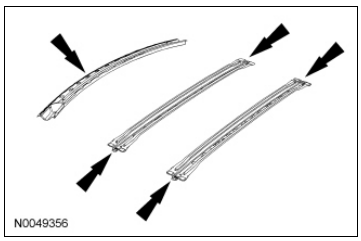
Rear Sill - Explorer/Mountaineer



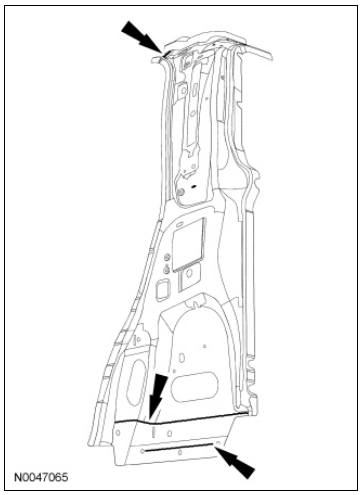
Roof Reinforcements and Back Panel - Explorer/Mountaineer



Explorer Sport Trac

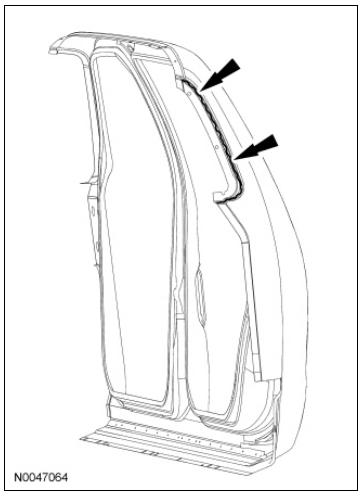


Rear Corner Inside Panel - Explorer Sport Trac

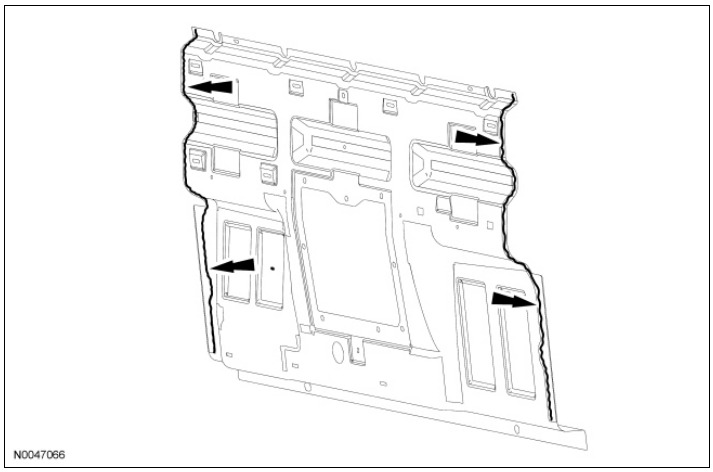


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Bodyside Rear Corner - Explorer Sport Trac



Back Panel - Explorer Sport Trac



Sectioning Guidelines

General Equipment

3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
Premium Undercoating ValuGardâ ¢ VG101, VG101A (aerosol)	â
Rust Inhibitor ValuGardâ ¢ VG104, VG104A (aerosol)	â
Seam Sealer TA-2	â

Body Side ï¿½ Explorer/Mountaineer

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

⚠ WARNING: On vehicles equipped with Safety CanopyÂ® options, prior to carrying out any sectioning repairs near the roof line or sail panel areas of the vehicle, remove the Safety CanopyÂ® module and related components. Failure to comply may result in accidental deployment or damage to the Safety CanopyÂ®. Refer to Section 501-20B . Failure to follow these instructions may result in serious injury to technician or vehicle occupant(s).

⚠ WARNING: Do not carry out body side sectioning repairs in areas of laser welds. Factory laser welds cannot be duplicated with conventional welding equipment and structural integrity may be compromised. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

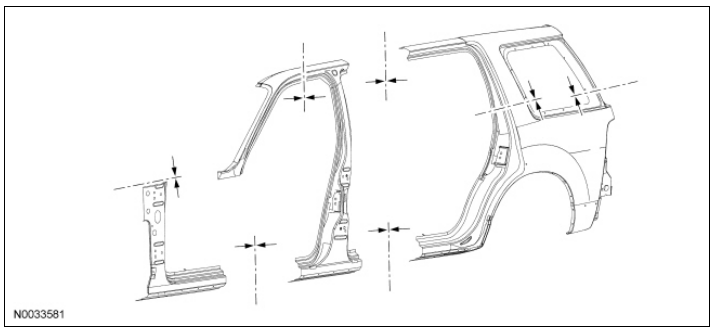
⚠ WARNING: Do not carry out body side sectioning repairs in areas of door hinge or striker anchoring points. Welding within 50 mm (1.96 in) of door hinge or striker locations may compromise structural integrity during a collision. Failure to follow these instructions may result in serious injury to vehicle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

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NOTE: Factory spot welds may be substituted with either resistance spot welds or Metal Inert Gas (MIG) plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

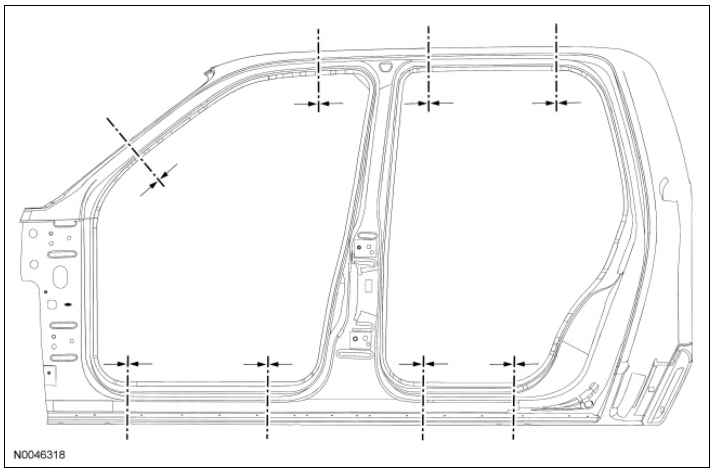
NOTE: When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding in this section.

NOTE: Left side shown, right side similar.



Body Side ï¿½ Explorer Sport Trac

NOTE: Left side shown, right side similar.



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

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

1. Drill out the spot welds of the damaged panel to be sectioned. Using a cut-off wheel, reciprocating saw or plasma cutter, cut through the damaged area of the outer panel only and remove the section to be replaced.

2. When welding overlapping surfaces or substrates, apply weld-through primer between the surfaces prior to welding.

3. Make sure horizontal joints and flanges are correctly sealed with seam sealer to prevent moisture intrusion. Water and moisture migrate to horizontal joints and corrosion tends to occur more rapidly in these areas. Metal surfaces must be clean and dry before applying seam sealer.

4. Proceed with the refinishing process following Ford-approved paint recommendations. Apply corrosion protection material to the exterior surfaces or substrates after refinishing.

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Restoring Corrosion Protection Following Repair

Special Tool(s)

 ST3049-A	Rust Inhibitor Installation Kit 286-00002
 ST3048-A	Undercoating Spray Gun 286-00001

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Premium Undercoating ValuGardTM VG101, VG101A (aerosol)	-
Rust Inhibitor ValuGardTM VG104, VG104A (aerosol)	-

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

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

NOTICE: **Drilling access holes in body panels is not recommended. Drilling holes will break the original paint finish and promote corrosion.**

NOTE: Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are made.

NOTE: Refer to product label for preparation and handling instructions.

1. The surfaces must be free of oil, dirt and other foreign material. Carry out the process in the following sequence.
    1. Thoroughly clean and degrease metal surfaces using metal surface prep to remove wax and grease.
    2. For best results, the vehicle should be at room temperature. Attach the rust inhibitor canister to the Rust Inhibitor Installation Kit 286-00002.
    3. Rust inhibitor should be applied after the welding and refinishing process. Product cannot be welded through.
    4. Air pressure setting for applicator gun is 448-517 kPa (65-75 psi).

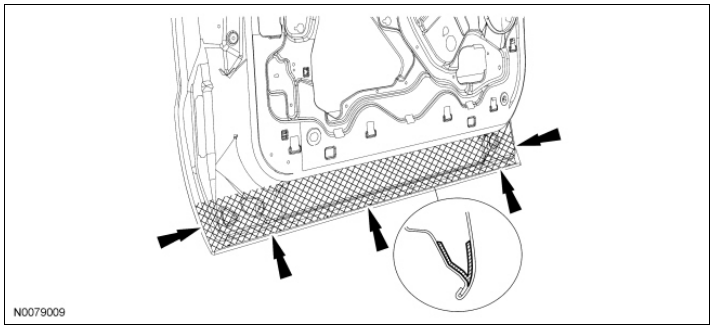
- Use the long wand when spraying enclosed areas. The spray nozzle provides a 360-degree spray pattern. Insert the wand as far as possible into the access hole, pull the trigger and wait 2-3 seconds and slowly pull the wand out of the access hole.
- The short, hook-shaped wand sprays in one direction and must be rotated to provide complete coverage.
- Apply the material in light mist coats.
- Material displaces moisture.

5. Clean up any overspray with a mild solvent such as mineral spirits or bug and tar remover.

NOTE: The following illustrations provide typical applications of body seams and spot welded flanges and are not vehicle specific.

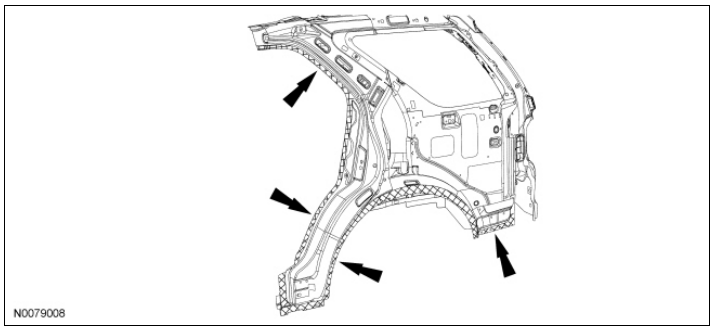
2. **NOTE:** Door assembly lower view.

   Apply rust inhibitor as shown to the inside of the door shell on all the interior metal surfaces using the most suitable applicator wand. Apply material to the exposed edges after carrying out the welding process. Make sure horizontal surfaces are well protected as they are more susceptible to corrosion. Keep door drain holes clear to prevent moisture buildup.



3. **NOTE:** Quarter panel inner view.

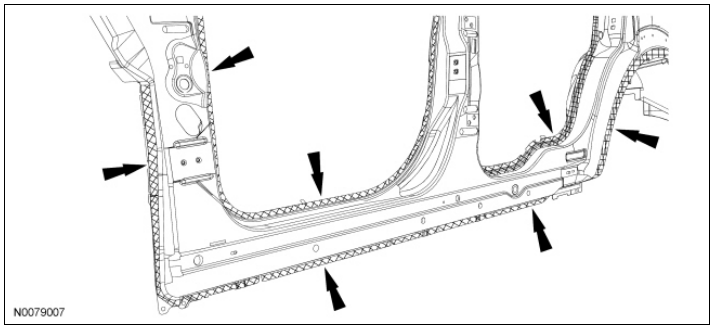
   Apply rust inhibitor to the closed channel portion of the spot weld flange areas using the short, hook-shaped wand. Apply material to the exposed edges after carrying out the welding process. Make sure horizontal surfaces are well protected as they are more susceptible to corrosion.



4. **NOTE:** Door frame opening view.

   Apply rust inhibitor to the closed channel portion of the spot weld flange areas using the short, hook-shaped wand. Make sure horizontal surfaces are well protected as they are more susceptible to corrosion.

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Body and Frame Undercoating

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

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

   NOTICE: **Do not allow undercoating on powertrain components. Failure to follow these instructions may result in incorrect operation of these components.**

   NOTE: Refer to product label for preparation and handling instructions.

   NOTE: Avoid high-pressure water spray cleaning to treated underbody area for 24 hours.

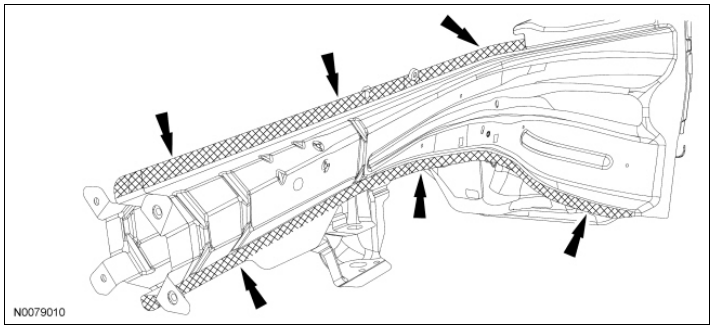
   Wire brush the area and make sure the surfaces are free of oil, dirt and other foreign material. Carry out the undercoating process in the following sequence.

   1. Thoroughly clean and degrease metal surfaces using metal surface prep to remove wax and grease.
   2. For best results, the vehicle should be at room temperature.
      - ♦ Canister attaches directly to the dispensing gun. Attach the undercoating canister to the Undercoating Spray Gun 286-00001.
   3. Undercoat should be applied after the welding and refinishing process. Product cannot be welded through.
   4. Air pressure setting for applicator gun is 552-621 kPa (80-90 psi).
      - ♦ Apply light mist coats, applicator sprays in fogging pattern.
      - ♦ Material displaces moisture.
   5. Clean up any overspray with a mild solvent such as mineral spirits or bug and tar remover.

NOTE: The following illustrations provide typical applications to frame rails and are not vehicle specific.

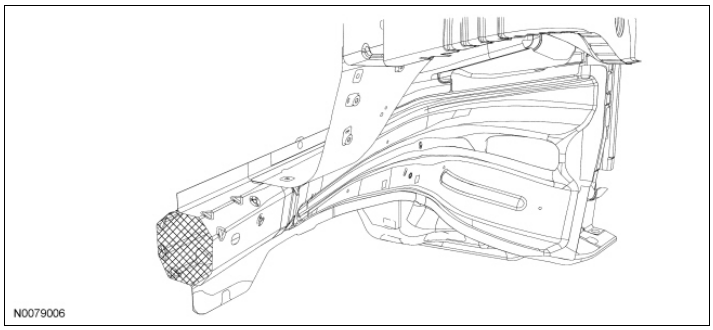
2. **NOTE:** Frame rail exterior spot-weld flange view.

   Apply undercoat material to the exterior exposed edges after carrying out the welding and refinishing process.



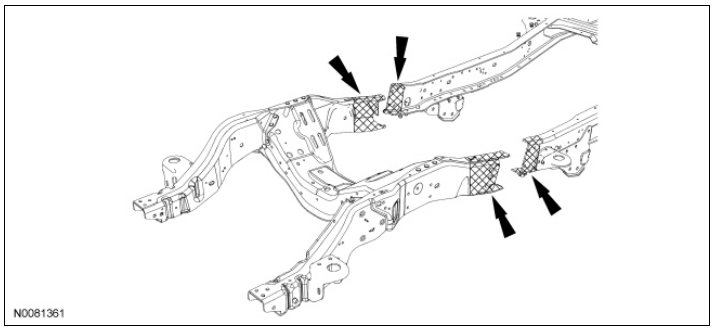
3. **NOTE:** Cross section view of typical unibody frame rail shown.

   Apply rust inhibitor to the inner surfaces of the rail after carrying out welding process. Use the long wand and insert as far as possible, depress trigger and wait 2-3 seconds and slowly pull the wand to make sure the area is completely fogged.



4. **NOTE:** Full frame vehicle, front rail-to-mid rail section repair shown.

   Apply undercoat material to the exposed surfaces after carrying out the welding process. Make sure to completely cover any bare metal areas.



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Refinishing - Environmental Damage

Material

Item	Specification
Motorcraft® Acid Neutralizer ZC-1-A	-
Motorcraft® Alkaline Neutralizer ZC-2-A	-
3MTM Perfect-ItTM Show Car Liquid Wax 39026	-
Motorcraft® Detail Wash ZC-3-A	-

Iron Oxide (Rail Dust) or Acid Rain Decontamination

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

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

NOTICE: **In extreme cases of contamination, the vehicle may require refinishing. To avoid paint failure, follow the appropriate decontamination procedure prior to carrying out any panel refinishing procedure.**

NOTE: Iron oxide contamination appears as tiny rust spots on horizontal surfaces and in severe cases can be felt. This damage is typically caused from rail shipment, storage near railroad tracks or fallout from industrial manufacturing facilities.

NOTE: Acid rain contamination can be identified as water spotting and, in severe cases, staining within the water spots.

1. ***NOTICE:*** **Never paint over iron particles as rust spots will reoccur. Use only the recommended decontamination procedure detailed below.**

   Rinse any dust, dirt and foreign material from the vehicle body with cold water. Flush liberally.

2. Prepare the acid neutralizer by mixing 8 parts of water to 1 part neutralizer in a bucket.

3. ***NOTICE:*** **To avoid paint failure, do not allow the product to dry on the vehicle.**

   NOTE: Use a separate wash mitt for each product applied to the vehicle.

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Working quickly and beginning at the top of the vehicle and working to the sides, apply the acid neutralizer mix to the entire vehicle. Keep the vehicle wet with the solution and lightly agitate for 5 to 7 minutes. Continue around the vehicle 4 to 5 times. For severe conditions, work the product for up to 8 minutes.

4. Rinse the vehicle completely with cold water to remove the product.
5. Dry only the horizontal surfaces of the vehicle, do not dry the glass at this time.
6. ***NOTICE:*** **To avoid damage to the paint surface, do not apply the alkaline neutralizer directly to the vehicle plastic trim.**

   NOTE: Use a separate wash mitt for each product applied to the vehicle.

   NOTE: Alkaline neutralizer is a ready-to-use product. Do not mix with water.

   Pour the alkaline neutralizer into a squirt bottle and apply the solution to a clean wash mitt.
7. ***NOTICE:*** **To avoid paint failure, do not allow the alkaline neutralizer to dry on the vehicle.**

   Apply the product to the vehicle keeping the solution wet and lightly agitate for 5 to 7 minutes. For severe conditions, work the product for up to 8 minutes.
8. Rinse the vehicle completely with cold water to remove the product.
9. Prepare the detail wash by mixing 29.5 ml (1 oz) with 3.78L (1 gal) of water.
10. Using a clean wash mitt, shampoo the entire vehicle and rinse with cold water. Dry the vehicle completely.
11. Visually inspect the paint surface for any remaining evidence of ferrous metal particles. Repeat procedure as necessary.

Surface Finishing Following Decontamination

1. ***NOTICE:*** **When attempting to affect a repair by buffing, polishing or color sanding, do not remove an excess of 0.3 mil of paint film or refinishing will be required.**

   NOTE: Acid rain discoloring or etching may require color sanding in addition to buffing and polishing. In extreme cases, refinishing may be required if the following procedure does not restore the vehicle finish.

   NOTE: Do not intermix buffing products. Use only one manufacturer's product.

   NOTE: Always follow the manufacturer's product usage sequence. Use the appropriate buffing or polishing pad at the recommended buffing speed as specified by the product manufacturer.

   Apply rubbing compound to the vehicle surface as recommended by the product manufacturer.
2. Apply machine glaze to the vehicle surface as recommended by the product manufacturer.
3. Use an alcohol and water mixture (1 to 1) to clean the buffed and polished areas. Verify removal of scratches and swirls before the application of the final polish.

4. Apply a final polish material by hand, with a dual-action sander and foam pad, or with an orbital polisher and appropriate polishing bonnet.

5. Wash and dry the vehicle.

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Refinishing - Manufacturing Damage

Material

Item	Specification
3MTM Perfect-ItTM Show Car Liquid Wax 39026	-
Motorcraft® Detail Wash ZC-3-A	-

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

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

NOTICE: **To avoid overspray damage to adjacent panels, protect adjacent areas/substrates when preparing for and during refinishing.**

NOTE: Peeling/delamination concerns can be described as lack of adhesion, either between the substrate and topcoats or between individual coats of paint.

1. Wash the repair area with detail wash or pH-neutral soap and water.
2. Remove any trim, emblems and hardware from the area to be repaired.
3. **NOTE:** All delamination must be removed.

   Sand or media blast the damaged surface, keeping the repair area as minimal as possible.
4. Treat any bare metal surface to prevent flash corrosion, and prime and block sand as necessary prior to refinishing.
5. Mask the adjacent panels to protect from overspray.
6. Spot repair the base coat as necessary, following the paint manufacturer's prescribed procedures.
7. Following the paint manufacturer's prescribed procedure, apply clear coat to the entire panel.

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Weld-Bonding

General Equipment

3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
Metal Bonding Adhesive TA-1	-
Premium Undercoating ValuGardTM VG101, VG101A (aerosol)	-
Rust Inhibitor ValuGardTM VG104, VG104A (aerosol)	-
Seam Sealer TA-2	-

Weld-Bonding - Squeeze-Type Resistance Spot Welding (STRW) Method

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

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

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

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

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

NOTE: Corrosion protection needs to be restored whenever it is necessary to grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

NOTE: On door shells that are manufactured with structural adhesives only, weld bonding door skins is not recommended. Only metal bonding adhesive should be used.

NOTE: Weld-bonding is a method used to join metals using Squeeze-Type Resistance Spot Welding (STRW) or Metal Inert Gas (MIG) and structural adhesive. The steps listed in this procedure apply to both types of welding. STRW is the preferred method. MIG welding should only be used when areas to be welded cannot be accessed using STRW -type machinery.

NOTE: Factory spot welds should be substituted with STRW or MIG welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

1. Verify the vehicle is dimensionally correct on a frame machine. Straighten if necessary.

2. Remove damaged panels with an air saw or air chisel. Remove only large portions of the damaged panel. Avoid cutting into mating flanges or adjacent parts.

3. Drill out the spot welds using an appropriate spot-weld cutter and remove the remaining portions of the panel to be replaced.

4. Prepare any damaged flanges on the vehicle using a hammer and a dolly.

5. Grind the mating surface of the original flanges not greater than 25 mm (0.98 in) where the metal bonding adhesive will be applied.
   - Be sure to remove galvanizing on metal. Metal should have a shiny appearance.
   - Be careful not to damage the corners or thin the metal. The E-coat should also be removed on the opposite side of the flange only where the spot welds are to be placed.

6. Dry-fit and clamp the replacement service parts to verify a correct fit.
   - Remove the service part after verifying correct fit and alignment.

7. **NOTE:** The ends of welding clamps should be insulated on the ends using tape or similar material when welding is carried out.

   Follow manufacturer's prescribed welding procedures and settings. For additional information, refer to Welding Precautions - Steel in this section.

8. Prepare the adhesive. Dispense a small amount of metal bonding adhesive from the cartridge to make sure of an even flow of both components. Attach the mixing tip and dispense a mixing tip length of adhesive to make sure of a correct mix ratio.

9. **NOTE:** Welding can be carried out anytime during the adhesive curing process or after the adhesive is fully cured. Welder settings will vary when welding through wet adhesive versus welding through fully cured adhesive. Refer to welder manufacturer's recommended settings for welding through fully cured adhesive. It is recommended to place a shunt weld in an area with no adhesive to make sure of conductivity, particularly when welding through fully cured adhesive.

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NOTE: Refer to product label for preparation and handling instructions.

Create a test sample.

1. Prepare the metal and adhesive as described. Apply a 6-9 mm (0.23-0.35 in) bead of adhesive and weld the sample.
2. Place the welded sample in a vise and carry out destructive weld tests by peeling the scrap metal apart using large lock-type pliers. Measure the weld nugget to determine that the nugget meets Ford weld nugget requirements. If the weld nugget does not meet required size, adjust welder settings until the correct weld nugget size is achieved.
3. When the correct weld nugget size is achieved, the service part can be weld-bonded. For additional information, refer to Specifications in this section.

10. Apply a 6-9 mm (0.23-0.35 in) bead of metal bonding adhesive to the vehicle prepared flange surface.

11. Place the service part(s) in the correct position on the vehicle.
    - When positioned, do not pull the component away from the vehicle. If repositioning is necessary, slide the service part(s). This will make sure of correct contact between the components and adhesive.

12. Clamp evenly and tightly. The adhesive contains glass beads which will prevent over-clamping the component.

13. **NOTE:** If welding will not be carried out immediately, allow a minimum of 1.5 to 2 hours of adhesive cure time at 21°C (70°F) before removing clamps. Cure time at lower temperatures should be increased. Clamps may be removed immediately after the component is welded.

    Wipe excess adhesive from the panel before it cures.

14. Finish any cosmetic section seams with fiber-filled body filler. Rough sand the filler, after the adhesive cures, apply conventional body filler and block-sand the area.

15. Use seam sealer wherever a cosmetic seam sealer is required.

16. Mix and apply primer surfacer per paint manufacturer's recommendations.

17. Mix and apply basecoat per Ford-approved paint recommendations.

18. Mix and apply clearcoat per Ford-approved paint recommendations. Refinishing materials may be force-dried following paint manufacturer's recommendations.

19. Apply corrosion protection to the repair area as required.

Weld-Bonding - Metal Inert Gas (MIG) Welding Method

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

⚠ WARNING: Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear

protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.

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

NOTE: MIG weld-bonding can be substituted as an alternative to STRW . It may only be used to weld areas that are inaccessible to STRW machinery. However, when accessible, STRW is the preferred method.

NOTE: Corrosion protection needs to be restored whenever it is necessary to grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

NOTE: On door shells that are manufactured with structural adhesives only, weld-bonding door skins is not recommended. Only metal bonding adhesive should be used.

NOTE: Factory spot welds should be substituted with STRW welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

1. Remove damaged panels with an air saw or air chisel. Remove only large portions of the damaged panel. Avoid cutting into mating flanges or adjacent parts.
    - Drill out the spot welds using an appropriate spot-weld cutter and remove the remaining portions of the panel to be replaced.

2. After removing the damaged sheet metal panel(s), repair any damaged flanges on the vehicle using a hammer and dolly.

3. Using an appropriate grinder, carefully grind around the entire receiving flange area following the original welds. Be sure to remove all E-coat, paint or galvanized coating from the mating surfaces of the joint.
    - Be sure to remove galvanizing on metal. Metal should have a shiny appearance.
    - Be careful not to damage the corners or thin the metal. The E-coat should also be removed on the opposite side of the flange only where the spot welds are to be placed.

4. Repeat Step 3 on the mating surface of the replacement service part(s).

5. Prepare the new service panel for plug welds.
    - Using the original panel as a reference, drill or punch 8 mm (0.31 in) diameter holes in the exact number as the original spot welds. The holes should be positioned as close as possible to the original spot weld locations, without lining up exactly on top of an original spot weld site.
    - To make sure of correct weld performance, grind the immediate perimeter of plug weld hole. Grind only in the area of the plug weld, this will keep corrosion to a minimum.

6. Dry-fit and clamp the replacement service parts to verify a correct fit and alignment.
    - Remove the service part after verifying correct fit and alignment.

7. The vehicle prepared flange areas where plug welds will be located must be kept free of adhesive. Apply 25 mm (0.98 in) tape to the plug weld areas to prevent contamination from the adhesive.

8. Prepare the adhesive. Dispense a small amount of metal bonding adhesive from the cartridge to make sure of an even flow of both components. Attach the mixing tip and dispense a mixing tip length of

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adhesive to make sure of correct mix ratio.

9. **NOTE:** Refer to product label for preparation and handling instructions.

   Apply a 6-9 mm (0.23-0.35 in) bead of adhesive to the vehicle prepared flange surface. Remove the tape from the plug weld areas.

10. Place the service part(s) in the correct position on the vehicle.
    - When positioned, do not pull the component away from the vehicle. If repositioning is necessary, slide the service part(s). This will make sure of correct contact between the components and adhesive.

11. Clamp evenly and tightly. The adhesive contains glass beads which will prevent over-clamping the component.

12. **NOTE:** Welding can be carried out anytime during the adhesive curing process or after the adhesive is fully cured.

    NOTE: If welding will not be carried out immediately, allow a minimum of 1.5 to 2 hours of adhesive cure time at 21°C (70°F) before removing clamps. Cure time at lower temperatures should be increased. Clamps may be removed immediately after the component is welded.

    Wipe excess adhesive from the panel before it cures.

13. Finish any cosmetic section seams with fiber-filled body filler. Rough sand the filler, apply conventional body filler after the adhesive cures and block-sand the area.

14. Use seam sealer wherever a cosmetic seam sealer is required.

15. Mix and apply primer surfacer per paint manufacturer's recommendations.

16. Mix and apply basecoat per Ford-approved paint recommendations.

17. Mix and apply clearcoat per Ford-approved paint recommendations. Refinishing materials may be force-dried following paint manufacturer's recommendations.

18. Apply corrosion protection to the repair area as required.

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Plastics Identification

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

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

NOTE: Identification of the various plastic types is necessary to select the appropriate repair methods to make high quality plastic repairs. Plastics can generally be broken down into 2 categories, thermoplastics and thermosetting plastics. Thermoplastics can be remolded by heating. This makes plastic welding a possible repair alternative.

1. **NOTE:** In some instances, a code or material designation is stamped indicating the plastic type.

   Thermoplastics are solvent reactive. Types of thermoplastics include Thermoplastic Olefin (TPO), Polyvinyl Chloride (PVC) and Acrylonitrile Butadiene Styrene (ABS). Polyolefins have an oily or waxy appearance. Examples include some bumper covers, stone shields, fender aprons and fan shrouds. Polyolefins require an adhesion promoter prior to carrying out any refinish procedure.

   - To determine if the part is a polyolefin, grind the damaged area in an out-of-sight area. Grinding a polyolefin will melt and smear the plastic and leave a ragged edge. If the part is non-polyolefin, the area will grind or sand smoothly, producing a powdery dust.

Rigid Plastic Parts

Code	Family Name	Common Trade Name	Typical Application
ABS	Acrylonitrile Butadiene Styrene	ABS, Cycolac, Lustran, Kralistic	A-Pillars, Consoles, Grilles
SMC	Sheet Molded Composite	SMC	Body Panels

Flexible Plastic Parts

Code	Family Name	Common Trade Name	Typical Application
RRIM	Reinforced Reaction Injection-Mold Material PUR	RRIM	Fascias, Body Panels, Body Trims
TPO	Thermoplastic Polyolefin	Polytrope, Renflex, Santropren Telcar, Vistaflex, ETA, Apex, TPO	Bumpers, End Caps, Rubber Strips, Sight Shields, Claddings, Interior B-Post

2. Polyolefin plastic can also be identified by placing a small sliver in a container of water, if the sample floats, it is a polyolefin plastic. A non-polyolefin will sink when placed in a container of water.

3. Generally, thermosetting plastics are rigid or semi-rigid. Sheet-Molded Composite (SMC) is reinforced with glass and other fibers and are strong and rigid. SMC is used for large panels such as hoods, liftgates, fenders and quarter panels.
    - A burn test can be a reliable method to determine if a plastic is a thermosetting plastic. Extreme care must be exercised when using this method.
        - ***NOTICE:*** **The component must be isolated away from the vehicle and all combustible materials to perform this test.**

          Apply an open flame to the corner of the damaged component. If the material crystallizes and becomes hard, it is a thermosetting plastic.

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Plastics Repair

Material

Item	Specification
Plastic Bonding Adhesive TA-9	-

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

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

1. In deciding whether to repair or install a new component, follow these guidelines.
   - Is a part readily available?
   - Can the damaged part be economically returned to its original strength and appearance, or will the labor cost exceed the cost of a new component?
   - Will repair provide for the fastest, highest quality repair?

2. ***NOTICE:*** **Never apply solvents such as lacquer thinner or reducer at any stage of plastic repair. Solvents, cleaners and water are absorbed by many types of plastics and by the glass fibers used for reinforcements. If this occurs, the plastic may swell in the area of repair and cause the repair to fail. Remove cleaners and water quickly and use air and heat to speed up drying.**

   NOTICE: **During the repair of many plastics and particularly polyolefin plastics, an adhesion promoter must be applied to the substrate to allow repair materials and paint to bond correctly. Reapplication is required when grinding or sanding through the sealer or primered layers.**

   NOTE: When possible, it is recommended to carry out as much of the plastic repair as possible on the vehicle. Parts mounted on the vehicle are held in correct alignment throughout the repair. Attempting to repair the part off the vehicle may cause misalignment. This could lead to failure of the repair.

   Select the correct repair method by identifying the type of plastic being repaired. For additional information, refer to Plastics Identification in this section to determine the type of plastic being repaired.

3. **NOTE:** Always refer to the manufacturer's label directions for the type of repair materials, fillers and bonding agents being used as they are material specific.

   Determine whether a reinforcement piece is needed as a backer on large repairs.

   - Construct a reinforcement piece from a scrap piece of the type of plastic being repaired and follow manufacturer's label directions for the type of system being used.
   - When repairing Sheet-Molded Composite (SMC), a reinforcement piece can be constructed using several layers of glass cloth saturated with resin or structural adhesive. The weave of the cloth or screening should be loose enough to allow the resin to thoroughly penetrate. Reinforcement should cover the entire area of damage and extend outward beyond the

damage or joint area.

Sheet-Molded Composite (SMC) Panel Repair

NOTE: The following procedure applies to repair of structural cracks and large gouges. If damage is cosmetic, use of reinforcing cloth may not be necessary.

1. Panels to be repaired should be dry and at room temperature 18°C (65°F) to 24°C (75°F) prior to carrying out any repairs. Both sides of the panel must be thoroughly cleaned before sanding or grinding.

2. Cover the break in the SMC (front and back) with masking tape. This protects the damaged area from absorbing the prep cleaner and eliminates wicking of the cleaner through the fibers into the SMC .

3. Remove all waxes, silicones, dirt and road oils from the area surrounding both sides of the damaged area with a plastics wax and grease remover.
    - Remove the tape and sand the back of the repair area with an angle grinder, Dual Action (D/A) sander or by hand using 80-grit sandpaper. Remove all dust with a vacuum and tack cloth.

4. Create a reinforcing patch using a piece of scrap SMC that conforms well to the back of the damaged area or form a patch from fiberglass cloth.
    - Cut a section of cloth large enough to cover the repair, plus 25.4 mm (1 in) around the repair area.
    - Cut a section of plastic film backing approximately 25.4 mm (1 in) larger than the cloth. Lay the plastic on a smooth, flat surface where it will be used to create a pyramid patch.

5. Follow manufacturer's directions and apply plastic repair adhesive to the plastic film backing and smooth with plastic spreader to recommended thickness. Place the pre-cut fiberglass cloth on the adhesive-coated plastic film. Cover the cloth with a coat of repair adhesive and spread to the recommended thickness.

6. Apply the prepared patch to the backside of the panel and compress. Follow manufacturer's instructions for adhesive cure. Remove plastic film after adhesive cures and sand as necessary to remove roughness.

7. Remove masking tape from the front side of damaged area and grind down to the backing patch. Use an angle grinder with a 30- to 40-grit wheel. Make a gradual taper in the area, this will prevent bull's-eyes or read-through in the finished repair. Sand prepared area with a D/A sander or hand-sand with 80-grit sandpaper.

8. Build a pyramid patch using fiberglass cloth or equivalent and plastic repair adhesive. Following manufacturer's directions, apply patch to damaged area.

9. Rough-grind area to remove excess adhesive. Sand repair area with 80-grit sandpaper, making sure to cut slightly below the SMC finished surface. This will allow for a finish coat of plastic body repair material.

10. Apply a finish coat of plastic repair filler material per manufacturer's directions.

11. Finish-sand, prime and topcoat using Ford-approved paint systems.

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Thermoplastic Compounds

1. In deciding whether to repair or install a new component, follow these guidelines.
   - Is a part readily available?
   - Can the damaged part be economically returned to its original strength and appearance, or will the labor cost exceed the cost of a new component?
   - Will repair provide for the fastest, highest quality repair?

2. **NOTE:** The following steps are to be used as a guideline. Depending on what brand of adhesives or patch materials are used, procedures may vary slightly.

   Thoroughly clean the damaged area with wax and grease remover formulated for use with plastics.

3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air.

4. Apply a plastics adhesion promoter per label directions to the repair area.

5. For small repairs, a plastic adhesive filler can be applied to the damaged area. Follow manufacturer's directions and build layers to form a thickness above the damaged area. This will allow the area to be sanded smooth.

6. To repair large holes or cracks, measure and cut a piece of fiberglass cloth or equivalent 25.4 mm (1 in) larger than the crack or hole.
   - Apply plastic repair adhesive to the damaged area and immediately apply fiberglass cloth into plastic adhesive for reinforcement. Apply additional plastic repair adhesive for strength and shape as required.

7. Contour and shape the repair as necessary with a D/A sander. Avoid sanding through the repair.

8. Finish-sand the area and carry out any required paint operations using Ford-approved paint systems.

Tab Repair - Bumper

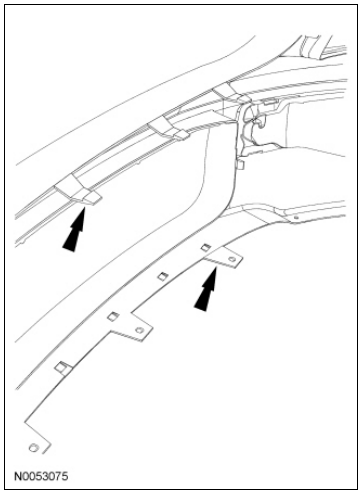
1. **NOTE:** Inspect the bumper cover to determine if part of it can be repaired to an acceptable level of quality of appearance, fit and durability. Will labor and material cost of the repair meet or exceed the cost of a new replacement bumper cover? If the bumper cover is determined to be repairable, proceed to the following steps.

   NOTE: The following steps are to be used as a guideline. Depending on what brand of adhesives or patch materials are used, procedures may vary slightly.

   Remove the affected bumper. For additional information, refer to Section 501-19 .

NOTE: Illustration is not vehicle specific.

2. Clean the broken tab(s) with a plastics wax and grease remover.



3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air.

4. Apply a plastics adhesion promoter per label directions to the repair area.

5. Measure and cut a patch of fiberglass cloth or equivalent large enough to form the front of the tab, then slope back in a wedge shape approximately 51 mm (2 in) from original tab.

6. Prepare the repair adhesive cloth patch per manufacturer's instructions and apply to the affected area.
    - Immediately position the plastic repair material patch to form the tab shape.

7. Allow appropriate cure time and shape the repair tab using a small angle sander. Use extreme care to not sand through the exterior surface.

8. Carry out any required paint repair operations to the bumper cover using Ford-approved paint systems.

9. Reassemble and install the bumper cover. For additional information, refer to Section 501-19 .

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Plastics Refinishing

All Components

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

⚠ WARNING: Do not paint any air bag module trim covers or deployment doors. Paint may cause the air bag to deploy incorrectly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

NOTE: When using any Ford-approved refinishing product, it is recommended to stay within the same paint system throughout the process. For example, do not use one manufacturer's primers and another manufacturer's topcoats.

1. **NOTE:** Care must be used if applying heat to parts. Thermoplastics soften and tend to lose their shape when heated.

   The first step for any repair or refinish procedure is to identify the type of plastic. Is it thermosetting or thermoplastic, grained or smooth? This will determine how it should be cleaned and prepared for refinishing. For additional information, refer to Plastics Identification in this section.

   - It is essential that the correct cleaner is used, depending on which painting system is employed, solvent-based or water-based.
   - Clean part with warm water/mild detergent, then with plastic cleaner to remove wax, silicone and other contaminants. Do not allow parts to remain wet for extended periods.
   - As a general rule, if water beads on the part, it requires additional cleaning as all the manufacturing release agents have not been removed.

2. New parts may require baking in a spray booth or heating with heat lamps to release trapped solvents or mold release agents used in the manufacturing processes.

Non-grained components

3. After cleaning, lightly sand with 600-grit or finer sandpaper. Remove sanding residue with plastic cleaner and wipe dry.

Grained components

4. After cleaning, light use of a gray scuff pad is permissible providing the graining not be flattened. Remove sanding residue with plastic cleaner and wipe dry.

All components

5. Apply a plastics adhesion promoter to any bare plastic part following manufacturer's recommendation. Throughout the refinish procedure, any time bare plastic is exposed for any reason, it is essential that adhesion promoter be reapplied to that area.

6. A sealer may be required to prevent wrinkling and lifting of the topcoat prior to carrying out the refinish procedure.

7. Flexible and non-flexible components should be refinished separately as a flex additive may be required when refinishing flexible parts (refer to the paint manufacturer's recommendation).

8. It is recommended to carry out refinishing of exterior components on-vehicle (after cut-in) to control color match and blending to adjacent panels.

9. Proceed with the refinish process and follow the Ford-approved paint system procedures. Steps may vary between paint manufacturers.

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Frame Members

General Equipment

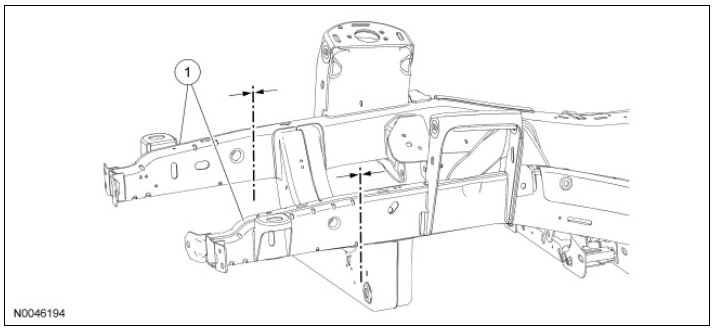
3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
MotorcraftÂ® Metal Surface Prep ZC-31-A	â
Premium Undercoating ValuGardâ ¢ VG101, VG101A (aerosol)	â
Rust Inhibitor ValuGardâ ¢ VG104, VG104A (aerosol)	â

Front Frame Rail

NOTE: Cut lines shown in illustration are approximate, refer to the following procedure for specific cut locations.



Item	Part Number	Description
1	5D059 LH/ 5D058 RH	Frame rail sectioning kit

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

⚠ WARNING: Frame rail crush zones absorb crash energy during a collision and must be replaced if damaged. Prior to replacement of frame rail crush zones, straighten damaged frame rails to correct frame dimensions. Failure to follow these instructions may adversely affect frame rail crush zone performance and may result in serious personal injury to vehicle occupants in a crash.

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

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

NOTICE: **The front frame rail kit and No. 6 crossmember are the only serviceable components of the frame assembly. Follow the manufacturer's prescribed procedure included with the service replacement kit.**

NOTE: Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

NOTE: Observe prescribed welding procedures when carrying out repairs to the frame assembly. For additional information, refer to Welding Precautions â Steel in this section.

1. **NOTE:** To make sure of correct fit and alignment of replacement components, the vehicle should be rough straightened to restore it to pre-accident dimensions before removal of structural or welded components.

   Position the vehicle on a frame rack following the manufacturer's recommendations. Measure the vehicle to determine body and frame alignment. For additional information, refer to Body in this section for dimensional information.

2. Remove the front bumper. For additional information, refer to Section 501-19 .

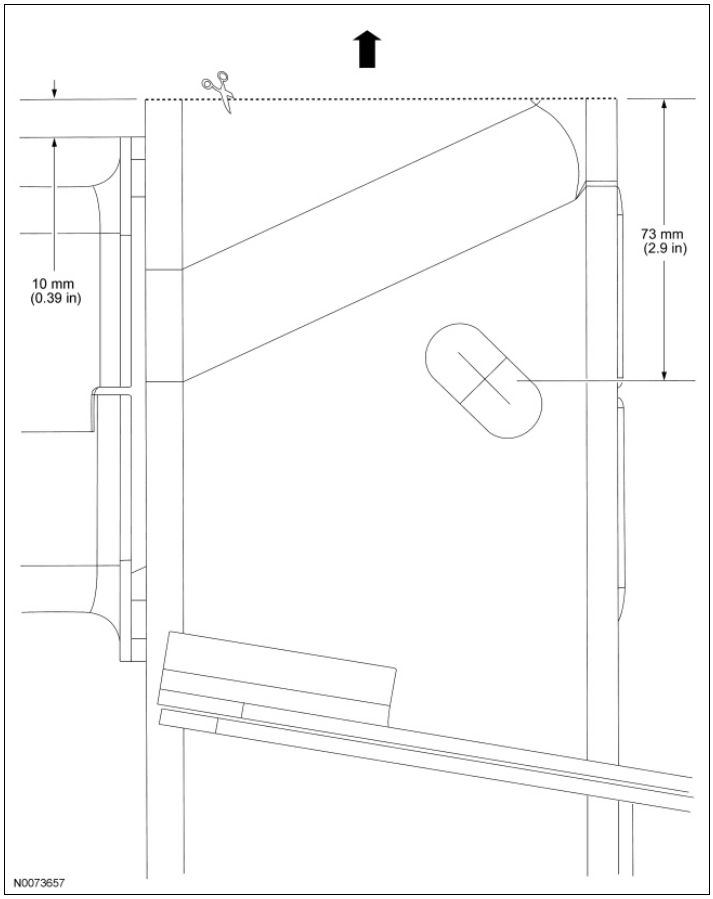
3. Unbolt the LH and RH front stabilizer bar brackets.

4. Remove the Front End Sheet Metal (FESM) body mount bolts and mounts on the side the repair is being carried out.

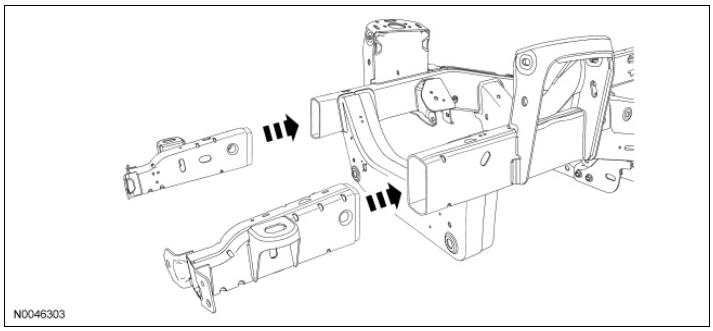
5. **NOTE:** It is recommended to create a clear vinyl copy of this template. Template must be applied to frame with arrow to front of vehicle in horizontal position.

   Scribe cutting lines on the damaged front frame section using the template above.

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6. Using a plasma cutter, reciprocating saw or die-grinder, remove the damaged front frame horn section. DO NOT cut directly along the scribe line. Leave enough material on the forward side of the scribe line to allow the edge to be ground back exactly to the scribe line. This is required to make sure of correct fit up between the frame and the replacement section.



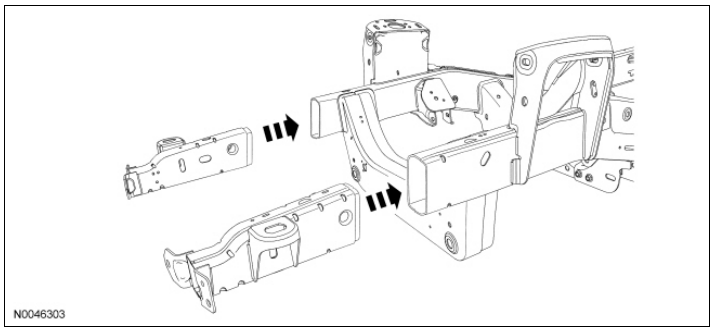
NOTICE: **Do not thin out the frame rail. The material must maintain a minimum thickness of 3.4 mm (0.13 in) after grinding.**

7. Grind off the excess frame in front of the scribed line on the existing frame horn.
    - Sand off as much of the frame coating as possible using 36 to 60 grit sandpaper on the inner and outer surfaces within a minimum of 20 mm (0.78 in) of the repair joint-including the overlap.

8. Use a wire brush to remove any foreign material from the frame within 25 mm (0.98 in) of the repair joint. Use metal surface prep or equivalent to remove the remaining coating on the inner and outer surfaces within 20 mm (0.78 in) of the joint.
    - Apply a zinc-rich weld-through primer to the exposed inner and outer mating surfaces.

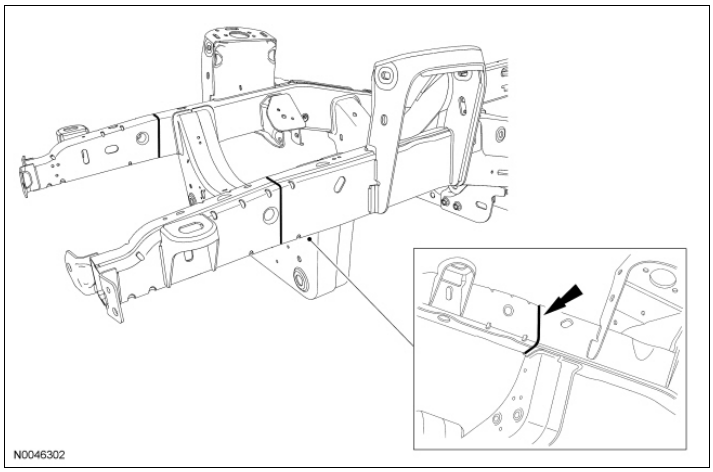
9. Make sure that the frame and service replacement part have attained a minimum room temperature of 10ï¿½C (50ï¿½F) before beginning the weld procedure. A Metal Inert Gas (MIG) welder capable of producing 185-250 amps must be used. Use 0.035 to 0.045 inch ER70S-3 or equivalent weld wire that is compatible with SAE 1010 steel. Shielding gas must be 100% carbon dioxide or 75% carbon dioxide and 25% argon.

10. Install the replacement frame section onto the frame. Slide the replacement frame section all the way into the frame rail until it touches the rail. Support the replacement frame section in position. Verify that the FESM mount bracket lines up with sheet metal hole. The holes should line up so that the FESM mount can be installed and the FESM mount bolt can be installed.



11. Tack weld the frame horn replacement section into the existing frame at 4 small points centered on the flats between the corners. This will hold the section in place to check the fit up prior to completely welding up the section.

12. Make sure the frame section replacement is correctly aligned.
    - Carry out the remainder of the welding procedure.
    - After welding is complete, grind off any excess weld material.



13. Use a dye penetrant to determine if any cracks or large voids exist in the weld joint after the welding process has been completed.
    - If any cracks or other defects exist, grind out the defect and repair it until the imperfection is corrected.

14. Clean the repaired area(s) and any exposed metal surfaces. Restore corrosion protection to the interior and exterior surfaces of the repaired area(s) to the extent possible.

15. Install the components removed during the repair procedure.

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Inner Body Reinforcing Panels

Special Tool(s)

 ST2738-A	Heat Treatment Induction Resistance Spot Welder 254-00001
 ST2956-A	Pro 230 MIG Welder 208-00030

Material

Item	Specification
Metal Bonding Adhesive TA-1	â
MotorcraftÂ® Metal Surface Prep ZC-31-A	â
Premium Undercoating ValuGardâ ¢ VG101, VG101A (aerosol)	â
Rust Inhibitor ValuGardâ ¢ VG104, VG104A (aerosol)	â
Seam Sealer TA-2	â

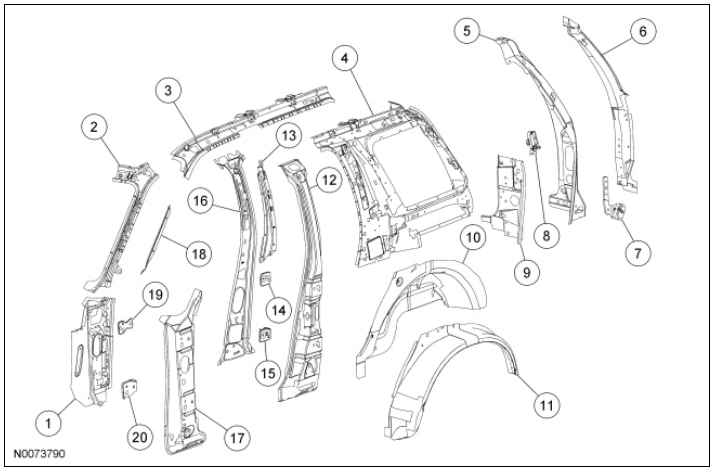
Explorer/Mountaineer

NOTICE: **Sectioning procedures can only be carried out on the outer body side panel. No sectioning repairs can be carried out on inner reinforcement panels. Failure to follow these instructions may compromise structural integrity of the body structure. For additional information, refer to Sectioning Guidelines in this section.**

NOTE: Refer to the Ford Recommended Steel Repairability Matrix in the Specifications portion of this section for specific information regarding steel descriptions.

NOTE: Part callout numbers 13 and 18 have structural adhesive applied for additional strength. Structural adhesive TA-1 must be reapplied when repair procedures are carried out on these components. For additional information, refer to Weld-Bonding in this section.

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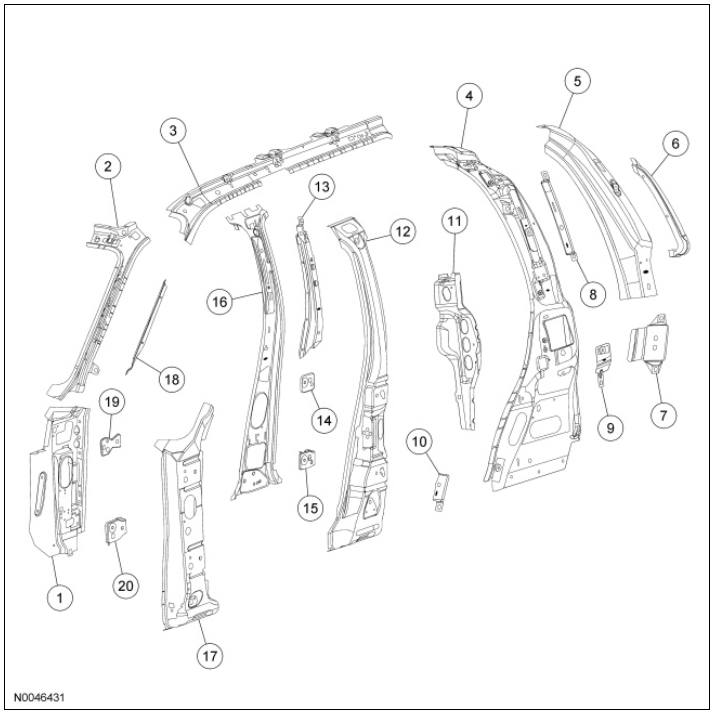
Item	Part Number	Description
1	02039 LH/ 02038 RH	Cowl side panel ï¿½ mild steel
2	02509 LH/ 02508 RH	A-pillar assembly ï¿½ mild steel
3	513A31 LH/ 513A30 RH	Roof side rail ï¿½ High-Strength Low Alloy (HSLA) 250 steel
4	40477 LH/ 40476 RH	Inner quarter panel ï¿½ mild steel
5	41039 LH/ 41038 RH	Rear corner pillar ï¿½ Bake Hardened Steel (BH) 250
6	45115 LH/ 45114 RH	Liftgate opening drain trough ï¿½ BH 210 steel
7	428W55 LH/ 428W54 RH	Reinforcement ï¿½ mild steel
8	45131 LH/ 45130 RH	Extension ï¿½ mild steel
9	41225 LH/ 41224 RH	Corner pillar, inner ï¿½ HSLA 250 steel
10	278887A LH/ 27886A RH	Wheelhouse panel, inner ï¿½ mild steel
11	27887B LH/ 27886B RH	Wheelhouse panel, outer ï¿½ mild steel
12	24383 LH/ 24382 RH	B-pillar reinforcement ï¿½ BH 180 steel
13	78611C09 LH/ 78611C08 RH	B-pillar reinforcement ï¿½ HSLA 300 steel
14	244A23 LH/ 244A22 RH	Hinge plate reinforcement ï¿½ mild steel
15	244A23 LH/ 244A22 RH	Hinge plate reinforcement ï¿½ mild steel
16	24301 LH/ 24300 RH	Center body inner panel ï¿½ mild steel
17	244011 LH/ 211A11 RH	Door frame panel ï¿½ mild steel
18	7802527 LH/ 7802526 RH	A-pillar reinforcement ï¿½ HSLA 250 steel
19	22836	Hinge reinforcement ï¿½ mild steel
20	22836	Hinge reinforcement ï¿½ mild steel

Explorer Sport Trac

NOTICE: **Sectioning procedures can only be carried out on the outer body side panel. No sectioning repairs can be carried out on inner reinforcement panels. Failure to follow these instructions may compromise structural integrity of the body structure. For additional information, refer to Sectioning Guidelines in this section.**

NOTE: Refer to the Ford Recommended Steel Repairability Matrix in the Specifications portion of this section for specific information regarding steel descriptions.

NOTE: Part callout numbers 13 and 18 have structural adhesive applied for additional strength. Structural adhesive TA-1 must be reapplied when repair procedures are carried out on these components. For additional information, refer to Weld-Bonding in this section.

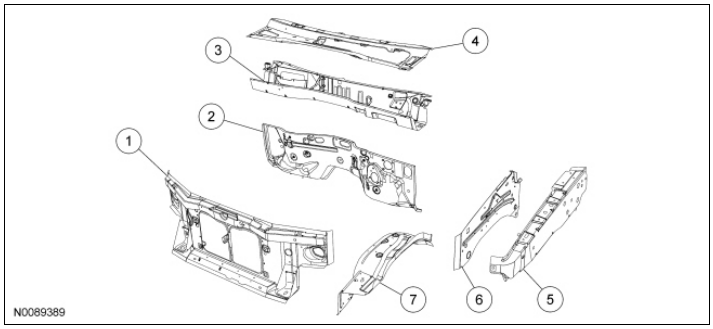


Item	Part Number	Description
1	02039 LH/ 02038 RH	Cowl side panel ï¿½ mild steel
2	02509 LH/ 02508 RH	A-pillar assembly ï¿½ mild steel
3	513A31 LH/ 513A30 RH	Roof side rail ï¿½ High-Strength Low Alloy (HSLA) 250 steel
4	40477 LH/ 40476 RH	Back inside panel ï¿½ mild steel
5	28365 LH/ 28364 RH	Body lock pillar reinforcement ï¿½ mild steel
6	278A29 LH/ 278A28 RH	Rear corner panel ï¿½ mild steel
7	264K44	Door lock striker reinforcement ï¿½ HSLA 300
8	611C08	Front seat shoulder strap reinforcement ï¿½ HSLA 300 steel
9	611C07 LH/ 611C06 RH	Rear seat belt retractor reinforcement ï¿½ mild steel
10	61271 LH/ 61270 RH	Rear seat belt anchor-to-pillar reinforcement ï¿½ HSLA 300 steel

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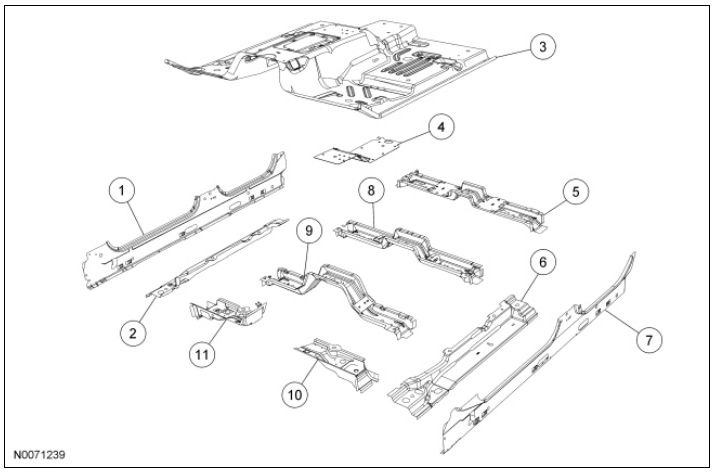
11	278B11 LH/ 278B10 RH	Quarter panel inside rear ï¿½ mild steel
12	24383 LH/ 24382 RH	B-pillar reinforcement ï¿½ Bake Hardened Steel (BH) 180
13	78611C09 LH/ 78611C08 RH	B-pillar reinforcement ï¿½ HSLA 300 steel
14	244A23 LH/ 244A22 RH	Hinge plate reinforcement ï¿½ mild steel
15	244A23 LH/ 244A22 RH	Hinge plate reinforcement ï¿½ mild steel
16	24301 LH/ 24300 RH	Center body inner panel ï¿½ mild steel
17	244011 LH/ 211A11 RH	Door frame panel ï¿½ mild steel
18	7802527 LH/ 7802526 RH	A-pillar reinforcement ï¿½ HSLA 250 steel
19	22836	Hinge reinforcement ï¿½ mild steel
20	22836	Hinge reinforcement ï¿½ mild steel

Front Structure



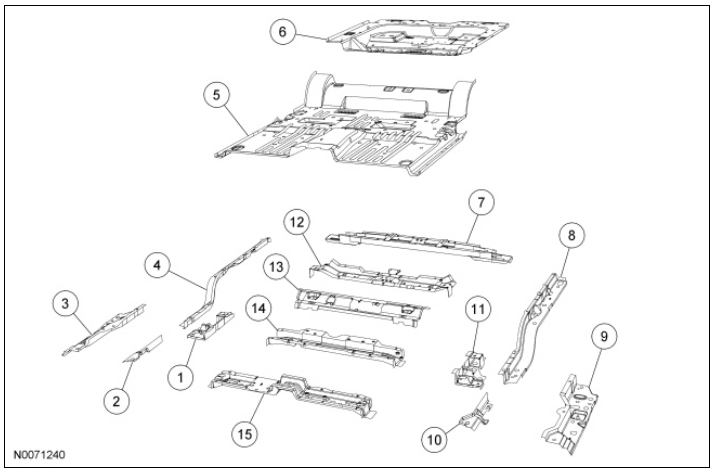
Item	Part Number	Description
1	16138	Radiator support ï¿½ mild steel
2	01610	Dash panel ï¿½ laminated sound/vibration steel
3	02030	Cowl top inner panel ï¿½ mild steel
4	02015	Cowl top panel ï¿½ mild steel
5	16C275 LH/ 16C274 RH	Inner fender reinforcement ï¿½ mild steel
6	16K007 LH/ 16K006 RH	Fender reinforcement ï¿½ mild steel
7	16E207 LH/ 16E205 RH	Body assembly ï¿½ mild steel

Underbody Front ï¿½ Explorer/Mountaineer



Item	Part Number	Description
1	10110	Floor side member (RH) ï¿½ mild steel
2	103K88	Floor side center member (RH) ï¿½ High-Strength Low Alloy (HSLA) 350 steel
3	11135	Floor pan assembly ï¿½ mild steel
4	045B32	Console bracket ï¿½ mild steel
5	11338	Floor pan reinforcement ï¿½ mild steel
6	103K89	Floor side center member (LH) ï¿½ HSLA 350 steel
7	10111	Floor side member (LH) ï¿½ mild steel
8	10624	Front crossmember ï¿½ HSLA 350 and mild steel
9	617C50	Reinforcement ï¿½ mild steel
10	10685	Crossmember ï¿½ mild steel
11	10684	Crossmember ï¿½ mild steel

Underbody Center and Rear ï¿½ Explorer/Mountaineer

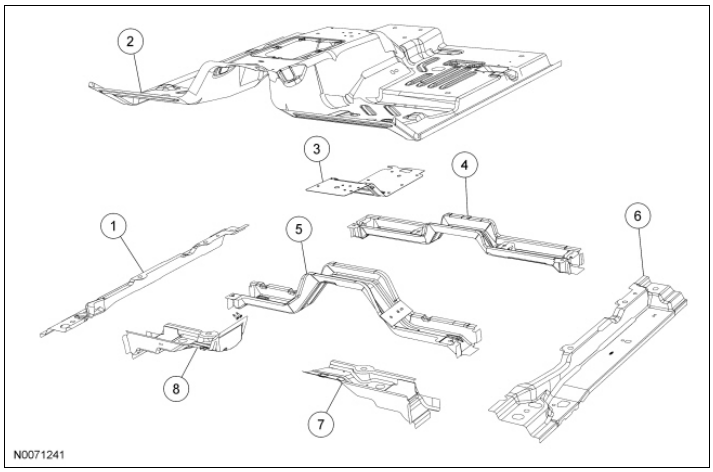


Item	Part Number	Description

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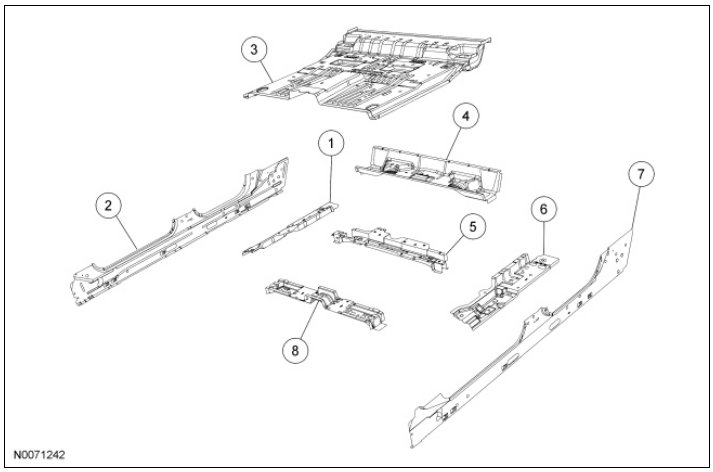
1	11252	Extension (RH) ï¿½ High-Strength Low Alloy (HSLA) 350 steel
2	ï¿½	Reinforcement (part of 10124) ï¿½ HSLA 350 steel
3	10124	Floor side member (RH) ï¿½ HSLA 350 steel
4	101A14	Floor side member assembly (RH) ï¿½ mild steel
5	11160	Center floor pan assembly ï¿½ mild steel
6	11218	Rear floor pan assembly ï¿½ mild steel
7	10608	Rear floor crossmember ï¿½ mild steel
8	101A15	Floor side member assembly (LH) ï¿½ mild steel
9	10125	Floor side member (LH) ï¿½ HSLA 350 steel
10	ï¿½	Reinforcement (part of 10125) ï¿½ HSLA 350 steel
11	11253	Extension (LH) ï¿½ HSLA 350 steel
12	10716	Crossmember ï¿½ mild steel
13	10786	Crossmember ï¿½ mild steel
14	11338	Floor pan reinforcement ï¿½ HSLA 250 steel
15	11C32	Floor pan reinforcement ï¿½ mild steel

Underbody Front ï¿½ Explorer Sport Trac



Item	Part Number	Description
1	103K88	Floor side member (RH) ï¿½ High-Strength Low Alloy (HSLA) 350 steel
2	11135	Floor pan assembly ï¿½ mild steel
3	045B32	Console bracket ï¿½ mild steel
4	11338	Floor pan reinforcement ï¿½ HSLA 350 and mild steel
5	10624	Front crossmember ï¿½ mild steel
6	103K89	Floor side member (LH) ï¿½ HSLA 350 steel
7	10685	Crossmember (LH) ï¿½ mild steel
8	10684	Crossmember (RH) ï¿½ mild steel

Underbody Center and Rear ï¿½ Explorer Sport Trac



Item	Part Number	Description
1	10124	Floor side member (RH) ï¿½ High-Strength Low Alloy (HSLA) 350 steel
2	10110	Floor side member assembly (RH) ï¿½ mild steel
3	11218	Floor pan assembly ï¿½ mild steel
4	10608	Rear floor crossmember ï¿½ mild steel
5	111C32	Rear floor reinforcement ï¿½ HSLA 350 steel
6	10125	Floor side member (LH) ï¿½ HSLA 350 steel
7	10111	Floor side member assembly (LH) ï¿½ mild steel
8	617C50	Reinforcement ï¿½ mild steel

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

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

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

⚠ WARNING: Do not cut or grind body side components within 50 mm (1.96 in) of restraint anchoring points. Welding within 50 mm (1.96 in) of restraint anchoring points may result in incorrect operation of restraint devices. For additional restraints anchoring location information, refer to Section 501-20A and Section 501-20B . Failure to follow these instructions may result in serious injury to vehicle occupant(s).

⚠ WARNING: Do not carry out body side sectioning repairs in areas of door hinge or striker anchoring points. Welding within 50 mm (1.96 in) of door hinge or striker locations may compromise

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structural integrity during a collision. Failure to follow these instructions may result in serious injury to vehicle occupant(s).

⚠ WARNING: On vehicles equipped with Safety CanopyÂ® options, prior to carrying out any sectioning repairs near the roof line or sail panel areas of the vehicle, remove the Safety CanopyÂ® module and related components. Failure to comply may result in accidental deployment or damage to the Safety CanopyÂ®. Refer to Section 501-20B . Failure to follow these instructions may result in serious injury to technician or vehicle occupant(s).

⚠ WARNING: Do not carry out body side sectioning repairs in areas of laser welds. Factory laser welds cannot be duplicated with conventional welding equipment and structural integrity may be compromised. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

NOTE: Factory spot welds may be substituted with either resistance spot welds or Metal Inert Gas (MIG) plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

Observe prescribed welding procedures when carrying out any body side section repair. For additional information, refer to Welding Precautions â Steel in this section.

NOTE: When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding in this section.

1. Remove the outer body sheet metal from the affected area prior to carrying out any body side reinforcing panel replacement. For additional information, refer to Sectioning Guidelines in this section. Clean the repair area with metal surface prep or equivalent to remove any grease or contaminants prior to welding.

2. Where possible, create a backer piece using a portion of the old panel. This will create a stronger joint.

3. **NOTE:** Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. For additional information, refer to Restoring Corrosion Protection Following Repair in this section.

   When welding overlapping surfaces or substrates, apply a weld-through primer between the surfaces prior to welding. When the surfaces have been welded, apply corrosion protection material to the exterior surfaces or substrates.

   - Make sure horizontal joints and flanges are correctly sealed with seam sealer to prevent moisture intrusion. Water and moisture migrate to horizontal joints and corrosion tends to occur more rapidly in these areas. Metal surfaces must be clean and dry before applying seam sealer.

4. Proceed with refinishing procedures following Ford-approved paint guidelines. Apply corrosion protection to the repair area as required.

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Material

Item	Specification	Fill Capacity
High Temperature Anti-Corrosion Coating PM-13-A	-	-

Torque Specifications

Description	Nm	lb-ft	lb-in
1B crossmember nuts	103	76	-
Front End Sheet Metal (FESM) support bolt	55	41	-
FESM support nut	55	41	-
Heat shield bolts	18	-	159
No. 1 body support bolt	90	66	-
No. 1 body support nuts	103	76	-
No. 2 body support bolt	90	66	-
No. 3 body support bolt	90	66	-
No. 3 body support nuts	103	76	-
No. 4 body support bolt (Explorer/Mountaineer only)	90	66	-
Spare tire heat shield bolt	15	-	133
Trailer hitch assembly bolts - inboard (service hitch only)	235	174	-
Trailer hitch assembly bolts - outboard (service hitch only)	235	174	-
Transfer case skid plate bolt	15	-	133
Transmission crossmember lower bolts	80	59	-
Transmission crossmember upper nuts	143	105	-
Transmission mount nuts	90	66	-

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Frame and Body Mounting

The frame consists of 2 steel-channel rails, 10 crossmembers for Explorer Sport Trac or 8 crossmembers for Explorer/Mountaineer including a front crossmember, transmission support crossmember and a rear crossmember (trailer hitch). New side rails and welded crossmembers, including the trailer hitch, are not installed separately. A front frame rail repair kit is available if the front rail is to be repaired and a rear crossmember (hitch) repair kit is available if the rear crossmember or rail is to be repaired.

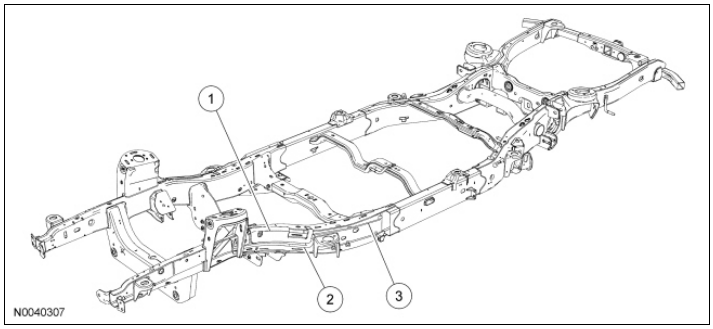
The 1B crossmember and transmission crossmember are included in assembly to the frame, but can be serviced separately. For any frame repair, refer to Section 501-35 .

Frame-Mounted Heat Shields

The frame-mounted heat shields are attached to the top of the frame and crossmembers with bolts. The body must be lifted off the frame enough for access to the bolts that attach the heat shields to the top of the frame.

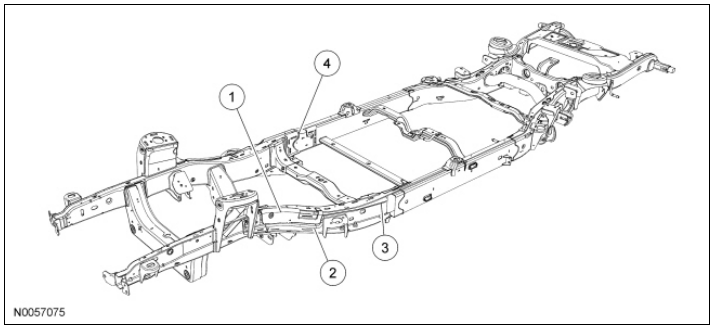
Structural Enhancement - Explorer

NOTE: Portions of the frame are removed from this drawing to show the location of the inserts.



Item	Part Number	Description
1	-	Exterior frame reinforcement
2	-	Fore reinforcement
3	-	Aft reinforcement

Structural Enhancement - Explorer Sport Trac



Item	Part Number	Description
1	-	Exterior frame reinforcement
2	-	Fore reinforcement
3	-	Aft reinforcement
4	-	External reinforcement

The purpose of these inserts is to enhance the structural rigidity of the frame in this area. Inserts cannot be repaired or installed new.

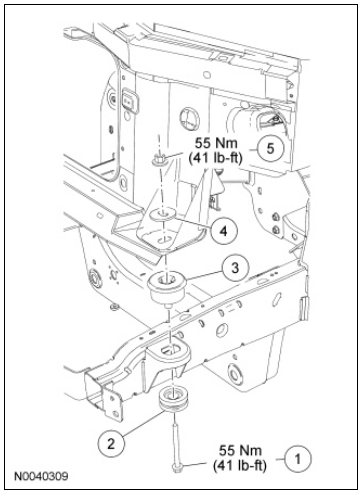
NOTICE: **When removing upper body mounts, enough adjacent body mount support bolts and nuts must be removed to prevent damage occurring to the vehicle.**

NOTE: Body mounts must be held with a wrench on the bottom while loosening the bolt from the top.

NOTE: Do not reuse body support mounting fasteners. New fasteners must be installed for each fastener that has been removed or loosened.

NOTE: No lubricants of any kind are to be used during body mount support installation.

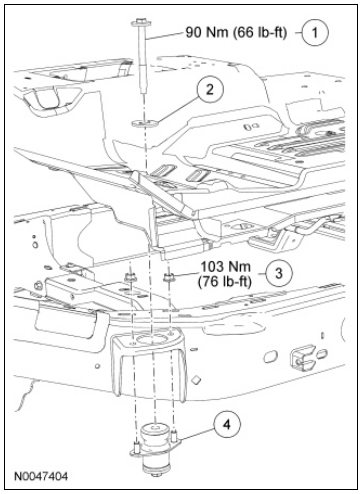
Body Support - Front End Sheet Metal (FESM)



Item	Part Number	Description
1	W710231	Body support bolt
2	00155A	Front End Sheet Metal (FESM) body support mount - lower
3	00154A	FESM body support mount - upper
4	W710733	Body support washer
5	N621946	Body support nut

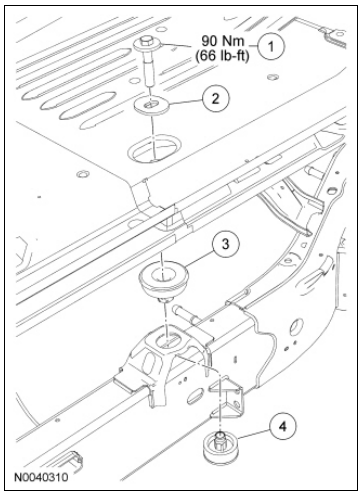
Body Support - No. 1

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Item	Part Number	Description
1	W710725	Body support bolt
2	W710733	Body support washer
3	N800937	Body support nut (2 required)
4	00154B	Body support mount (Explorer/Mountaineer)
4	00154C	Body support mount (Explorer Sport Trac)

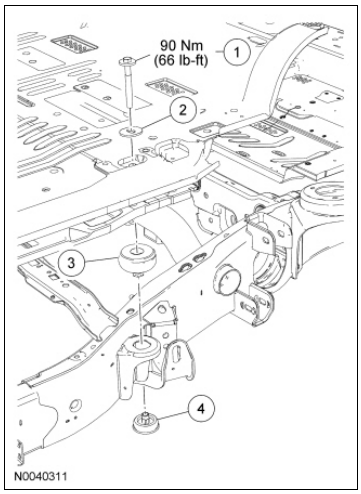
Body Support - No. 2



Item	Part Number	Description
1	W711547	Body support bolt
2	W710733	Body support washer
3	00154C	Body support mount - upper
4	00154B	Body support mount - lower

Body Support - No. 3

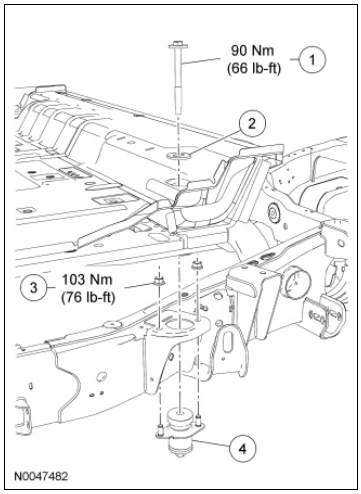
NOTE: Explorer/Mountaineer only.



Item	Part Number	Description
1	W711315	Body support bolt
2	W710733	Body support washer
3	00154E	Body support mount - upper
4	00155C	Body support mount - lower

Body Support - No. 3

NOTE: Explorer Sport Trac only.

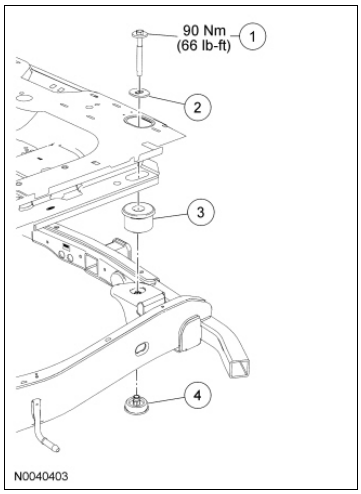


Item	Part Number	Description
1	W710725	Body support bolt
2	W710733	Body support washer
3	N800937	Body support nut (2 required)
4	00154	Body support mount

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Body Support - No. 4

NOTE: Explorer/Mountaineer only.



Item	Part Number	Description
1	W711315	Body support bolt
2	W710733	Body support washer
3	00154D	Body support mount - upper
4	00155C	Body support mount - lower

Frame Drilling

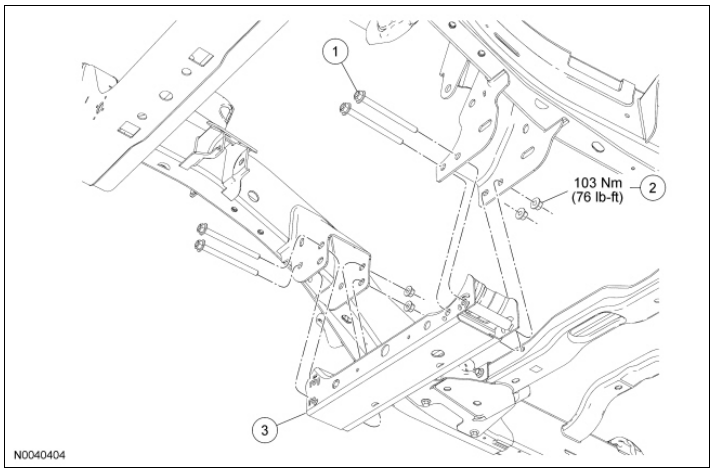
1. Holes that would weaken the frame sidemember should not be drilled in the frame.

2. Holes are not to be drilled in the sidemember's top or bottom flange.

3. Holes to mount brackets, out-riggers and supports may be drilled in the vertical frame side rail web with the following restrictions:
    - Material between edge of hole and inside of upper or lower flange must not be less than 38.1 mm (1.50 in) for low carbon steel (36,000 psi yield).
    - The minimum edge distance between any 2 holes up to 15.74 mm (0.625 in) diameter must be 25.4 mm (1.00 in). For larger than 15.74 mm (0.625 in) diameter holes, the minimum edge distance must be 1.5 times the diameter of the largest hole.
    - No holes will be allowed to exceed 19.05 mm (0.75 in) in diameter.
    - Avoid close vertical succession of fasteners.
    - All attaching fasteners, including flat washers, must be of high-strength steel (Grade 8).

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Crossmember - 1B



Item	Part Number	Description
1	W709834	1B crossmember bolt (4 required)
2	W520114	1B crossmember nut (4 required)
3	5E138	1B crossmember

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 4 crossmember bolts.

3. Remove the 4 crossmember nuts.
   - To install, tighten to 103 Nm (76 lb-ft).

4. Remove the 1B crossmember.

5. To install, reverse the removal procedure.

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Trailer Hitch

Material

Item	Specification
High Temperature Anti-Corrosion Coating PM-13-A	-

Removal and Installation

NOTE: The factory rear trailer hitch crossmember is welded to the frame. The service replacement rear trailer hitch crossmember will be bolted to the frame.

All vehicles

1. Remove the spare tire.

2. Remove the rear bumper cover. For additional information, refer to Section 501-19 .

3. Disconnect the trailer wiring harness.

Explorer/Mountaineer

4. Cut the rear rails vertically at least 10-18 mm (0.39-0.70 in) behind the rear body/box mount leg.
   - Use Explorer/Mountaineer template No. 1. Refer to the trailer hitch procedure on the PTS website.

5. Drill 18 mm (0.688 in) diameter holes for the inboard and outboard attachments to each frame rail.
   - For the inboard side use Explorer/Mountaineer template No. 2. Refer to the trailer hitch procedure on the PTS website.
   - For the outboard side use Explorer/Mountaineer template No. 3. Refer to the trailer hitch procedure on the PTS website.

Explorer Sport Trac

6. Cut the rear rails vertically at least 10-18 mm (0.39-0.70 in) behind the rear body/box mount leg.
   - Use Sport Trac template No. 1. Refer to the trailer hitch procedure on the PTS website.

7. Drill 18 mm (0.688 in) diameter holes for the inboard and outboard attachments to each frame rail.
   - Use Sport Trac Template No. 2. Refer to the trailer hitch procedure on the PTS website.
   - Use Sport Trac template No. 3. Refer to the trailer hitch procedure on the PTS website.

All vehicles

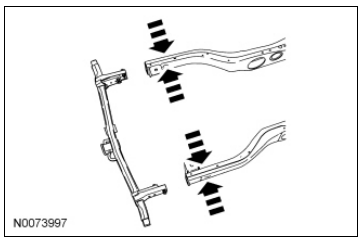
8. Deburr the cut edges of the frame rail and the drilled holes.

9. Clean the inner and outer surfaces of the frame rails, making sure all mating surfaces are free of foreign material.

10. Apply 3 even coats of the specified anti-corrosion coating onto the inner and outer surfaces of the frame rails where bare metal is present.

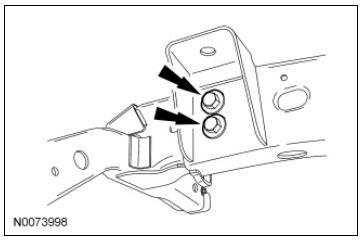
11. **NOTE:** It may be necessary to spread apart or pull together the frame rails slightly to get the brackets to fit.

    Insert the new trailer hitch crossmember assembly into the frame.

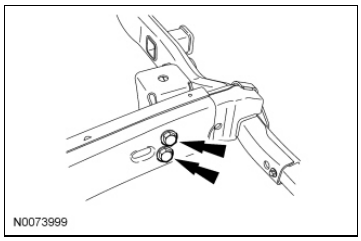


12. Hand-start all 8 bolts into the weld nuts in the hitch brackets.

13. Tighten the inboard bolts.
    - Tighten to 235 Nm (174 lb-ft).



14. Tighten the outboard bolts.
    - Tighten to 235 Nm (174 lb-ft).



15. Install the trailer wiring harness.

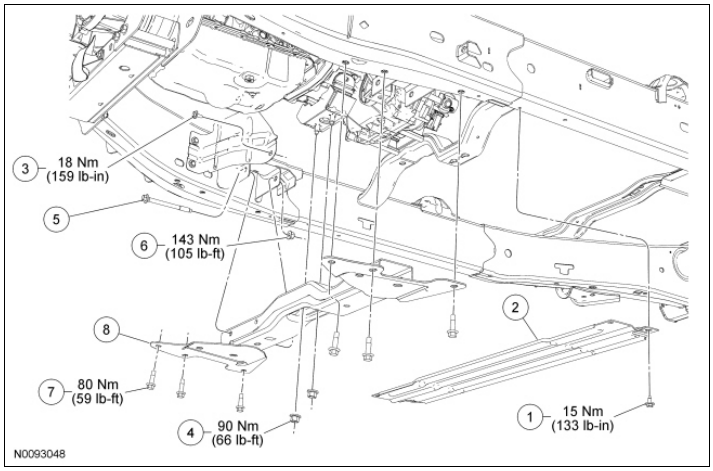
16. Install the rear bumper cover. For additional information, refer to Section 501-19 .

17. Install the spare tire.

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Transmission Support Crossmember

NOTE: Explorer/Mountaineer shown, Explorer Sport Trac similar.



Item	Part Number	Description
1	W707079	Transfer case skid plate bolt (4 required)
2	7E063	Transfer case skid plate
3	W710617	Heat shield bolt (3 required)
4	N621945	Transmission mount nut (2 required)
5	W705049	Transmission crossmember upper bolt (2 required)
6	W520114	Transmission crossmember upper nut (2 required)
7	W506442	Transmission crossmember lower bolt (6 required)
8	5025	Transmission crossmember

Removal and Installation

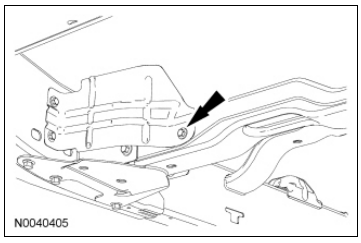
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 4 transfer case skid plate bolts and remove the transfer case skid plate.
   - To install, tighten to 15 Nm (133 lb-in).

3. **NOTE:** Explorer/Mountaineer shown, Explorer Sport Trac similar.

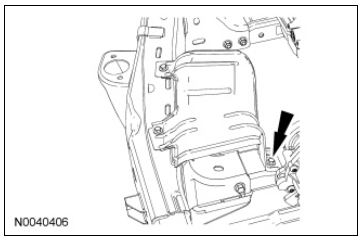
   Remove the heat shield bolt from the RH heat shield.

   - To install, tighten to 18 Nm (159 lb-in).



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4. Remove the heat shield bolt from the LH heat shield.
    - To install, tighten to 18 Nm (159 lb-in).



5. Support the transmission with a suitable jack.

6. Remove the 2 transmission mount nuts.
    - To install, tighten to 90 Nm (66 lb-ft).

7. Remove the 6 transmission crossmember lower bolts.
    - To install, tighten to 80 Nm (59 lb-ft).

8. **NOTE:** Tighten the nut side of the joint.

   Remove the 2 upper nuts and 2 bolts from the transmission crossmember.

    - To install, tighten to 143 Nm (105 lb-ft).

9. Remove the transmission crossmember.

10. To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
Dye-Lite® Gasoline Engine Oil Leak Detection Dye 164-R3700 (Rotunda)	-	-
High Temperature Retaining Compound Loctite® 620TM/Permatex® 62050, or equivalent; obtain locally	WSK-M2G349-A9	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil (Canada) XO-5W20-QSP (US); CXO-5W20-LSP12 (Canada)	WSS-M2C945-A	-
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil (Canada) XO-5W30-QSP (US); CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C946-A, 5W30;	-
Threadlock 262 TA-26	WSK-M2G351-A6	-

Torque Specifications

Description	Nm	lb-in
Variable Camshaft Timing (VCT) oil control solenoid screw	5	44

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Engine

⚠ **WARNING: Do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation. A damaged fan can separate during operation. Failure to follow this instruction may result in serious personal injury.**

NOTICE: **When repairing engines, all parts must be contamination free. If contamination/foreign material is present when repairing an engine, premature engine failure may occur.**

NOTE: This section contains information, steps and procedures that may not be specific to every engine.

NOTE: If a component fails to meet the specifications, repair or install a new component as necessary.

NOTE: Refer to the appropriate Section 303-01 for the specification.

This section covers general procedures and diagnosis and testing of the engine system, except for exhaust emission control devices, the diagnosis of which are covered in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

The engine incorporates the following features:

- a closed PCV system. For service, refer to Section 303-08 .
- an exhaust emission control system. For service, refer to Section 303-08 .
- an Evaporative Emission (EVAP) control system. For service, refer to Section 303-13 .

Some engines incorporate a fail-safe cooling system. Refer to the appropriate section in Group 303 for the procedure.

The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. Refer to the scheduled Maintenance Guide.

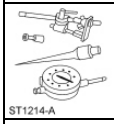
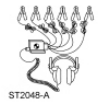
Correct engine identification is required to order parts. Refer to the appropriate section in Group 303 for the procedure.

For complete vehicle and engine identification codes, refer to Section 100-01 .

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Engine

Special Tool(s)

 ST1300-A	12-Volt Master UV Diagnostic Inspection Kit 164-R0756 or equivalent (Leak Detector)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2312-A	EngineEAR 107-R2103 or equivalent
 ST2048-A	EngineEAR/ChassisEAR 107-R2102 or equivalent
 ST1296-A	Oil Pressure Gauge 303-088 (T73L-6600-A)
 ST1297-A	Vacuum/Pressure Tester 164-R0253 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Dye-Lite® Gasoline Engine Oil Leak Detection Dye 164-R3700 (Rotunda)	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil (Canada) XO-5W20-QSP (US); CXO-5W20-LSP12 (Canada)	WSS-M2C945-A
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil (Canada)	WSS-M2C946-A, 5W30;

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XO-5W30-QSP (US); CXO-5W30-LSP12 (Canada); or equivalent	

There are 2 diagnostic paths that can be followed depending on the type of engine concern. Carry out the Inspection and Verification - Engine Performance or Inspection and Verification - Engine NVH.

Inspection and Verification - Engine Performance

1. Verify the customer concern by operating the engine to duplicate the condition.

2. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Engine coolant leaks • Engine oil leaks • Fuel leaks • Damaged or severely worn parts • Loose mounting bolts, studs and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. Clear the CMDTCs and carry out the self-test diagnostics for the PCM.

9. If the DTCs retrieved are related to the concern, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Engine Performance .

Inspection and Verification - Engine NVH

1. Engine NVH symptoms should be identified using the diagnostic tools and techniques that are available. For a list of these techniques, tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 .

2. Verify the customer concern by operating the engine to duplicate the condition.

3. Inspect the engine for installation of an aftermarket oil filter. Review oil and filter maintenance history to make sure that the vehicle has not gone beyond the standard Ford recommended oil change interval.

4. Check the engine oil level and check the oil for contamination. Low engine oil level or contaminated oil are common causes of engine noise. If the oil is contaminated, the source of the contamination must be identified and repaired as necessary.

5. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Loose mounting bolts, studs and nuts • Damaged or leaking powertrain mounts • Damaged or disconnected vacuum hoses • Damaged or disconnected air intake components • Obstruction of cooling fan • Obstruction of Front End Accessory Drive (FEAD) • Obstruction of Rear End Accessory Drive (READ), if equipped

6. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

7. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

8. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

9. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.

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- verify the scan tool operation with a known good vehicle.
- refer to Section 418-00 to diagnose no response from the PCM.

10. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record CMDTCs .

11. Clear the CMDTCs and carry out the self-test diagnostics for the PCM.

12. If the DTCs retrieved are related to the concern, refer to Section 419-10 .

13. If no DTCs related to the concern are retrieved, continue the inspection and verification if a noise concern is related to the engine. For vibration concerns and noise concerns such as powertrain mounts, air intake system and starter GO to Symptom Chart - Engine NVH .

In some cases, a noise may be a normal characteristic of that engine type. In other cases the noise may require further investigation. Comparing the noise to a similar year/model vehicle equipped with the same engine will aid in determining if the noise is normal or abnormal.

Once a customer concern has been identified as an abnormal engine noise, it is critical to determine the location of the specific noise. Use the EngineEAR/ChassisEAR or stethoscope (the noise will always be louder closer to the noise source) to isolate the location of the noise to one of the following areas.

- Upper end of engine
- Lower end of engine
- Front of engine
- Rear of engine

Upper end engine noise

Common sources of upper end engine noise (ticking, knocking or rattle) include the fuel injectors, camshaft phaser sprocket(s), camshaft(s) and valve train. Upper end engine noise can be determined using the EngineEAR/ChassisEAR or stethoscope on the valve cover bolts. If the noise is loudest from the valve cover bolts, then the noise is upper end. The EngineEAR/ChassisEAR or stethoscope can be used to further isolate the noise to the specific cylinder bank and cylinder. Removal of the valve covers will be required to pinpoint the source of the noise.

- Fuel Injector Noise
    - A common source of an engine ticking noise can be related to the fuel injector(s). This is normal engine noise that can be verified by listening to another vehicle. If the injector noise is excessive or irregular, use the EngineEAR/ChassisEAR or stethoscope to isolate the noise to a specific fuel injector.
- Camshaft Phaser and Sprocket Noise [Variable Camshaft Timing (VCT) Engines Only]
    - The camshaft phaser and sprocket may emit a light knock in normal operation and is audible only at idle speed, with a hot engine (gear selector in park/neutral). If the camshaft phaser and sprocket noise is excessive or irregular, use the EngineEAR/ChassisEAR or stethoscope to isolate the noise to the LH or RH cylinder head. This normal noise is not prevalent at cold temperature, the engine may require a cold soak overnight for a full diagnosis to effectively be made at hot idle.
- Valve Train
    - Lash adjusters can make an engine ticking or tapping noise noticeable at any engine rpm or temperature and is audible through the wheel well or an open hood. However, with the hood down, lash adjuster noise can be heard as a light tapping noise through the wheel well and is considered normal. The EngineEAR/ChassisEAR or stethoscope can be used to further isolate

the noise to the specific cylinder bank and cylinder, some disassembly of the engine may be required to inspect for damage or wear.

Lower end engine noise

A common source of lower end engine noise (ticking or knocking) include the crankshaft, connecting rod(s) and bearings. Lower end noises can be determined by using the oil pan or cylinder block lug bosses. If the noise is loudest from these areas then the noise is lower end. If an engine noise is isolated to the lower end, some disassembly of the engine may be required to inspect for damage or wear.

Front of engine noise

A common source of noise from the front of the engine (squeal, chirp, whine or hoot) is the Front End Accessory Drive (FEAD) components. To isolate FEAD noise, carry out the Engine Accessory Test, refer to Section 100-04 .

Some other noises from the front of the engine (ticking, tapping or rattle) may be internal to the engine. Use the EngineEAR/ChassisEAR or stethoscope on the engine front cover to determine if the noise is internal to the engine. Removal of the engine front cover may be necessary to inspect internal engine components.

Rear of engine noise

A common source of noise from the rear of the engine (knocking) is the flywheel/flexplate. Inspection of the flywheel/flexplate will be necessary.

14. After the noise is localized, note the characteristics of the noise, including type of noise, frequency and conditions when the noise occurs and GO to Symptom Chart - Engine NVH .

Symptom Chart - Engine Performance

Symptom Chart - Engine Performance

Symptom Chart - Engine NVH

Symptom Chart - Engine NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible that any one of multiple systems may be the cause of the symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Drone type noise
- Powertrain mount(s)
- CARRY OUT the Powertrain/Drivetrain Mount Neutralizing procedure in this section.

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- Drumming noise - occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent
- Engine vibration excites the body resonances inducing interior noise
- CARRY OUT the Powertrain/Drivetrain Mount Neutralizing procedure in this section.
- Engine drumming noise - accompanied by vibration
- Powertrain mount(s)
- CARRY OUT the Powertrain/Drivetrain Mount Neutralizing procedure in this section.
- Rattle - occurs at idle or at light acceleration from a stop
- Powertrain mount(s)
- CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the appropriate section in Group 303 for the procedure. For automatic transmission, Refer to the appropriate section in Group 307 for the procedure.
- Whine/moan type noise - pitch increases or changes with vehicle speed
- Powertrain mount(s)
- CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the appropriate section in Group 303 for the procedure. For automatic transmission, Refer to the appropriate section in Group 307 for the procedure.
- Clunk - occurs when shifting from PARK or between REVERSE and DRIVE
- Powertrain mounts
- CHECK the powertrain/drivetrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the appropriate section in Group 303 for the procedure. For automatic transmission, Refer to the appropriate section in Group 307 for the procedure.
- Idle speed is too high
- CHECK for the correct idle speed.
- Accessory drive bearing hoot - occurs at idle or high idle in cold temperatures of approximately +4°C (+40°F) or colder at the first start of the day
- Accessory drive idler or tensioner pulley bearing is experiencing stick/slip between ball bearings and the bearing race
- CARRY OUT the engine cold soak procedure. REFER to Section 100-04 .
- PLACE the EngineEAR probe directly on the idler/tensioner center post or bolt to verify which bearing is making the noise. INSTALL new parts as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Accessory drive belt noise, squeal or chirping

- Defective/worn or incorrect accessory drive belt
- Misaligned pulley(s)
- Pulley runout
- Damaged or worn accessory drive component or idler
- Fluid contamination of the accessory drive belt or pulleys
- Damaged or worn accessory drive belt tensioner
- Damaged pulley grooves

- CARRY OUT the Engine Accessory Test. REFER to Section 100-04 . INSPECT components and INSTALL new parts as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Clunking noise

- Coolant pump has excessive end play or imbalance

- CHECK the coolant pump for excessive end play. INSPECT the coolant pump for imbalance with the drive belt off. INSTALL a new coolant pump as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Whine or moaning noise

- Air intake system

- CHECK the air cleaner and ducts for correct fit. INSPECT the air intake system for leaks or damage. REPAIR as necessary.Refer to the appropriate section in Group 303 for the procedure.

- Whistling noise - normally accompanied with poor idle condition

- Air intake system

- CHECK the air intake ducts, Air Cleaner (ACL), Throttle Body (TB) and vacuum hoses for leaks and correct fit. REPAIR or ADJUST as necessary.Refer to the appropriate section in Group 303 for the procedure.

- Hissing noise - occurs during idle or high idle that is apparent with the hood open

- Vacuum leak noise

- USE the EngineEAR to locate the source. SCAN the air intake system from the inlet to each cylinder intake port. DISCARD the leaking parts, and INSTALL a new component.

- Vehicles with a plastic intake manifold

- Acceptable condition. Some plastic manifolds exhibit this noise, which is the effect of the plastic manifold.

- Grinding noise - occurs during engine cranking

- Incorrect starter motor mounting

- INSPECT the starter motor for correct mounting. REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Starter motor

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- CHECK the starter motor. INSTALL a new starter motor as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Incorrect starter motor drive engagement

- INSPECT the starter motor drive for wear or damage. INSTALL a new starter motor as necessary. Refer to the appropriate section in Group 303 for the procedure.
- INSPECT the flywheel/flexplate for wear or damage. INSTALL a new flywheel/flexplate as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Engine noise, front of engine - knocking noise from lower front of engine

- Damaged or separated crankshaft pulley/damper

- CHECK for obvious signs of damage or wobble during operation. INSTALL new as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Engine noise, front of engine - ticking, tapping or rattling noise from the front of the engine

- Timing drive components

- REMOVE the accessory drive belt. Refer to the appropriate section in Group 303 for the procedure.
- USE the EngineEAR to isolate the noise to the engine front cover.
- REMOVE the engine front cover and INSPECT the timing drive components. INSTALL new parts as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Engine noise, upper end - ticking noise near the fuel rail and intake manifold

- Fuel rail clip

- CHECK for loose or damaged fuel rail clip(s). REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Fuel injector

- USE the EngineEAR to isolate the noisy injector(s). INSTALL new injector(s) as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Engine noise, upper end - ticking, knocking or rattle noise that occurs during idle or high idle during the first cold start of the day and may disappear as the engine warms

- Valve train noise (bled down lifter/lash adjuster)

- CARRY OUT the Valve Train Analysis Component Test in this section. INSTALL new parts as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Engine noise, upper end - occurs mostly with a warm engine at light/medium acceleration

- Worn or damaged spark plugs

- REMOVE the spark plugs. INSPECT and INSTALL new as necessary. Refer to the appropriate section in Group 303 for the procedure.

- Carbon accumulation in combustion chamber

- INSPECT the cylinder using a Bore scope. ELIMINATE carbon buildup.
- Engine noise, upper end - rattling noise from the valve train. Worse when the engine is cold
- Low oil level
- CHECK the oil level. FILL as necessary.
- Worn valve train components
- CARRY OUT the Valve Train Analysis Component Test in this section. INSTALL new parts as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Worn valve guides
- CARRY OUT the Valve Guide Inner Diameter procedure in this section.
- Excessive runout of the valve seats on the valve face
- CARRY OUT the Valve Seat Inspection procedure in this section.
- Engine noise, upper end - pinging noise
- Gasoline octane too low
- VERIFY with customer the type of gasoline used. CORRECT as necessary.
- Knock Sensor (KS) operation
- CHECK the KS . INSTALL a new KS as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Incorrect spark timing
- REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- High operating temperature
- INSPECT the cooling system for leaks. CHECK the coolant level. REFILL as necessary. CHECK the coolant for the correct mix ratio. DRAIN and REFILL as needed. VERIFY the engine operating temperature is within specifications. REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Spark plug
- CHECK the spark plugs. REPAIR or INSTALL new spark plugs as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Catalytic converter
- Acceptable noise.
- Engine noise, upper end - knocking or ticking noise, occurs mostly with a warm engine at idle

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- Low oil level
- CHECK the oil level. FILL as necessary.
- Thin or diluted oil
- INSPECT the oil for contamination. If the oil is contaminated, CHECK for the source. REPAIR as necessary. CHANGE the oil and filter.
- Damaged or incorrect oil filter
- INSPECT the oil filter. INSTALL a new oil filter as necessary.
- Low oil pressure
- CARRY OUT the oil pressure test.
- Camshaft phaser and sprocket(s) [VCT engines only]
- GO to Pinpoint Test A .
- Engine noise, lower end - ticking or knocking noise near the oil filter adapter
- Oil pump
- USE the EngineEAR to verify the oil pump as the source of the noise at low rpm. REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Engine noise, lower end - light knocking noise, also described as piston slap. Noise is most noticeable when the engine is cold with light to medium acceleration. The noise disappears as the engine warms
- Excessive clearance between the piston and the cylinder wall
- CARRY OUT the Piston To Cylinder Bore Clearance procedure in this section.
- Engine noise, lower end - light double knock or sharp rap sound. Occurs mostly with a warm engine at idle or low speeds in drive. Increases in relation to engine load. Associated with a poor lubrication history
- Excessive clearance between the piston and the piston pin
- CARRY OUT the Piston Pin Bore Diameter procedure and the Piston Pin Diameter procedure in this section.
- Engine noise, lower end - light knocking noise. The noise is most noticeable when the engine is warm. The noise tends to decrease when the vehicle is coasting or in NEUTRAL
- Excessive clearance between the connecting rod bearings and the crankshaft
- CARRY OUT the Connecting Rod Bearing Journal-to-Bearing Clearance procedure in this section.
- Engine noise, lower end - deep knocking noise. The noise is most noticeable when the engine is warm, at lower rpm and under a light load and then at float

- Worn or damaged crankshaft main bearings
- CARRY OUT the Crankshaft Main Bearing Journal-to-Bearing Clearance procedure in this section.
- Engine noise, rear of engine - knocking noise at rear of engine
- Damaged flywheel/flexplate
- CARRY OUT the Flexplate Inspection procedure in this section.
- Engine vibration - vibration felt at all times
- Excessive crankshaft pulley runout
- CARRY OUT the Engine Accessory Test. INSTALL a new crankshaft pulley as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Damaged or worn accessory component
- CARRY OUT the Engine Accessory Test. REPAIR or INSTALL a new component as necessary.
- Engine vibration - at idle, a low-frequency vibration (5-20 Hz) or mild shake that is felt through the seat/floorpan
- Cylinder misfire
- CARRY OUT the cylinder power balance and the relative compression test using the scan tool. REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Engine or torque converter out of balance
- VERIFY the torque converter to crankshaft pilot clearance is correct. REPAIR as necessary. RE-INDEX the torque converter on the flexplate by 120 degrees for a 3-bolt converter or 180 degrees for a 4-bolt converter. Refer to the appropriate section in Group 307 for the procedure.
- Engine vibration - is felt with increases and decreases in engine rpm
- Powertrain mount(s)
- CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the appropriate section in Group 303 for the procedure. For automatic transmission, Refer to the appropriate section in Group 307 for the procedure.
- Engine or transmission contacting the chassis
- INSPECT the powertrain/drivetrain for correct clearances. REPAIR as necessary.
- Engine vibration - increases intensity as the engine rpm is increased
- Engine out-of-balance
- CARRY OUT the Neutral Engine Run-Up (NERU) Test. REFER to Section 100-04 . ROTATE the torque converter, 120 degrees for 3-bolt or 180 degrees for 4-bolt. INSPECT the torque converter pilot outer diameter to crankshaft pilot inner diameter. REPAIR as necessary. Refer to the appropriate

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section in Group 307 for the procedure.

- Engine vibration - mostly at coast/neutral coast. Condition improves with vehicle acceleration
- Combustion instability
- CHECK the ignition system. INSTALL new components as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Engine vibration or shudder - occurs with light to medium acceleration above 56 km/h (35 mph)
- Worn or damaged spark plugs
- INSPECT the spark plugs for cracks, high resistance or broken insulators. INSTALL a new spark plug(s) as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Plugged fuel injector
- INSTALL a new fuel injector as necessary. Refer to the appropriate section in Group 303 for the procedure.
- Contaminated fuel
- INSPECT the fuel for contamination. DRAIN the fuel system and refill.

Pinpoint Tests

Pinpoint Test A: Engine Noise, Upper End - Camshaft Phaser and Sprocket(s) [Variable Camshaft Timing (VCT) Engines Only]

This pinpoint test is intended to diagnose the following:
- Camshaft phaser and sprocket noise

PINPOINT TEST A: ENGINE NOISE, UPPER END - CAMSHAFT PHASER AND SPROCKET(S) [VCT ENGINES ONLY]

Test Step	Result / Action to Take
A1 VERIFY THE CAMSHAFT PHASER AND SPROCKET(S) NOISE	
• Ignition OFF. • Disconnecting the RH and LH Variable Camshaft Timing (VCT) solenoid electrical connectors. • Start the vehicle and elevate the engine rpm and then return to idle. • **Is the camshaft phaser and sprocket noise still audible?**	**Yes** The concern is not VCT related. GO to Symptom Chart - Engine NVH . **No** GO to A2 .

A2 CHECK THE ENGINE MINIMUM OIL PRESSURE	
• Check the engine oil pressure. Carry out the oil pressure test. • **Is the oil pressure reading within the minimum specification?**	**Yes** GO to A3 . **No** GO to Pinpoint Test B .
A3 CHECK THE VCT HOUSING OIL SCREEN FOR DEBRIS	
• Remove the VCT housing oil screen and inspect for debris. • **Is the VCT oil screen clean and free of debris?**	**Yes** INSPECT the VCT camshaft phaser and sprockets and REPAIR as necessary. REFER to Camshaft Phaser and Sprocket Inspection in this section. **No** REMOVE the VCT housing, Refer to the appropriate section in Group 303 for the procedure. CLEAN and INSPECT the VCT housing. REFER to Variable Camshaft Timing (VCT) Housing Cleaning and Inspection in the section.

Pinpoint Test B: Low Oil Pressure

Normal Operation

Oil is drawn into the oil pump through the oil pump screen and pickup tube in the sump of the oil pan. Oil is pumped through the oil filter on the left front side of the cylinder block then enters the main gallery where it is distributed to the crankshaft main journals and to both cylinder heads. From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly. The left cylinder head is fed from a drilling into the supply passage feeding the main gallery at the front of the cylinder block. The right cylinder head is fed from a drilling into the rear of the main gallery. Main gallery pressure is reduced as it enters the cylinder head galleries through fixed serviceable orifices, located at the upper part of the feed passages. It is this reduced pressure in the cylinder head galleries which feed the camshaft journals, the hydraulic lash adjusters and the primary and secondary timing chain tensioners. On Variable Camshaft Timing (VCT) equipped engines, the oil pressure feed for the VCT solenoids, VCT housings and camshaft phaser and sprockets is not reduced. The camshaft lobe and roller followers are lubricated by splash created through valve train operation.

This pinpoint test is intended to diagnose the following:

- Excessive crankshaft end play
- Excessive main bearing clearance
- Excessive connecting rod bearing clearance
- Excessive camshaft bearing cap clearance
- Loose camshaft phaser and sprocket bolt(s) [VCT engines only]
- Loose oil galley plugs
- Loose timing chain tensioner bolts
- Loose VCT housing bolts [VCT engines only]
- Oil pump screen and pickup tube
- Restricted oil flow passages
- Worn or damaged oil pump

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PINPOINT TEST B: LOW OIL PRESSURE

Test Step	Result / Action to Take
B1 CHECK THE CRANKSHAFT END PLAY	
• Check the crankshaft end play. Refer to Crankshaft End Play in this section. • **Is the crankshaft end play within specification?**	**Yes** GO to B2 . **No** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.
B2 VERIFY THE CAMSHAFT BEARING CAPS ARE NOT DAMAGED AND TIGHT	
• Check that the camshaft bearing caps are not damaged and the bolts are properly tightened. Refer to the Specification chart in the appropriate engine section. • **Are the camshaft bearing caps loose or damaged?**	**Yes** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** If the engine is equipped with VCT , GO to B3 ; for all other engines, GO to B5 .
B3 VERIFY THE CAMSHAFT PHASER AND SPROCKET BOLT(S) ARE TIGHT	
• Check that the camshaft phaser and sprocket bolt(s) are tight. Refer to the Specification chart in the appropriate engine section. • **Are the camshaft phaser and sprocket bolt(s) loose?**	**Yes** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** GO to B4 .
B4 VERIFY THE VCT HOUSING BOLT(S) ARE TIGHT [VCT ENGINES ONLY]	
• Check that the VCT housing bolts are tight. Refer to the Specification chart in the appropriate engine section. • **Are the VCT housing bolts loose?**	**Yes** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** GO to B5 .
B5 CHECK CAMSHAFT JOURNAL-TO-BEARING CLEARANCE	
• Check the camshaft journal-to-bearing clearance. Refer to the Specification chart in the appropriate engine section. • **Is camshaft journal-to-bearing clearance within specification?**	**Yes** GO to B6 . **No** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.
B6 CHECK FOR RESTRICTED OIL FLOW	
	Yes

• Verify the oil supply and return passages are not plugged and clean of debris. Refer to the oil flow chart in the appropriate engine section. • **Is oil flow restricted?**	REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** GO to B7 .
B7 CHECK THE TIMING CHAIN TENSIONERS FOR DAMAGE AND VERIFY THE BOLTS ARE TIGHT	
• Check that the timing chain tensioners are not damaged or the bolts are loose. Refer to the Specification chart in the appropriate engine section. • **Are the timing chain tensioners damaged or bolts loose?**	**Yes** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** GO to B8 .
B8 CHECK THE OIL PUMP PICKUP TUBE AND SCREEN FOR DAMAGE	
• Check that the oil pump pickup tube and screen is not plugged, cracked or that the bolts are loose. Refer to the Specification chart in the appropriate engine section. • **Is the oil pump screen and pickup tube damaged or loose?**	**Yes** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** GO to B9 .
B9 CHECK THE OIL PUMP FOR DAMAGE	
• Verify the oil pump is not damaged. • **Is oil pump damaged?**	**Yes** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure. **No** GO to B10 .
B10 CHECK CRANKSHAFT MAIN BEARING JOURNAL-TO-BEARING CLEARANCE	
• Check the crankshaft main bearing journal-to-bearing clearance. Refer to the Specification chart in the appropriate engine section. • **Is crankshaft main bearing journal-to-bearing clearance within specification?**	**Yes** GO to B11 . **No** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.
B11 CHECK CONNECTING ROD BEARING JOURNAL-TO-BEARING CLEARANCE	
• Check the connecting rod bearing journal-to-bearing clearance. Refer to the Specification chart in the appropriate engine section. • **Is connecting rod bearing journal-to-bearing clearance within specification?**	**Yes** The concern may have been caused by debris or an incorrect assembly. REPEAT the oil pressure test. **No** REPAIR as necessary. Refer to the appropriate section in Group 303 for the procedure.

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Component Tests

The following component tests are used to diagnose engine concerns.

Engine Oil Leaks

NOTICE: **If an overnight drive is done, the fan air or road air blast may cause erroneous readings.**

NOTE: When diagnosing engine oil leaks, the source and location of the leak must be positively identified prior to repair.

Prior to carrying out this procedure, clean the cylinder block, cylinder heads, valve covers, oil pan and flywheel with a suitable solvent to remove all traces of oil.

Engine Oil Leaks - Fluorescent Oil Additive Method

Use the 12 Volt Master UV Diagnostic Inspection Kit to carry out the following procedure for oil leak diagnosis.

1. Add 29.6 ml (1 oz) of gasoline engine oil dye to a minimum of 0.47L (1/2 qt) and a maximum of 0.95L (1 qt) engine oil and fill through the engine oil fill. If the oil is not premixed, the gasoline engine oil dye will not have enough time to reach the crankcase, oil galleries and seal surfaces during this particular 15 minute test. The gasoline engine oil dye must be mixed with oil and added through the oil fill. Check the level on the oil level indicator to determine what amount of oil to premix. If it is in the middle of the crosshatch area or below the full mark, use 0.95L (1 qt). If it is at the full mark, use 0.47L (1/2 qt).

2. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the UV Diagnostic Inspection Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be required for the leak to appear.

3. At the end of test, make sure the oil level is within the upper and lower oil indicator marks. Remove oil as necessary if it registers above the full mark.

Leakage Points - Underhood

Examine the following areas for oil leakage:

- Valve cover gaskets
- Cylinder head gaskets
- Oil cooler, if equipped
- Oil filter adapter
- Engine front cover
- Oil filter adapter and filter body
- Oil level indicator tube connection
- Engine Oil Pressure (EOP) sensor

Leakage Points - Under Engine, With Vehicle on Hoist

Examine the following areas for oil leakage:

- Oil pan gaskets

- Oil pan sealer
- Engine front cover gasket
- Crankshaft front seal
- Crankshaft rear oil seal
- Oil filter adapter and filter body
- Oil cooler, if equipped

Leakage Points - With Transmission and Flywheel Removed

Examine the following areas for oil leakage:

- Crankshaft rear seal
- Crankshaft rear seal retainer
- Rear main bearing cap parting line
- Flexplate mounting bolt holes (with flexplate installed)
- Pipe plugs at the end of oil passages

Oil leaks at crimped seams in sheet metal parts and cracks in cast or stamped parts can be detected when using the Gasoline Engine Oil Dye method.

Compression Test - Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the wide-open position.

3. Install a compression gauge in the No. 1 cylinder.

4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

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Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure	Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure	Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure	Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (145 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (105 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (189 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (135 psi)	745 kPa (108 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (236 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (174 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (237 psi)	1,145 kPa (166 psi)	—	—

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If one or more cylinders reads low, squirt approximately one tablespoon of engine oil on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are faulty.

2. If compression does not improve, valves are sticking or seating incorrectly.

3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.
   Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of a cylinder leakage tester will be helpful in pinpointing the exact cause.

The leakage tester is inserted in the spark plug hole, the piston is brought up to dead center on the compression stroke and compressed air is admitted.

Once the combustion chamber is pressurized, the leakage tester gauge will read the percentage of leakage. Leakage exceeding 20% is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve will be heard in the Throttle Body (TB). A leak at the exhaust valve can be heard at the tail pipe. Leakage past the piston rings will be audible at the PCV connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the spark plug hole of the cylinder into which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator.

Excessive Engine Oil Consumption

Nearly all engines consume oil, which is essential for normal lubrication of the cylinder bore walls and pistons and rings. Determining the level of oil consumption may require testing by recording how much oil is being added over a given set of miles.

Customer driving habits greatly influence oil consumption. Mileage accumulated during towing or heavy loading generates extra heat. Frequent short trips, stop-and-go type traffic or extensive idling, prevent the engine from reaching normal operating temperature. This prevents component clearances from reaching specified operating ranges.

The following diagnostic procedure may be utilized to determine internal oil consumption. Make sure that the concern is related to internal oil consumption, and not external leakage, which also consumes oil. Verify there are no leaks before carrying out the test. Once verified, the rate of internal oil consumption can be tested.

A new engine may require extra oil in the early stages of operation. Internal piston-to-bore clearances and sealing characteristics improve as the engine breaks in. Engines are designed for close tolerances and do not require break-in oils or additives. Use the oil specified in the Owner's Literature. Ambient temperatures may determine the oil viscosity specification. Verify that the correct oil is being used for the vehicle in the geographic region in which it is driven.

Basic Pre-checks

1. For persistent complaints of oil consumption, interview the customer to determine the oil consumption characteristics. If possible, determine the brand and grade of oil currently in the oil pan. Look at the oil filter or oil-change station tags to determine if Ford-recommended maintenance schedules have been followed. Make sure that the oil has been changed at the specified mileage intervals. If vehicle mileage is past the first recommended drain interval, the OEM production filter should have been changed.

2. Ask how the most current mileage was accumulated. That is, determine whether the vehicle was driven under the following conditions:
    - Extended idling or curbside engine operation
    - Stop-and-go traffic or taxi operation
    - Towing a trailer or vehicle loaded heavily
    - Frequent short trips (engine not up to normal operating temperature)
    - Excessive throttling or high engine-rpm driving

3. Verify that there are no external leaks. If necessary, review the diagnostic procedure under Engine Oil Leaks in the Diagnosis and Testing portion of this section.

4. Inspect the crankcase ventilation system for:
    - disconnected hoses at the valve cover or TB .
    - loose or missing valve cover fill cap.
    - missing or incorrectly seated engine oil level indicator.
    - incorrect or dirty PCV valve.
    - a PCV valve grommet unseated in the valve cover (if so equipped).

5. Inspect for signs of sludge. Sludge affects PCV performance and can plug or restrict cylinder head drainback wells. It can also increase oil pressure by restricting passages and reducing the drainback capability of piston oil control rings.

6. Inspect the air filter for dirt, sludge or damage. A hole in the filter element will allow unfiltered air to

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bypass into the air induction system. This can cause premature internal wear (engine dusting), allowing oil to escape past rings, pistons, valves and guides.

7. If the engine is hot or was recently shut down, wait at least 5 minutes to allow the oil to drain back. Ask the customer if this requirement has been followed. Adding oil without this wait period can cause an overfill condition, leading to excessive oil consumption and foaming which may cause engine damage.

8. Make sure the oil level indicator (dipstick) is correctly and fully seated in the indicator tube. Remove the oil level indicator and record the oil level.

Detailed Pre-checks

1. Check the thermostat opening temperature to make sure that the cooling system is operating at the specified temperature. If it is low, internal engine parts are not running at specified internal operating clearances.

2. Verify the spark plugs are not oil saturated. Oil leaking into one or more cylinders will appear as an oil soaked condition on the plug. If a plug is saturated, a compression check may be necessary at the conclusion of the oil consumption test.

Oil Consumption Test

Once all of the previous conditions are met, carry out an oil consumption test.

1. Drain the engine oil and remove the oil filter. Install a new manufacturer-specified oil filter. Make sure the vehicle is positioned on a level surface. Refill the oil pan to a level **one liter (quart) less** than the specified fill level, using manufacturer-specified oil.

2. Run the engine for 3 minutes (if hot) or 10 minutes (if cold). Allow for a minimum 5-minute drainback period and then record the oil level shown on the oil level indicator. Place a mark on the backside of the oil level indicator noting the oil level location.

3. Add the final 0.95L (1 qt) to complete the normal oil fill. Restart the engine and allow it to idle for 2 minutes. Shut the engine down.

4. After a 5-minute drainback period, record the location of the oil level again. Mark the oil level indicator with the new oil level location. (Note: Both marks should be very close to the MIN-MAX upper and lower limits or the upper and lower holes on the oil level indicator. These marks will exactly measure the engine's use of oil, with a one quart differential between the new marks.) Demonstrate to the customer that the factory-calibrated marks on the oil level indicator are where the oil should fall after an oil change with the specified fill amount. Explain however, that this may vary slightly between MIN-MAX or the upper and lower holes on the oil level indicator.

5. Record the vehicle mileage.

6. Advise the customer that oil level indicator readings must be taken every 320 km (200 mi) or weekly, using the revised marks as drawn. Remind the customer that the engine needs a minimum 5-minute drainback for an accurate reading and that the oil level indicator must be firmly seated in the tube prior to taking the reading.

7. When the subsequent indicator readings demonstrate a full quart (liter) has been used, record the vehicle mileage. The mileage driven between the 2 readings should not be less than 2,414 km (1,500 mi). The drive cycle the vehicle has been operated under must be considered when making this

calculation. It may be necessary to have the customer bring the vehicle in for a periodic oil level indicator reading to closely monitor oil usage.

Post Checks, Evaluation and Corrective Action

1. If test results indicate excessive oil consumption, carry out a cylinder compression test. The cylinder compression test should be carried out with a fully charged battery and all spark plugs removed. See the Compression Test Chart in this section for pressure range limits.

2. Compression should be consistent across all cylinders. Refer to the Compression Testing portion of this section. If compression tested within the specifications found in this section, the excessive oil consumption may be due to wear on the valve guides, valves or valve seals.

3. A cylinder leak detection test can be carried out using a cylinder leakage tester. This can help identify valves, piston rings, or worn valve guides/valve stems, inoperative valve stem seals or other related areas as the source of oil consumption.

NOTE: An oil-soaked appearance on the porcelain tips of the spark plugs also indicates excessive oil use. A typical engine with normal oil consumption will exhibit a light tan to brown appearance. See Spark Plug Analysis in this section for details. A single or adjoining, multiple cylinder leak can be traced by viewing the tips.

4. If an internal engine part is isolated as the root cause, determine if the repair will exceed cost limits and proceed with a repair strategy as required.

5. Once corrective action to engine is complete and verifying that all pre-check items were eliminated in the original diagnosis, repeat the Oil Consumption Test as described above and verify consumption results.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is performed. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 ft) of elevation above sea level.

The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

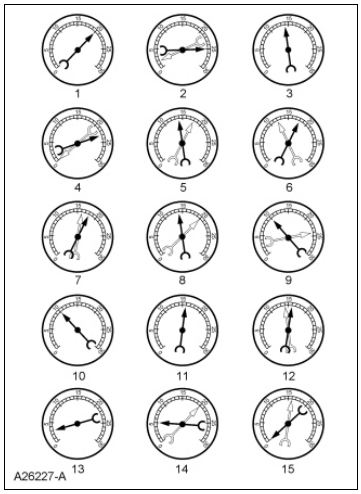
Intake Manifold Vacuum Test - Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.

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1. NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.

2. NORMAL READING DURING RAPID ACCELERATION AND DECELERATION: When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.

3. NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg), but will be relatively steady. Some oscillation is normal.

4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).

5. STICKING VALVES: When the needle (dotted) remains steady at a normal vacuum, but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.

6. BURNED OR WARPED VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient hydraulic lash adjuster or hydraulic lash adjuster clearance will also cause this reaction.

7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating.

8. WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.

9. WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine rpm is increased, weak valve springs are indicated. The reading at idle could be relatively steady.

10. LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.

11. IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady, but somewhat low, reading.

12. INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.

13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.

14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.

15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine rpm is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster, the unit will not function correctly. Always fix vacuum leaks.

Oil Pressure Test

NOTICE: **Inspect the engine for installation of an aftermarket oil filter. Review oil and filter maintenance history to make sure that the vehicle has not gone beyond the standard Ford recommended oil change intervals. Check the engine oil level and check the oil for contamination. If the oil is contaminated, engine damage can occur. The source of the contamination must be identified and repaired as necessary.**

1. Disconnect and remove the Engine Oil Pressure (EOP) switch from the engine. Refer to the appropriate section in Group 303 for the procedure.

2. Connect the Oil Pressure Gauge to the oil pressure port.

3. Run the engine until normal operating temperature is reached.

4. With the engine at idle record the gauge reading.

5. Run the engine at 2,000 rpm and record the gauge reading.

6. The oil pressure should be within specifications; refer to the specifications in the appropriate engine section.

7. If the pressure is not within specification, GO to Pinpoint Test B .

Valve Train Analysis

The following component tests are used to diagnose valve train concerns.

Valve Train Analysis - Engine Off - Valve Cover Removed

Check for damaged or severely worn parts and correct assembly. Make sure correct parts are used with the static engine analysis as follows.

Valve Train Analysis - Engine Off, Camshaft Roller Followers and Hydraulic Lash Adjusters, Overhead Camshaft

- Check for loose mounting bolts on camshaft carriers.
- Check for plugged oil feed in the camshaft roller followers, lash adjusters or cylinder heads.

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Valve Train Analysis - Engine Off, Camshaft - Engines

- Check for broken or damaged parts.

Valve Train Analysis - Valve Springs

- Check for broken or damaged parts.

Valve Train Analysis - Engine Off, Valve Spring Retainer and Valve Spring Retainer Keys

- Check for correct seating of the valve spring retainer key on the valve stem and in valve spring retainer.
- Check for correct seating on the valve stem.

Valve Train Analysis - Engine Off, Valves and Cylinder Head

- Check for plugged oil drain back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged guide-mounted valve stem seal.
- Check for damaged hydraulic lash adjuster.
- Check installed valve spring height.
- Check for missing or worn valve spring seats.
- Check for plugged oil metering orifice in cylinder head oil reservoir (if equipped).

Static checks (engine off) are to be made on the engine prior to the dynamic procedure.

Valve Train Analysis - Engine Running, Valves and Cylinder Head

- Check for plugged oil drain back holes.
- Check for missing or damaged valve stem seals or guide mounted valve stem seals.
- Check for a plugged oil metering orifice in the cylinder head oil reservoir.

If insufficient oiling is suspected, check oil passages for blockage, then accelerate the engine to 1,200 rpm with the transmission in NEUTRAL and the engine at normal operating temperature. Oil should spurt from the rocker arm oil holes such that valve tips and camshaft roller followers are well oiled. With the valve covers off, some oil splash may overshoot camshaft roller followers.

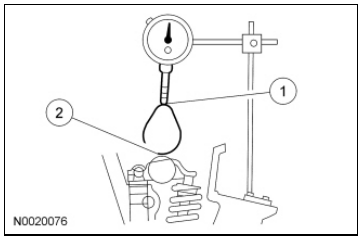
Valve Train Analysis - Camshaft Lobe Lift

Check the lift of each camshaft lobe in consecutive order and make a note of the readings.

1. Remove the spark plugs.

2. Install the Dial Indicator Gauge with Holding Fixture so the rounded tip of indicator is on top of the camshaft lobe.

3. Rotate the crankshaft using a breaker bar and socket attached to the crankshaft pulley retainer bolt. Rotate the crankshaft until the base circle of the camshaft lobe is reached.



4. Zero the Dial Indicator Gauge. Continue to rotate the crankshaft until the (1) high-lift point of the camshaft lobe is in the fully-raised position (highest indicator reading).

5. To check the accuracy of the original indicator reading, continue to rotate crankshaft until the (2) base circle is reached. The indicator reading should be zero. If zero reading is not obtained, repeat the measurement.

6. If the lift on any lobe is below specified service limits, install a new camshaft and camshaft roller followers.

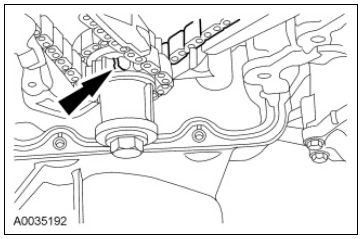
7. Install the spark plugs.

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Sprockets

1. Inspect the sprockets for cracks and worn or chipped teeth.

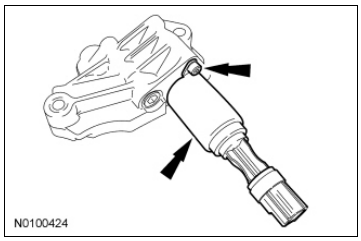


Variable Camshaft Timing (VCT) Housing Cleaning and Inspection

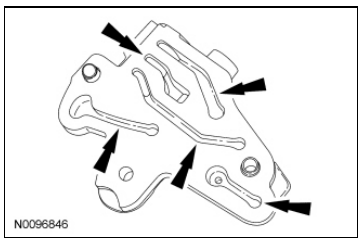
Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-

1. Remove the screw and the Variable Camshaft Timing (VCT) oil control solenoid.
   - To install, tighten to 5 Nm (44 lb-in).



2. Clean the mating surfaces and oil passages with metal surface prep. Follow the directions on the packaging.

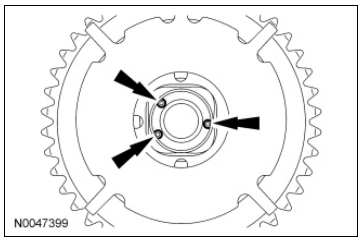


3. Inspect the VCT housing for pitting, cracks or damaged sealing surfaces. Install a new VCT housing if damaged.

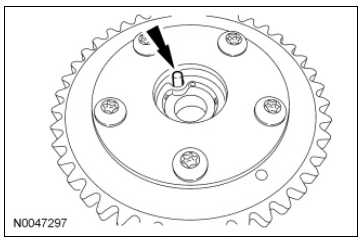
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Camshaft Phaser and Sprocket Inspection

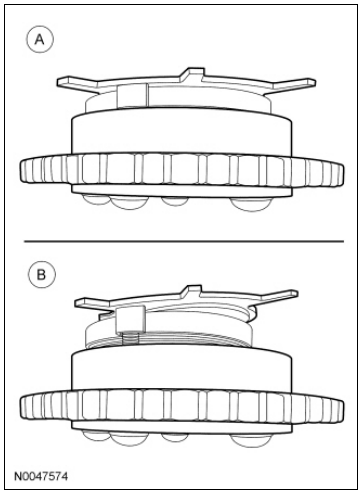
1. Inspect the front of the camshaft phaser and sprocket for missing or damaged roll pins.
   - If the roll pins are missing or damaged, a new camshaft phaser and sprocket must be installed.



2. Inspect the rear of the camshaft phaser and sprocket for a deformed or damaged location pin.
   - If the location pin is deformed or damaged, a new camshaft phaser and sprocket must be installed.



3. Visually inspect the camshaft phaser and sprocket for squareness (A). If the trigger wheel or spring is deformed or damaged (B), install a new camshaft phaser and sprocket.

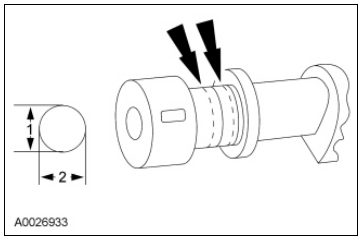


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Camshaft Bearing Journal Diameter

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure each camshaft journal diameter in 2 directions.



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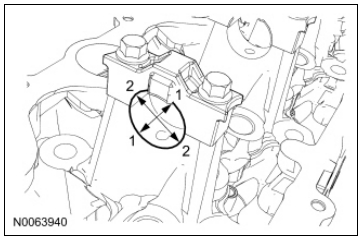
Camshaft Journal to Bearing Clearance - OHC Engines

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** The camshaft journals must meet specifications before checking camshaft journal clearance.

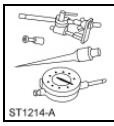
   Measure each camshaft bearing in 2 directions.

   - Subtract the camshaft journal diameter from the camshaft bearing diameter.



Camshaft End Play - OHC Engines

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

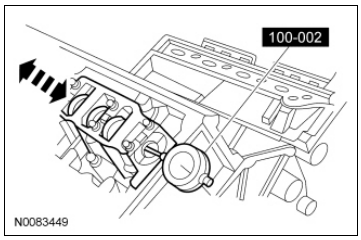
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft end play.

2. Position the camshaft to the rear of the cylinder head.

3. Zero the Dial Indicator Gauge.

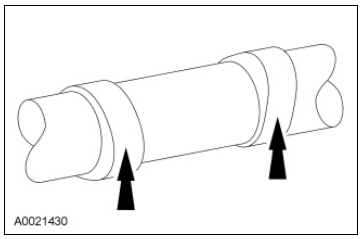
4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play.
   - If camshaft end play exceeds specifications, install a new camshaft and recheck end play.
   - If camshaft end play exceeds specification after camshaft installation, install a new cylinder head.



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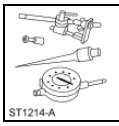
Camshaft Surface Inspection

1. Inspect camshaft lobes for pitting or damage in the contact area. Minor pitting is acceptable outside the contact area.



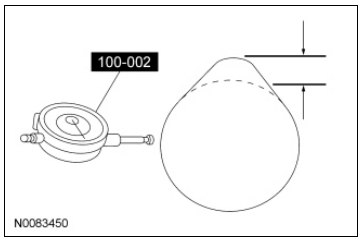
Camshaft Lobe Lift

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

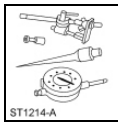
1. Use the Dial Indicator Gauge with Holding Fixture to measure camshaft intake/exhaust lobe lift.
   - Rotate the camshaft and subtract the lowest Dial Indicator Gauge reading from the highest Dial Indicator Gauge reading to figure the camshaft lobe lift.



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Camshaft Runout

Special Tool(s)

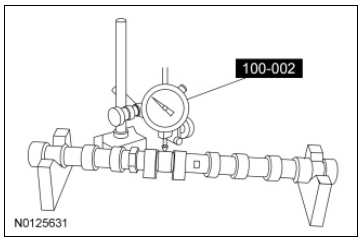
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** Camshaft journals must be within specifications before checking runout.

   Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft runout.

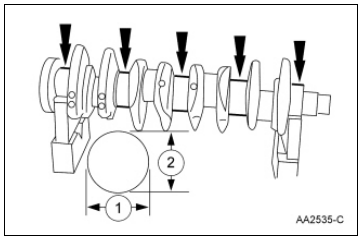
   - Camshaft must be supported on the first and last camshaft bearing journal.
   - Rotate the camshaft and subtract the lowest Dial Indicator Gauge reading from the highest Dial Indicator Gauge reading.



Crankshaft Main Bearing Journal Diameter

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure each of the crankshaft main bearing journal diameters in at least 2 directions.

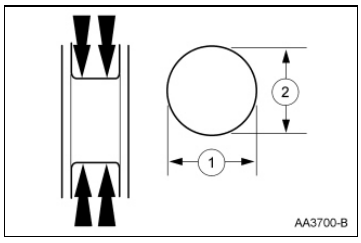


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Crankshaft Main Bearing Journal Taper and Out-of-Round

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure each of the crankshaft main bearing journal diameters in at least 2 directions at each end of the main bearing journal.

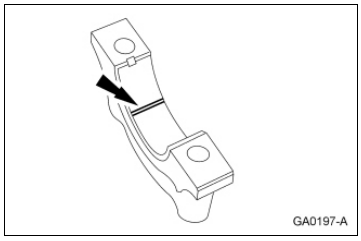


Crankshaft Main Bearing Journal-to-Bearing Clearance

NOTE: Refer to the appropriate Section 303-01 for the specification.

NOTE: Crankshaft main bearing journals must be within specifications before checking journal clearance.

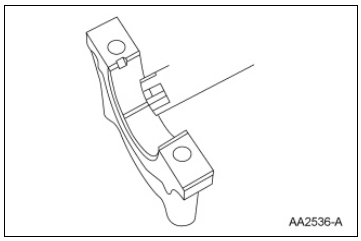
1. Remove the crankshaft main bearing caps and crankshaft main bearing.
2. Lay a piece of Plastigage across the face of each crankshaft main bearing surface.



3. **NOTE:** Do not turn the crankshaft while carrying out this procedure.

   Install and remove the crankshaft main bearing cap.

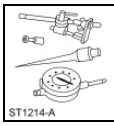
4. Verify the crankshaft journal clearance.



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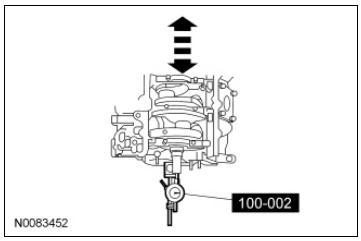
Crankshaft End Play

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

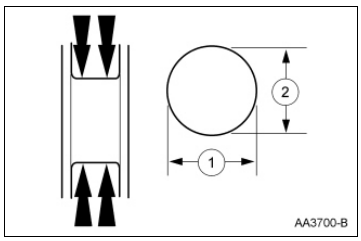
1. Install the Dial Indicator Gauge with Holding Fixture.
2. Position the crankshaft to the rear of the cylinder block.
3. Zero the Dial Indicator Gauge.
4. Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.



Connecting Rod Bearing Journal Taper and Out-of-Round

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure the crankshaft connecting rod journal diameters in 2 directions perpendicular to one another at each end of the connecting rod journal. The difference in the measurements from one end to the other is the taper. Verify measurement is within the wear limit.

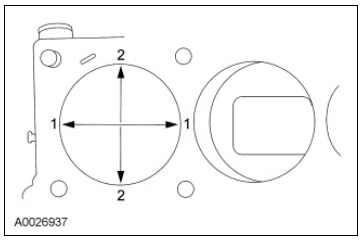


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Cylinder Bore Taper

NOTE: Refer to the appropriate Section 303-01 for the specification.

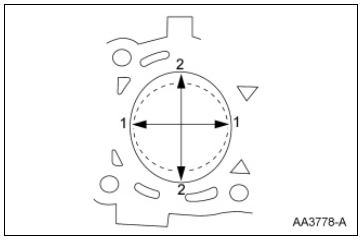
1. Measure the cylinder bore at the top, middle and bottom of piston ring travel in 2 directions as indicated. Verify the cylinder bore is within the wear limit. The difference indicates the cylinder bore taper. If the cylinder bore taper does not meet specification, bore the cylinder to the next oversize limit.



Cylinder Bore Out-of-Round

NOTE: Refer to the appropriate Section 303-01 for the specification.

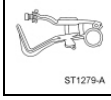
1. Measure the cylinder bore in 2 directions. The difference is the out-of-round.



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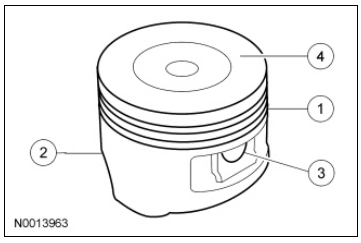
Piston Inspection

Special Tool(s)

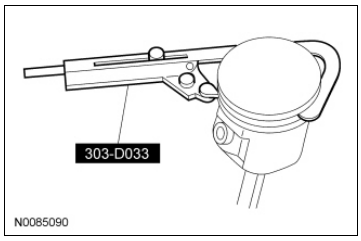
 ST1279-A	Scraper, Piston Ring Groove 303-D033 (D81L-6002-D) or equivalent

NOTICE: **Do not use a caustic cleaning solution or a wire brush to clean the pistons or damage can occur.**

1. Clean and inspect the (1) ring lands, (2) skirts, (3) pin bosses and the (4) tops of the pistons. If wear marks, scores or glazing is found on the piston skirt, check for a bent or twisted connecting rod.



2. Use the Piston Ring Groove Scraper to clean the piston ring grooves.
   - Make sure the oil ring holes are clean.



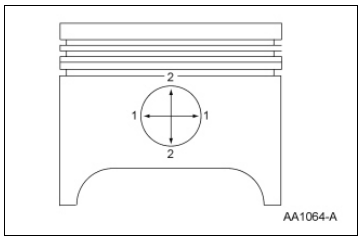
tomsn048@gmail.com

Piston Pin Bore Diameter

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** Piston and piston pins are a matched set and should not be interchanged.

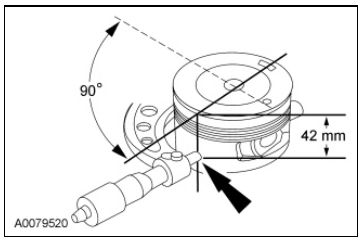
   Measure the piston pin bore diameter in 2 directions on each side. Verify the diameter is within specification.



Piston Diameter

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure the piston diameter 90 degrees from the piston pin and 42 mm (1.65 in) down from the top of the piston at the point indicated.



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Piston To Cylinder Bore Clearance

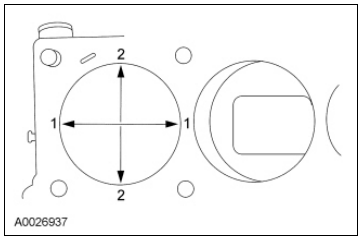
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Subtract the piston diameter from the cylinder bore diameter to find the piston-to-cylinder bore clearance.

Piston Selection

NOTE: The cylinder bore must be within the specifications for taper and out-of-round before fitting a piston.

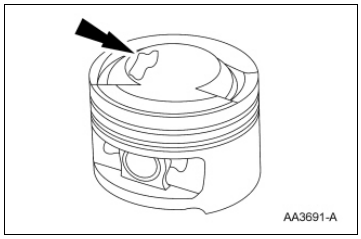
1. Select a piston size based on the cylinder bore.



2. **NOTE:** For precision fit, new pistons are divided into 3 categories within each size range based on their relative position within the range. A paint spot or specific size grade on a new piston indicates the position within the size range.

   Choose the piston with the correct paint color or specific size grade.

   - Refer to the appropriate section in Group 303 for the procedure.



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Piston Ring End Gap

Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

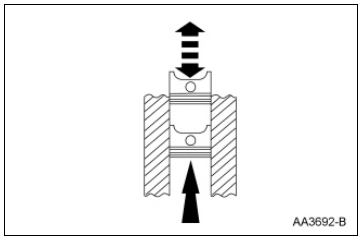
NOTICE: **Use care when fitting piston rings to avoid possible damage to the piston ring or the cylinder bore.**

NOTE: Piston rings should not be transferred from one piston to another.

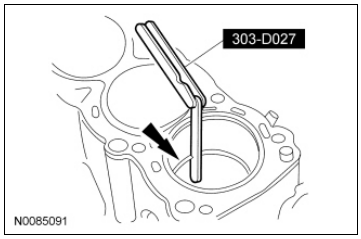
NOTE: Refer to the appropriate Section 303-01 for the specification.

NOTE: The cylinder bore must be within specification for taper and out-of-round.

1. Use a piston without rings to push a piston ring in a cylinder to the bottom of ring travel.



2. Use the Feeler Gauge Set to measure the top piston ring end gap and the second piston ring end gap.



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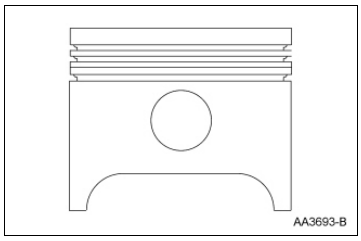
Piston Ring-to-Groove Clearance

Special Tool(s)

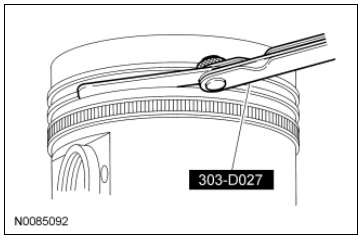
 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Inspect the piston for ring land damage or accelerated wear.



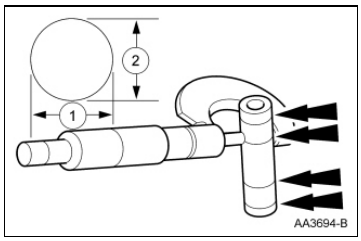
2. Using the Feeler Gauge Set, measure the piston ring-to-groove clearance.



Piston Pin Diameter

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure the piston pin diameter in 2 directions at the points shown. Verify the diameter is within specification.



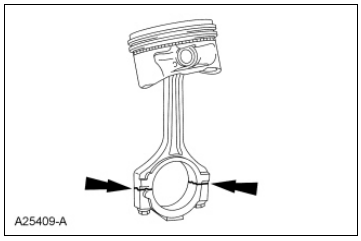
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Connecting Rod Cleaning

NOTICE: **Do not use a caustic cleaning solution or damage to connecting rods can occur.**

1. **NOTE:** The connecting rod large end is a matched set. The connecting rod cap must be installed on the original connecting rod in the original position. Do not reverse the cap. Parts are not interchangeable.

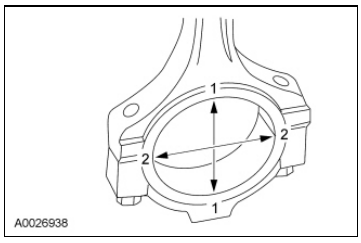
   Mark and separate the parts and clean with solvent. Clean the oil passages.



Connecting Rod Large End Bore

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Tighten the bolts to specification, then measure the bore in 2 directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.



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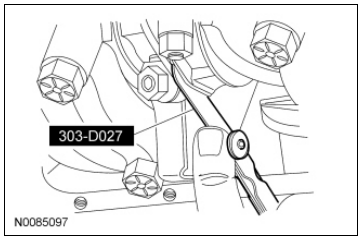
Connecting Rod to Crankshaft Side Clearance

Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

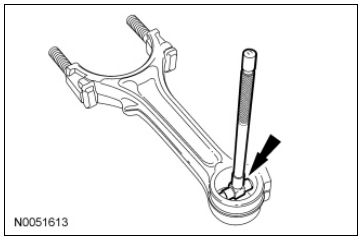
1. Using the Feeler Gauge Set, measure the clearance between the connecting rod and the crankshaft. Verify the measurement is within specification.



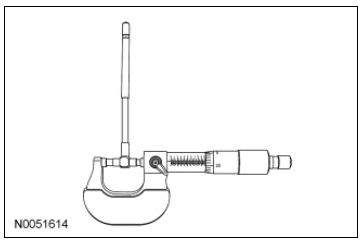
Connecting Rod Bushing Diameter

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Use a telescoping gauge to determine the ID of the connecting rod bushing, if equipped.



2. Measure the telescoping gauge with a micrometer. Verify the diameter is within specification.



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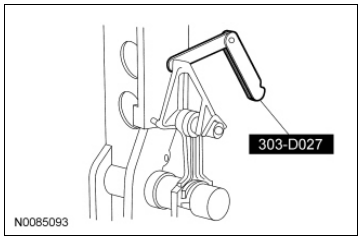
Connecting Rod Bend

Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Using the Feeler Gauge Set, measure the connecting rod bend on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the bend measurement is within specification.



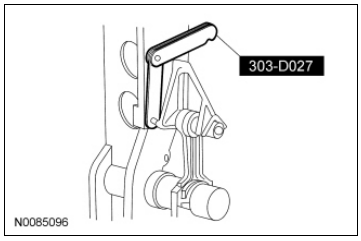
Connecting Rod Twist

Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Using the Feeler Gauge Set, measure the connecting rod twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the measurement is within specification.



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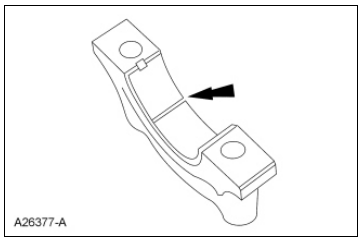
Connecting Rod Bearing Journal-to-Bearing Clearance

NOTE: Refer to the appropriate Section 303-01 for the specification.

NOTE: The crankshaft connecting rod journals must be within specifications to check the connecting rod bearing journal clearance.

1. Remove the connecting rod bearing cap.

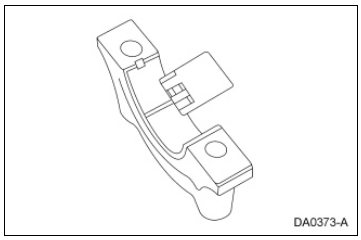
2. Position a piece of Plastigage across the bearing surface.



3. **NOTE:** Do not turn the crankshaft during this step.

   Install and tighten to specifications, then remove the connecting rod bearing cap.

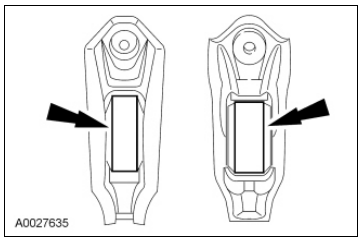
4. Measure the Plastigage to get the connecting rod bearing journal clearance. The Plastigage should be smooth and flat. A changing width indicates a tapered or damaged connecting rod or connecting rod bearing.



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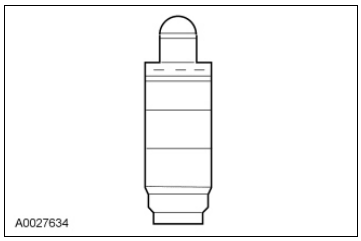
Roller Follower Inspection

1. Inspect the roller follower for flat spots or scoring. If any damage is found, inspect the camshaft lobes and hydraulic lash adjuster for damage.



Hydraulic Lash Adjuster Inspection

1. Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage.

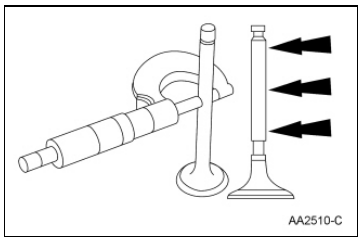


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Valve Stem Diameter

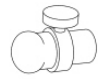
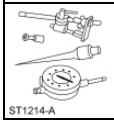
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure the diameter of each intake and exhaust valve stem at the points shown. Verify the diameter is within specification.



Valve Stem to Valve Guide Clearance

Special Tool(s)

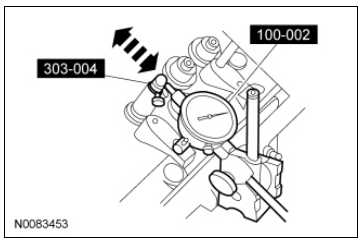
 ST1251-A	Clearance Gauge, Valve Guide 303-004 (TOOL-6505-E) or equivalent
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

NOTE: The valve stem diameter must be within specifications before checking valve stem-to-valve guide clearance.

1. **NOTE:** If necessary, use a magnetic base.

   Install a Valve Guide Clearance Gauge on the valve stem and install a Dial Indicator Gauge with Holding Fixture. Lower the valve until the clearance gauge contacts the upper surface of the valve guide.

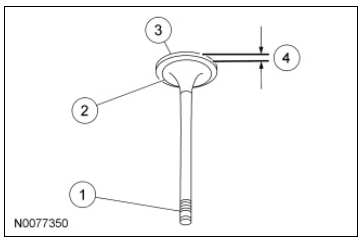


2. Move the Valve Guide Clearance Gauge toward the Dial Indicator Gauge with Holding Fixture and zero the Dial Indicator Gauge. Move the Valve Guide Clearance Gauge away from the Dial Indicator Gauge with Holding Fixture and note the reading. The reading will be DOUBLE the valve stem-to-valve guide clearance.

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Valve Inspection

1. Inspect the following valve areas:
    1. The end of the stem for grooves or scoring.
    2. The valve face and the edge for pits, grooves or scores.
    3. The valve head for signs of burning, erosion, warpage and cracking.
    4. The valve margin for wear.



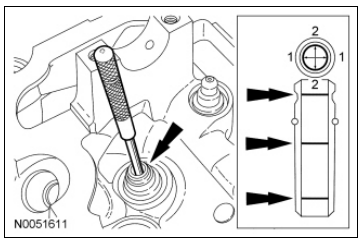
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Valve Guide Inner Diameter

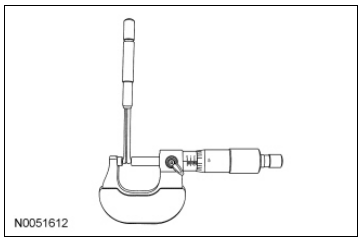
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** Valve guides tend to wear in an hourglass pattern. The ball gauge can be inserted into the combustion chamber side of the valve guide, if necessary.

   Use a ball gauge to determine the inside diameter of the valve guides in 2 directions at the top, middle and bottom of the valve guide.



2. Measure the ball gauge with a micrometer.

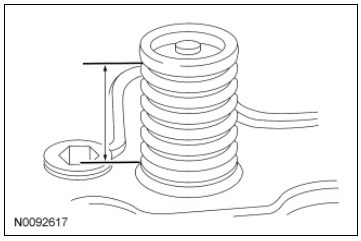


3. If the valve guide is not within specifications, install a new cylinder head assembly.

Valve Spring Installed Length

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure the installed length of each valve spring.

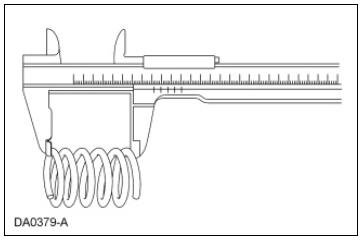


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Valve Spring Free Length

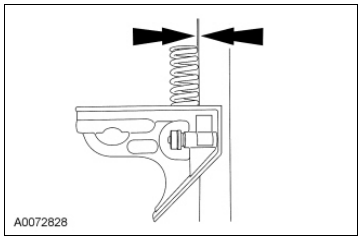
NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Measure the free length of each valve spring.



Valve Spring Squareness

1. Measure the out-of-square on each valve spring.
    - Turn the valve spring and observe the space between the top of the valve spring and the square.



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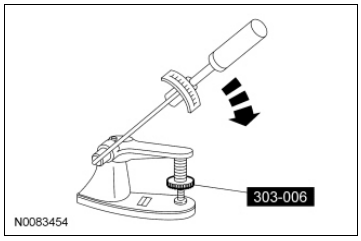
Valve Spring Strength

Special Tool(s)

 ST1278-A	Pressure Gauge, Valve/Clutch Spring 303-006 (TOOL-6513-DD) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Use the Valve/Clutch Spring Pressure Gauge to check the valve spring for correct strength at the specified valve spring length.



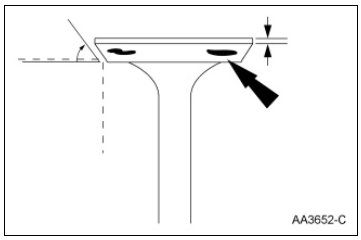
Valve Seat Inspection

Valve and Seat Refacing Measurements

NOTE: Refer to the appropriate Section 303-01 for the specification.

NOTE: After grinding valves or valve seats, check valve clearance.

1. Check the valve head and seat.
   - Check valve angles.
   - Check margin width.
   - Be sure margin width is within specification.



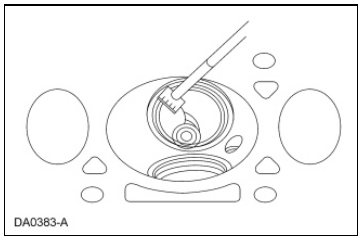
2. Inspect for abnormalities on the valve face and seat. Install a new cylinder head assembly if abnormalities are found.

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Valve Seat Width

NOTE: Refer to the appropriate Section 303-01 for the specification.

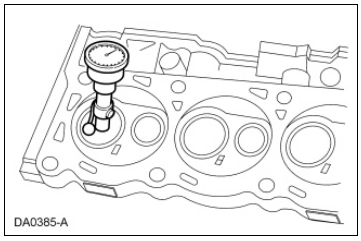
1. Measure the valve seat width. If necessary, grind the valve seat to specification.
    - Measure the intake valve seat width.
    - Measure the exhaust valve seat width.
    - Recheck the valve spring installed length after the seats have been ground, and shim the valve springs as necessary to achieve the correct installed spring length.
    - Depending on the engine, check the valve lash. Refer to General Procedures in Section 303-01.



Valve Seat Runout

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. Use a valve seat runout gauge to check valve seat runout.



Cylinder Head Distortion

Special Tool(s)

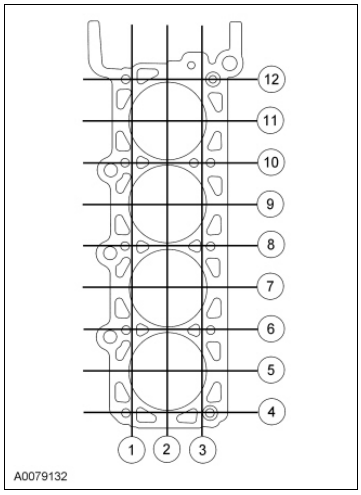
 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

1. **NOTE:** Make sure all cylinder head surfaces are clear of any gasket material, silicone sealant, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.

   NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

   Using a Straightedge and a Feeler Gauge Set, inspect the cylinder head for flatness in the sequence shown.



Cylinder Bore Cleaning

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil (Canada) XO-5W20-QSP (US); CXO-5W20-LSP12 (Canada)	WSS-M2C945-A
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil (Canada) XO-5W30-QSP (US); CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C946-A, 5W30;

1. ***NOTICE:*** **If these procedures are not followed, rusting of the cylinder bores may occur.**

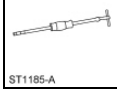
   Clean the cylinder bores with soap or detergent and water.

2. Thoroughly rinse with clean water and wipe dry with a clean, lint-free cloth.

3. Use a clean, lint-free cloth and lubricate the cylinder bores.
   - Use clean engine oil.

Core Plug Replacement

Special Tool(s)

 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
High Temperature Retaining Compound Loctite® 620TM/Permatex® 62050, or equivalent; obtain locally	WSK-M2G349-A9
Threadlock 262 TA-26	WSK-M2G351-A6

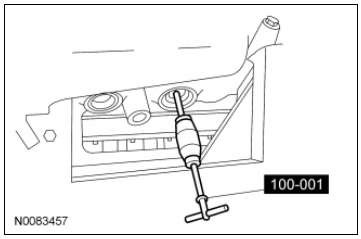
NOTICE: **It is necessary to use High Temperature Retaining Compound Loctite® 620TM/Permatex® 62050 or equivalent on all 3 valve modular engine cylinder head cup plugs. If not used, the cylinder head cup plugs could leak or seep, causing serious engine damage.**

NOTE: Use threadlock 262 on all other applications.

All core plugs

1. **NOTE:** Cylinder block core plug shown, cylinder head core plug similar.

   Use the Slide Hammer and a freeze plug remover to remove the core plug.



2. **NOTE:** Oversize plugs are identified by the OS stamped in the flat located on the cup side of the plug.

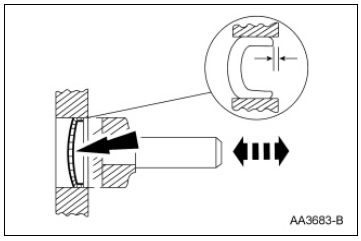
   Inspect the core plug bore for any damage that would interfere with the correct sealing of the plug. If the core plug bore is damaged, bore for the next oversize plug.

Cup-type

3. ***NOTICE:*** **Use care during this procedure so as not to disturb or distort the cup sealing surface.**

NOTE: When installed, the flanged edge must be below the chamfered edge of the bore to effectively seal the bore.

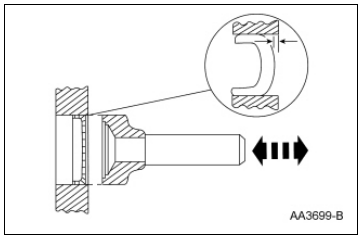
Coat the cup-type core plug and bore lightly with sealant and install the core plug using a freeze plug installer.



Expansion-type

4. ***NOTICE:*** **Do not contact the crown when installing an expansion-type core plug. This could expand the plug before seating and result in leakage.**

   Coat the expansion-type core plug and bore lightly with sealant and install the core plug using a freeze plug installer.



Cylinder Block Distortion

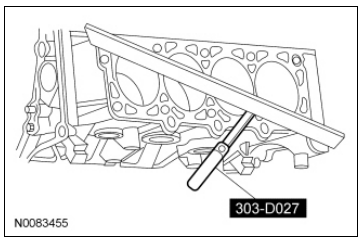
Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the appropriate Section 303-01 for the specification.

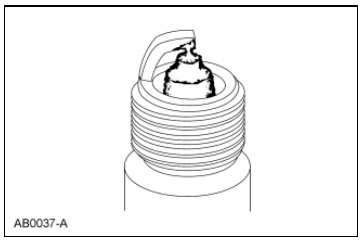
1. **NOTE:** Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

   Use a Straightedge and a Feeler Gauge Set to inspect the cylinder block for flatness.

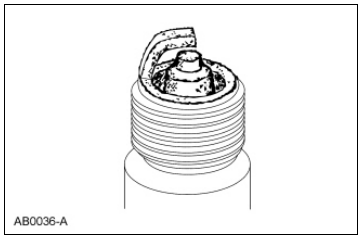


Spark Plug Inspection

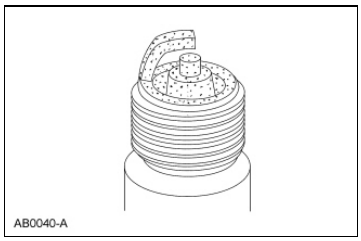
1. Inspect the spark plug for a bridged gap.
    - Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.
    - Install a new spark plug.



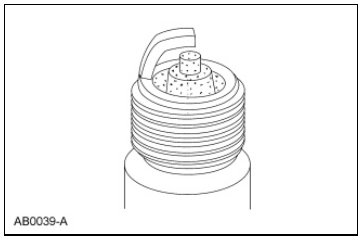
2. Check for oil fouling.
    - Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
    - Correct the oil leak concern.
    - Install a new spark plug.



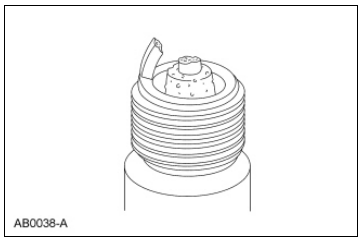
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
    - Install new spark plugs.



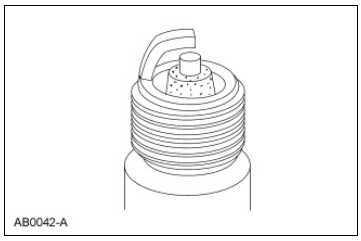
4. Inspect for normal burning.
    - Check for light tan or gray deposits on the firing tip.



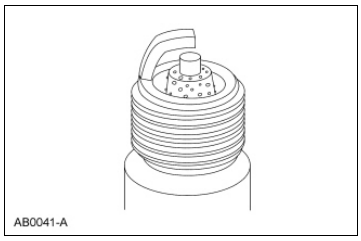
5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a heli-coil insert in place of the spark plug threads.
    - Install a new spark plug.



6. Inspect for overheating, identified by white or light gray spots and a bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.
    - Install a new spark plug.



7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.
    - Install new spark plugs.



Exhaust Manifold Cleaning and Inspection

Special Tool(s)

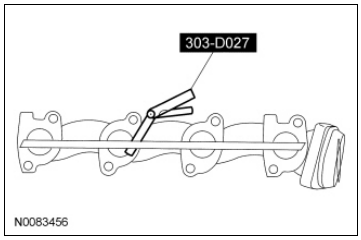
 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent

1. Clean the exhaust manifold using a suitable solvent. Use a plastic scraping tool to clean the gasket sealing surfaces.

2. **NOTE:** New exhaust manifold gaskets, studs, nuts and/or bolts must be installed when an exhaust manifold is serviced.

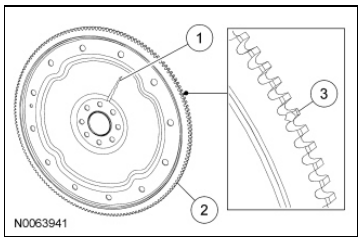
   NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

   Using the Straightedge and a Feeler Gauge Set, check the exhaust manifold sealing surface for warpage. If the warpage is greater than 0.76 mm (0.0299 in), install a new exhaust manifold.



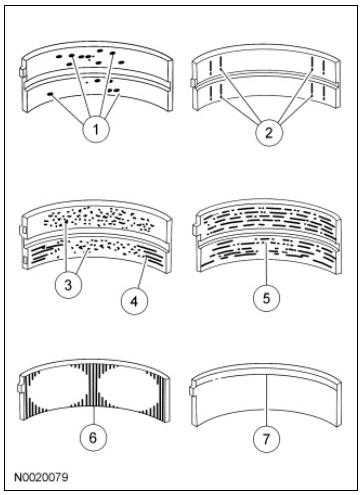
Flexplate Inspection

1. Inspect the flexplate for:
    1. any cracks.
    2. worn ring gear teeth.
    3. chipped or cracked ring gear teeth.



Bearing Inspection

1. Inspect bearings for the following defects:
    1. Cratering - fatigue failure
    2. Spot polishing - incorrect seating
    3. Imbedded dirty engine oil
    4. Scratching - dirty engine oil
    5. Base exposed - poor lubrication
    6. Both edges worn - journal damaged
    7. One edge worn - journal tapered or bearing not seated



Powertrain/Drivetrain Mount Neutralizing

NOTE: Refer to the appropriate section and procedure for special instructions on loosening and tightening mount fasteners.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners.
3. Lower the vehicle.
4. ***NOTICE:*** **Do not twist or strain the powertrain/drivetrain mounts or damage to the mounts may occur.**

   Start the vehicle and move it in forward 0.6-1.2 m (2-4 ft). Then move the vehicle in reverse the same distance.
5. Raise and support the vehicle.
6. Tighten the powertrain/drivetrain mount fasteners.
7. Lower the vehicle.
8. Test the system for normal operation.

Material

Item	Specification	Fill Capacity
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada); or equivalent	WSS-M97B51-A1	-
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A	4.73L (5 qt) with filter
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Motorcraft® Silicone Gasket Remover ZC-30	-	-
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

General Specifications

Item	Specification
Engine	
Displacement	4.0L (244 CID)
Number of cylinders	6
Bore	100.4 mm (3.953 in)
Stroke	84.4 mm (3.32 in)
Firing order	1-4-2-5-3-6
Oil pressure minimum at 2,000 rpm (engine at normal operating temperature)	103 kPa (15 psi)
Engine weight (without accessory drive components or flexplate)	189 kg (417 lb)
Cylinder Head and Valve Train	

Cylinder head gasket surface flatness	0.08 mm (0.003 in) total
Combustion chamber volume	65.197 ± 2.068-2.018 cc
Valve arrangement (front to rear) - LH	I-E-I-E-I-E
Valve arrangement (front to rear) - RH	E-I-E-I-E-I
Valve guide bore diameter	7.00-7.018 mm (0.276 in)
Valve stem diameter - intake	6.965-6.98 mm (0.274-0.275 in)
Valve stem diameter - exhaust	6.95-6.965 mm (0.27-0.274 in)
Valve stem-to-guide clearance - intake	0.020-0.053 mm (0.001-0.002 in)
Valve stem-to-guide clearance - exhaust	0.035-0.068 mm (0.001-0.003 in)
Valve head diameter - intake	45.9-46.1 mm (1.807-1.815 in)
Valve head diameter - exhaust	38.9-39.1 mm (1.531-1.539 in)
Valve face runout	0.03 mm (0.001 in)
Valve face angle	45 degrees
Valve seat width - intake	1.273-2.121 mm (0.05-0.083 in)
Valve seat width - exhaust	1.556-2.404 mm (0.061-0.095 in)
Valve seat runout	0.059 mm (0.002 in)
Valve seat angle	45 degrees
Valve spring free length	43.1 mm (1.7 in)
Valve spring squareness	± 1.5 degrees
Valve spring compression pressure @ specified height (lb)	275-305 N @ 35.9-36.7 mm (202.84-224.968 lb @ 1.413-1.445 in)
Valve spring installed height	39.86-40.86 mm (1.569-1.609 in)
Valve spring installed pressure	320 N (72 lb)
Roller follower ratio	1.98:1
Camshaft	
Theoretical valve lift @ 0 lash	11.93 mm (0.472 in)
Lobe lift	6.584 mm (0.259 in)
Allowable lobe lift loss	0.127 mm (0.005 in)
Journal diameter	27.935-27.96 mm (1.099-1.101 in)
Camshaft journal bore inside diameter	28.0-28.03 mm (1.102-1.104 in)
Camshaft journal-to-bearing clearance	0.04-0.095 mm (0.002-0.004 in)
Runout	0.05 mm (0.002 in)
End play	0.075-0.185 mm (0.003-0.007 in)
Cylinder Block	
Cylinder bore diameter	100.4 mm (3.953 in)
Cylinder bore maximum taper	0.025 mm (0.001 in)
Cylinder bore maximum out-of-round	0.025 mm (0.001 in)
Main bearing bore inside diameter	60.620-60.634 mm (2.387-2.387 in)
Head gasket surface flatness	0.1 mm (0.004 in) overall
Crankshaft	
Main bearing journal diameter	56.980-57.0 mm (2.243-2.244 in)
Main bearing journal maximum taper	0.008 mm (0.0003 in)
Main bearing journal maximum out-of-round	0.008 mm (0.0003 in)
Main bearing journal-to-cylinder block clearance	0.008-0.062 mm (0.0003-0.0024 in)

Connecting rod journal diameter	53.98-54.0 mm (2.125-2.126 in)
Connecting rod journal maximum taper	0.008 mm (0.0003 in)
Connecting rod journal maximum out-of-round	0.008 mm (0.0003 in)
Crankshaft maximum end play	0.05-0.32 mm (0.002-0.0126 in)
Main Bearings	
Clearance to crankshaft	0.015-0.053 mm (0.0006-0.002 in)
Bearing wall thickness	1.8-1.806 mm (0.0709-0.0711 in)
Piston and Connecting Rod	
Piston diameter - coded standard	100.360-100.400 mm (3.951-3.9528 in)
Piston diameter - coded 0.5	100.880-100.900 mm (3.971-3.972 in)
Piston diameter - coded 1.0	101.390-101.400 mm (3.991-3.992 in)
Piston-to-cylinder bore clearance	0.030-0.050 mm (0.0012-0.002 in)
Piston ring end gap - top	0.250-0.400 mm (0.009-0.015 in)
Piston ring end gap - bottom	0.40-0.65 mm (0.016-0.028 in)
Piston ring groove width - top	1.23-1.25 mm (0.0484-0.0492 in)
Piston ring groove width - bottom	1.52-1.54 mm (0.0598-0.0606 in)
Piston ring groove width - oil ring	3.01-3.03 mm (0.1185-0.1193 in)
Piston ring width - top	1.170-1.190 mm (0.0460-0.0469 in)
Piston ring width - bottom	1.472-1.490 mm (0.0580-0.0587 in)
Piston ring-to-groove clearance - top	0.040-0.075 mm (0.0016-0.0030 in)
Piston ring-to-groove clearance - bottom	0.030-0.065 mm (0.0012-0.0026 in)
Piston pin bore diameter	24.009-24.013 mm (0.9452-0.9453 in)
Piston pin diameter	23.997-24.000 mm (0.9447-0.9448 in)
Piston pin length	71.8-72.3 mm (2.826-2.846 in)
Piston pin-to-piston fit	0.009-0.016 mm (0.0003-0.0006 in)
Connecting rod pin bore diameter	23.958-23.976 mm (0.943-0.944 in)
Connecting rod length (center-to-center)	145.965-146.035 mm (5.747-5.749 in)
Connecting rod maximum allowed bend	0.0125 mm (0.0004 in) per 25.4 mm (1.000 in)
Connecting rod maximum allowed twist	0.038 mm (0.0015 in) per 25.4 mm (1.000 in)
Connecting rod bearing bore diameter	56.82 mm-56.84 mm (2.237 in-2.238 in)
Connecting rod bearing-to-crankshaft clearance	0.022-0.064 mm (0.0008-0.0025 in)
Connecting rod side clearance	0.092-0.318 mm (0.0036-0.0125 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor and power steering pump bracket	42	31	-
A/C line fitting nuts	15	-	133
A/C tube bracket nut	10	-	89
Accessory drive belt tensioner bolt	47	35	-

Balance shaft bolts	29	21	-
Balance shaft chain guide bolts	10	-	89
Balance shaft chain tensioner bolts [a]	-	-	-
Battery cable retainer bracket-to-frame nut	15	-	133
Battery cable-to-engine front cover bracket nut	20	-	177
Battery cable-to-Power Distribution Box (PDB) nut	12	-	106
Camshaft bearing cap bolts [a]	-	-	-
Camshaft sprocket bolt	85	63	-
Camshaft Sprocket Holding Tool top clamp bolts [a]	-	-	-
Cassette-to-cylinder block bolt	19	-	168
Cassette-to-cylinder head bolt, RH	10	-	89
Cassette-to-cylinder head bolt, LH	12	-	106
Connecting rod nuts [a]	-	-	-
Coolant expansion tank bolts	7	-	62
Coolant pump bolts	10	-	89
Coolant pump pulley bolts	25	18	-
Crankshaft Position (CKP) sensor bolts	10	-	89
Crankshaft pulley bolt [a]	-	-	-
Crossmember bolts	103	76	-
Cylinder block cradle bolts (inside) [a]	-	-	-
Cylinder block cradle bolts (outside)	14	-	124
Cylinder block cradle nuts (outside)	10	-	89
Cylinder block cradle inserts	3	-	27
Cylinder block cradle Torx bolts	10	-	89
Cylinder head bolts [a]	-	-	-
Electrical harness-to-rear of engine bolts	47	35	-
Engine front cover bolts	19	-	168
Engine lifting eye bolts (service)	37	27	-
Engine support insulator bracket bolts	80	59	-
Engine support insulator nuts	90	66	-
Engine support insulator through bolt	103	76	-
Exhaust manifold nuts	22	16	-
Exhaust manifold studs	12	-	106
Exhaust manifold-to-converter nuts	40	30	-
Exhaust manifold-to-EGR system module tube fittings	34	25	-
Flexplate bolts [a]	-	-	-
Front axle housing bolts	66	49	-
Front stabilizer bar bracket bolts	55	41	-
Fuel rail bolts	24	18	-
Fuel supply tube bracket-to-valve cover bolt	6	-	53
Fuel supply tube-to-fuel rail bolts	6	-	53
Generator B+ terminal nut	8	-	71
Generator bolts	47	35	-
Generator bracket bolts	42	31	-

Ground strap-to-RH cylinder head bolt	10	-	89
Ground wire nut	9	-	80
Heater hose tube bracket front bolt [b]	34	25	-
Heater hose tube bracket rear bolt	23	17	-
Hood hinge bolts	12	-	106
Hydraulic timing chain tensioner	44	32	-
Ignition coil bracket bolts	10	-	89
Intake manifold bolts	11	-	97
Jackshaft chain guide bolts	19	-	168
Jackshaft chain tensioner bolts	9	-	80
Jackshaft front sprocket bolt [a]	-	-	-
Jackshaft rear sprocket bolt [a]	-	-	-
Jackshaft thrust plate bolt	11	-	97
Knock Sensor (KS) bolt	20	-	177
Main bearing cap bolts	97	72	-
Oil cooler hose bracket bolt	25	18	-
Oil cooler insert	57	42	-
Oil filter	13	-	115
Oil filter adapter bolt	57	42	-
Oil filter adapter insert	33	24	-
Oil level indicator tube bracket bolt	10	-	89
Oil pan bolts	11	-	97
Oil pan drain plug	26	19	-
Oil pressure switch	13	-	115
Oil pump bolts	19	-	168
Oil pump drive bolt	19	-	168
Oil pump screen cover and tube bolts	10	-	89
Power steering fluid reservoir bolt	7	-	62
Power steering fluid reservoir-to-power steering pump hose bracket bolt	11	-	97
Power Steering Pressure (PSP) hose bracket bolt	11	-	97
Power steering pump bolts	25	18	-
Power steering pump pulley bolts	25	18	-
Radiator fan shroud bolts	7	-	62
Spark plugs	20	-	177
Starter B-terminal nut	12	-	106
Starter S-terminal nut	6	-	53
Thermostat housing bolts	11	-	97
Transmission cooler tube bracket nut	23	17	-
Transmission-to-cylinder block cradle bolts	47	35	-
Upper cooling fan shroud bolts	7	-	62
Valve cover bolts	10	-	89
Wiring harness-to-front cover bracket nut	20	-	177
Wiring harness-to-RH cylinder head bracket bolt	47	35	-
Wiring harness-to-throttle body bracket nut	9	-	80

[a] Refer to the procedure in this section.
[b] Also used for Engine Lifting Bracket.

Engine

The 4.0L SOHC engine consists of the following:

- Single overhead camshafts
- Sequential Multi-Port Fuel Injection (SFI)
- Distributorless ignition system
- Aluminum cylinder heads
- Cast-iron, 60-degree V cylinder block
- Jackshaft
- Unique engine timing configuration

The 4.0L engine is a 2-valve-per-cylinder, overhead camshaft engine. The engine features a jackshaft located in the cylinder block above the crankshaft and driven by the crankshaft via a sprocket and chain assembly. The jackshaft drives the 2 camshafts via 2 timing chain cassettes, the LH located on the front of the engine and the RH located on the rear of the engine. The oil pump is driven by the crankshaft via a sprocket and chain. The piston assembly is an aluminum piston with a powdered metal connecting rod. The engine uses a distributorless ignition system.

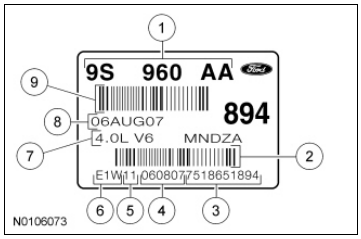
Engine Identification

Always refer to these labels when installation of new parts is necessary or when checking engine calibrations. The engine parts often differ within a CID family. Verification of the identification codes will make sure that the correct parts are obtained. These codes contain all the pertinent information relating to the dates, optional equipment and revisions. The Ford Catalog AdvantageTM or equivalent contains a complete listing of the codes and their applications.

Engine Code Information Label

The engine code information label is located on the side of the LH valve cover. It contains the following:

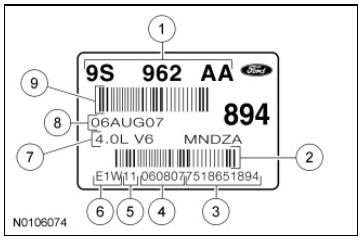
Without Oil Cooler



Item	Description
1	Engine part number
2	Bar code
3	Running number
4	Engine build date (DDMMYY)

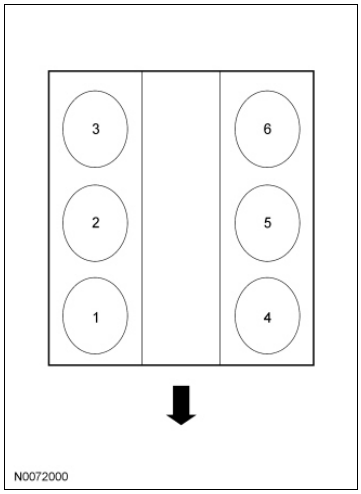
5	Plant shift assembly line
6	Cologne engine plant
7	Engine displacement
8	Engine build date (DDMMYY)
9	Bar code

With Oil Cooler



Item	Description
1	Engine part number
2	Bar code
3	Running number
4	Engine build date (DDMMYY)
5	Plant shift assembly line
6	Cologne engine plant
7	Engine displacement
8	Engine build date (DDMMYY)
9	Bar code

Engine Cylinder Identification



Exhaust Emission Control System

Operation and required maintenance of the exhaust emission control devices used on this engine is covered in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Induction System

The SFI provides the fuel/air mixture needed for combustion in the cylinders. The 6 solenoid-operated fuel injectors:

- are mounted in the cylinder heads.
- meter fuel to the air intake stream in accordance with engine demand.
- are positioned so their tips direct fuel just ahead of the engine intake valves.

PCV System

All engines are equipped with a closed-type PCV system recycling the crankcase vapors to the intake manifold.

Lubrication System

The engine lubrication system operates as follows:

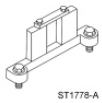
- Oil is drawn into the oil pump through the oil pump screen cover and tube in the sump of the oil pan.
- Oil is pumped through the oil filter on the right front side of the cylinder block.
- Oil enters the main gallery where it is distributed to the crankshaft main journals and to the cylinder head.
- From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly.

Engine

For basic engine mechanical concerns, refer to Section 303-00 . For driveability concerns, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

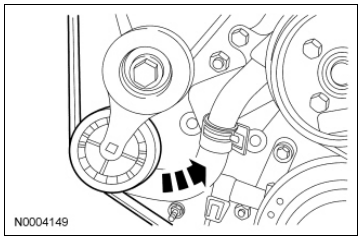
Camshaft Timing

Special Tool(s)

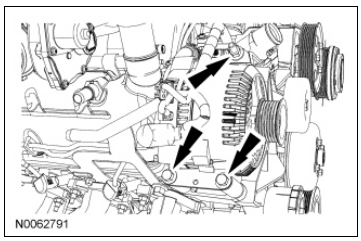
 ST1776-A	Adapter for 303-564 303-578 (T97T-6256-C)
 ST1779-A	Adapter for 303-577 303-576 (T97T-6256-D)
 ST1780-A	Extension, Torque Wrench 303-575 (T97T-6256-F)
 ST1778-A	Holding Tool, Camshaft 303-577 (T97T-6303-C)
 ST1777-A	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B)
 ST1781-A	Socket, Camshaft Sprocket Nut 303-565 (T97T-6256-G)
 ST1438-A	Strap Wrench 303-D055 (D85L-6000-A) or equivalent
 ST1774-A	Tensioner, Timing Chain 303-571 (T97T-6K254-A)
 ST1775-A	Timing Tool, Crankshaft TDC 303-573 (T97T-6303-A)

1. Remove the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.

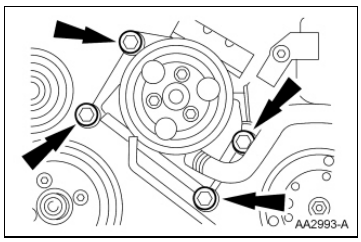
2. If necessary, rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.



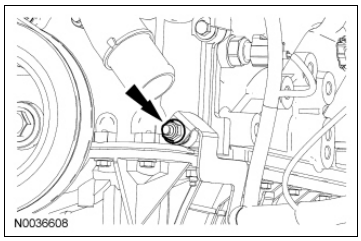
3. If necessary, remove the 3 bolts and position the generator aside.



4. If necessary, remove the 4 bolts and position the A/C compressor and power steering pump bracket aside.

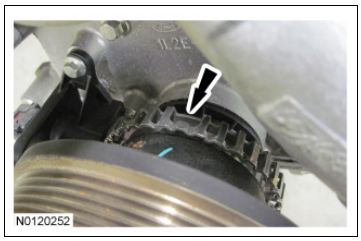


5. Remove the nut and position the wiring harness aside.

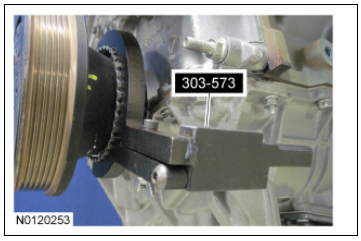


6. **NOTE:** The LH and RH camshafts must be retimed when either camshaft is disturbed.

   Turn the crankshaft pulley clockwise until the crankshaft pulley timing ring slot is at the 12 o'clock position.



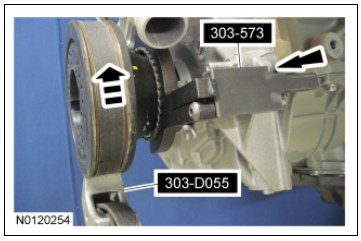
7. Install the Crankshaft TDC Timing Tool on the crankshaft pulley timing ring.



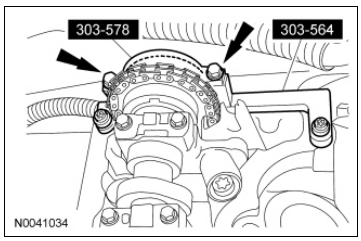
8. ***NOTICE:*** **While turning the crankshaft pulley, take care to not overturn the crankshaft pulley or damage to the crankshaft pulley timing ring may occur.**

NOTE: The Crankshaft TDC Timing Tool must be installed on the crankshaft pulley and should contact the engine block. This positions the engine at TDC .

Using the Strap Wrench, slowly turn the crankshaft counterclockwise until the TDC Timing Tool contacts the engine block in the slot shown.

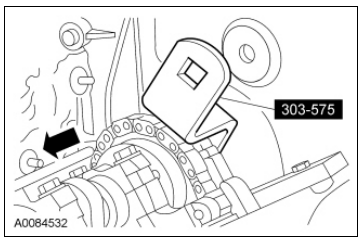


9. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 to the RH cylinder head and tighten the 2 top clamp bolts to 10 Nm (89 lb-in).

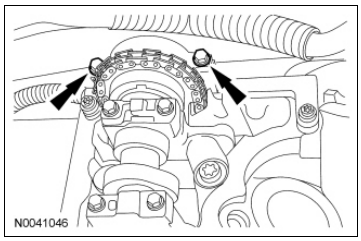


10. ***NOTICE:*** **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

    Using the Torque Wrench Extension with the Camshaft Sprocket Nut Socket 303-565, loosen the RH camshaft sprocket bolt.

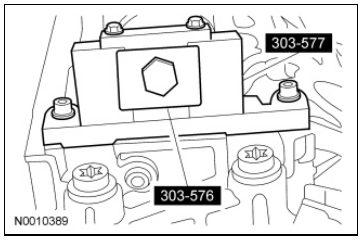


11. Loosen the top 2 Camshaft Sprocket Holding Tool clamp bolts.

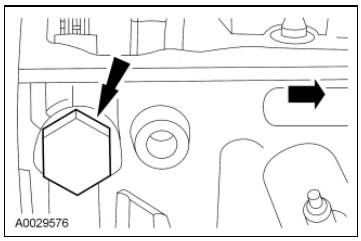


12. **NOTE:** The camshaft timing slots are off-center.

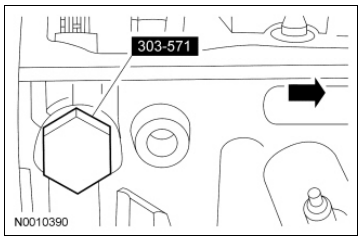
    Position the camshaft timing slots below the centerline of the camshaft and install the Camshaft Holding Tool and the Adapter for 303-577 on the front of the RH cylinder head.



13. Remove the RH hydraulic timing chain tensioner.
    - Discard the washer.



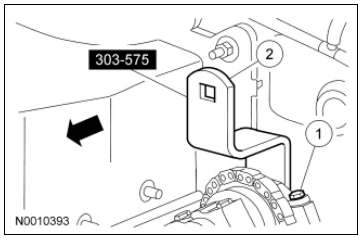
14. Install the Timing Chain Tensioner.



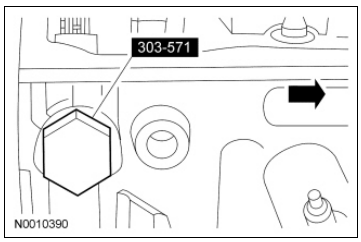
15. ***NOTICE:*** **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

    Tighten the bolts.

    1. Tighten the Camshaft Sprocket Holding Tool top 2 clamp bolts to 10 Nm (89 lb-in).
    2. Calculate the correct torque wrench setting for the following torque. Refer to the Torque Wrench Adapter Formulas in the Appendix.
       Using the Torque Wrench Extension with the Camshaft Sprocket Nut Socket 303-565, tighten the camshaft bolt to 85 Nm (63 lb-ft).



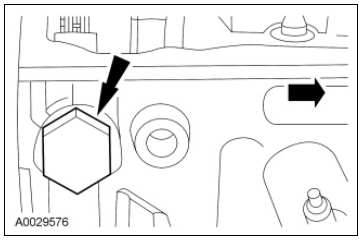
16. Remove the Timing Chain Tensioner.



17. **NOTE:** Install a new washer on the tensioner.

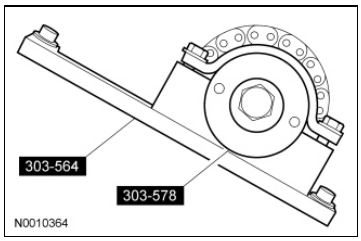
    Install the RH hydraulic timing chain tensioner.

    - Tighten to 44 Nm (32 lb-ft).

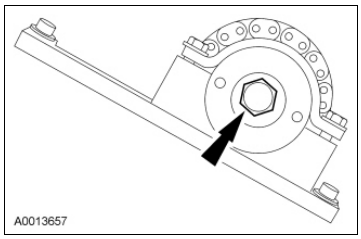


18. Remove the Camshaft Holding Tool, the Adapter for 303-577, the Camshaft Sprocket Holding Tool and the Adapter for 303-564 from the RH cylinder head.

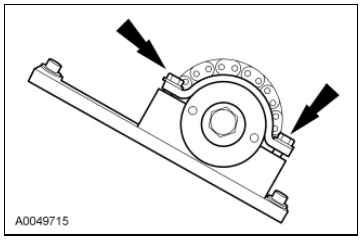
19. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the front of the LH cylinder head and tighten the top 2 clamp bolts to 10 Nm (89 lb-in).



20. Loosen the LH camshaft sprocket bolt.

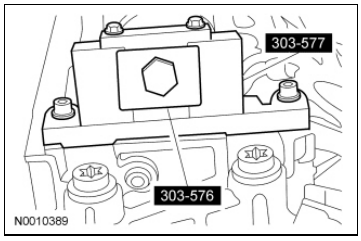


21. Loosen the top 2 clamp bolts on the Camshaft Sprocket Holding Tool to allow the camshaft sprocket to rotate freely.

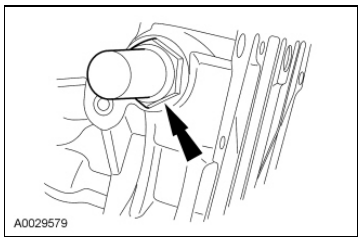


22. **NOTE:** The camshaft timing slots are off-center.

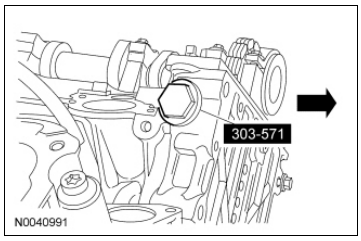
    Position the camshaft timing slots below the centerline of the camshaft and install the Camshaft Holding Tool and the Adapter for 303-577 on the rear of the LH cylinder head.



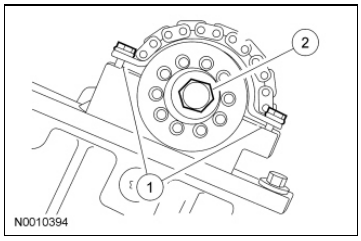
23. Remove the LH hydraulic timing chain tensioner.
    - Discard the washer.



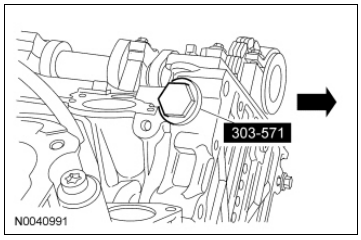
24. Install the Timing Chain Tensioner.



25. Tighten the bolts.
    1. Tighten the Camshaft Sprocket Holding Tool top 2 clamp bolts to 10 Nm (89 lb-in).
    2. Tighten the LH camshaft bolt to 85 Nm (63 lb-ft).



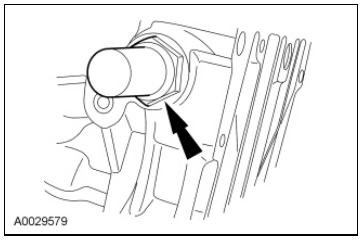
26. Remove the Timing Chain Tensioner.



27. **NOTE:** Install a new washer on the tensioner.

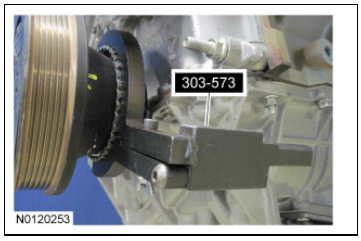
    Install the LH hydraulic timing chain tensioner.

    - Tighten to 44 Nm (32 lb-ft).

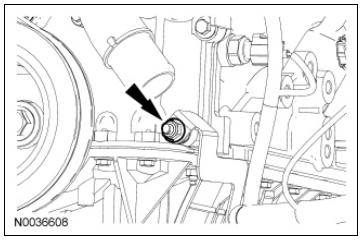


28. Remove the Camshaft Holding Tool, the Adapter for 303-577, the Camshaft Sprocket Holding Tool and the Adapter for 303-564 from the LH cylinder head.

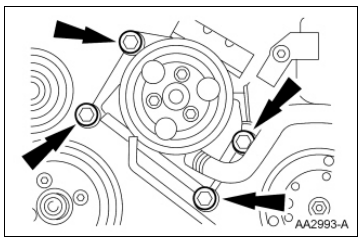
29. Remove the Crankshaft TDC Timing Tool.



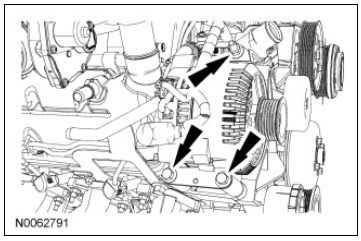
30. Position the battery cable bracket and install the nut.
    - Tighten to 20 Nm (177 lb-in).



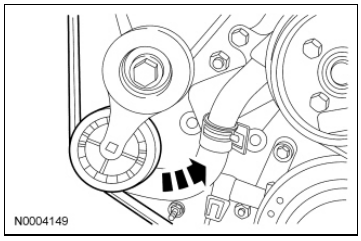
31. If necessary, position the A/C compressor and power steering pump bracket and install the 4 bolts.
    - Tighten to 42 Nm (31 lb-ft).



32. If necessary, position the generator and install the 3 bolts.
    - Tighten to 47 Nm (35 lb-ft).



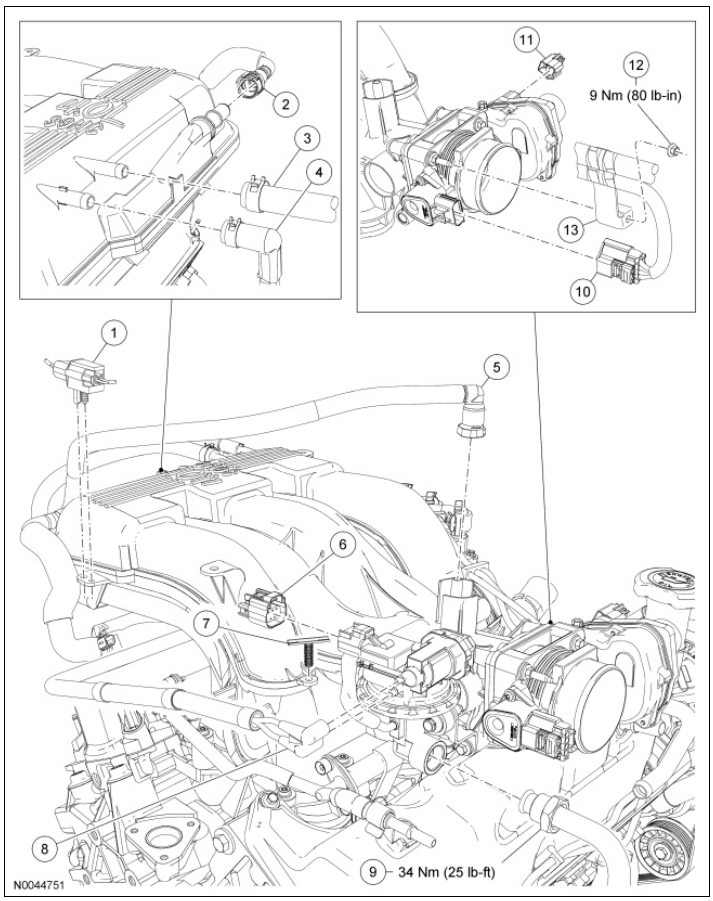
33. If necessary, rotate the accessory drive belt tensioner counterclockwise and install the accessory drive belt.



34. Install the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.

Intake Manifold

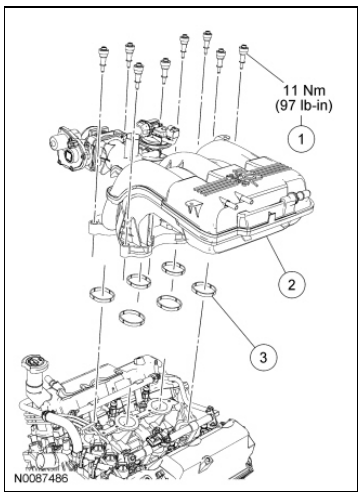
Intake Manifold Connections



Item	Part Number	Description
1	-	Knock Sensor (KS) electrical connector
2	6K817	PCV tube
3	9C482	Brake booster vacuum supply hose
4	9E499	Engine main vacuum harness-to-intake manifold fitting (part of 9E498)
5	9D289	Evaporative Emission (EVAP) tube
6	14A464	EGR system module electrical connector (part of 12B637)
7	-	Wiring harness pin-type retainer (part of 12B637)
8	9E499	EGR system module vacuum fitting (part of 9E498)
9	9J471	Exhaust manifold-to-EGR system module tube fitting (part of 9E469)
10	14A464	Throttle Position (TP) sensor electrical connector (part of 12B637)
11	14A464	

		Electronic Throttle Body (ETB) electrical connector (part of 12B637)
12	-	Wiring harness nut
13	-	Wiring harness bracket

Intake Manifold



Item	Part Number	Description
1	9K479	Intake manifold bolt (8 required)
2	9424	Intake manifold
3	9461	Intake manifold gasket (6 required)

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Detach the Knock Sensor (KS) electrical connector from the intake manifold.
4. Disconnect the PCV tube from the intake manifold.
5. Disconnect the brake booster vacuum hose from the intake manifold.

6. Disconnect the main vacuum harness fitting from the intake manifold.

7. Disconnect the Evaporative Emission (EVAP) tube from the intake manifold.

8. Disconnect the EGR system module electrical connector.

9. Detach the wiring harness retainer.

10. Disconnect the EGR system module vacuum fitting.

11. Loosen the fitting and disconnect the exhaust manifold-to-EGR system module tube from the EGR system module.
    - To install, tighten to 34 Nm (25 lb-ft).

12. Disconnect the Throttle Position (TP) sensor electrical connector.

13. Disconnect the Electronic Throttle Body (ETB) electrical connector.

14. Remove the nut and detach the wiring harness bracket from the ETB .
    - To install, tighten to 9 Nm (80 lb-in).

15. Remove the 8 bolts, the intake manifold and the 6 gaskets.
    - To install, tighten to 11 Nm (97 lb-in).

16. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools can cause scratches and gouges which can make leak paths. Use a plastic scraping tool to remove all traces of the old intake manifold gaskets.**

    Clean the sealing surfaces and inspect the gaskets. Install new gaskets if necessary.

17. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

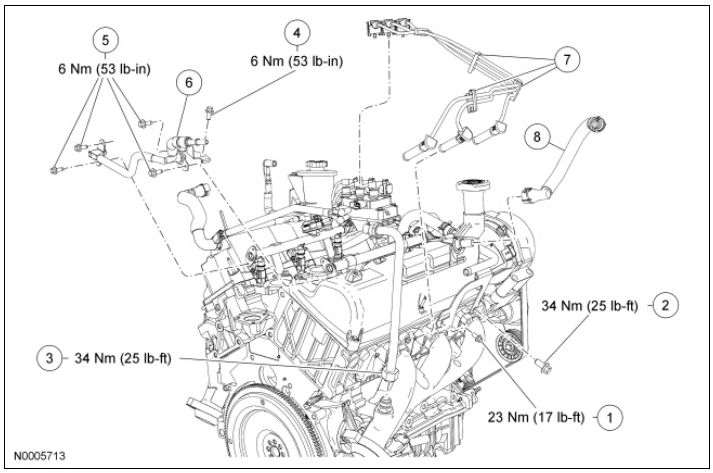
    To install, reverse the removal procedure.

Valve Cover - RH

Material

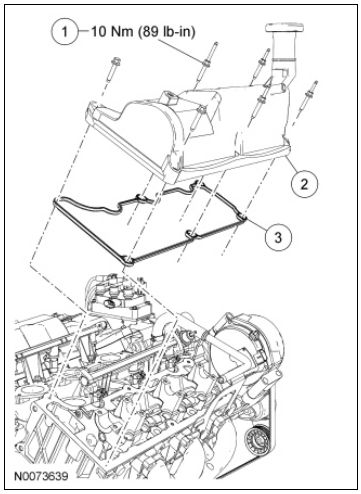
Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Heater Hose Tube, Spark Plug Wires, Fuel Supply Tube and Crankcase Ventilation Tube



Item	Part Number	Description
1	W500023	Heater hose tube bracket rear bolt
2	W500041	Heater hose tube bracket front bolt
3	9E469	EGR system module tube fitting
4	W500204	Fuel supply tube-to-valve cover bracket bolt
5	W708086	Fuel supply tube bolts (4 required)
6	9E964	Fuel supply tube
7	12297	Spark plug wire retainers
8	6758	Crankcase ventilation tube

RH Valve Cover



Item	Part Number	Description
1	6C519	RH valve cover fastener (6 required)
2	6582	RH valve cover
3	6584	RH valve cover gasket

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Disconnect the spring lock coupling from the fuel supply tube. For additional information, refer to Section 310-00 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the intake manifold. For additional information, refer to Intake Manifold in this section.

4. Remove the heater hose tube bracket rear bolt.
   - To install, tighten to 23 Nm (17 lb-ft).

5. Remove the heater hose tube bracket front bolt.
   - To install, tighten to 34 Nm (25 lb-ft).

6. Loosen the exhaust manifold-to-EGR system module tube lower fitting and remove the tube.
   - To install, tighten to 34 Nm (25 lb-ft).

7. ***NOTICE:*** **Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-ring seals may cause the fuel system to leak.**

Remove the fuel supply tube-to-valve cover bracket bolt, the 4 fuel supply tube bolts and the fuel supply tube. Remove and discard the O-ring seals.

- Install new O-ring seals and lubricate them with clean engine oil.
- To install, tighten to 6 Nm (53 lb-in).

8. Detach the spark plug wire retainers and position the spark plug wires aside.

9. Remove the crankcase ventilation tube.

10. Remove the 6 bolts and the valve cover.
    - To install, tighten to 10 Nm (89 lb-in).

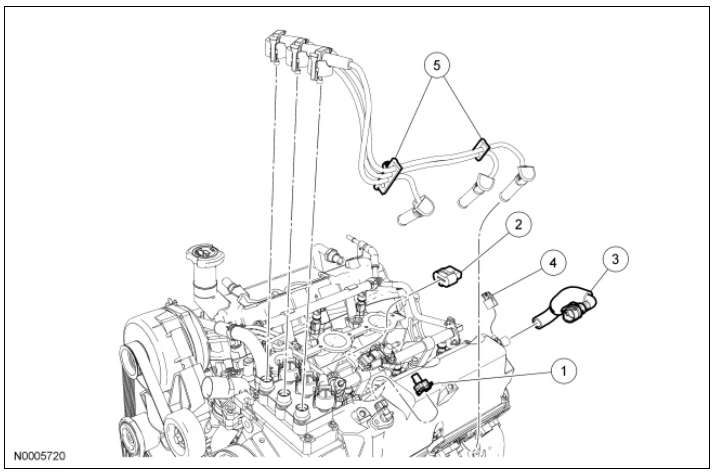
11. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches which make leak paths. Use a plastic scraping tool to remove all traces of the old valve cover gasket.**

    Clean and inspect the sealing surfaces and the gasket. Install a new gasket if necessary.

12. To install, reverse the removal procedure.

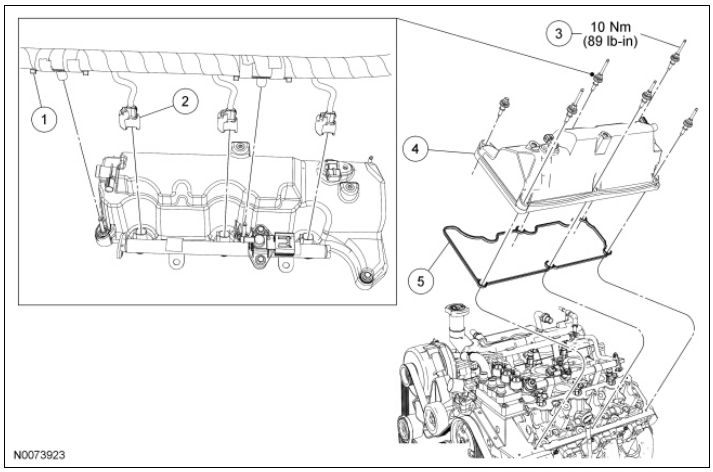
Valve Cover - LH

Ignition and PCV Components, and Camshaft Position (CMP) Sensor



Item	Part Number	Description
1	14A464	Camshaft Position (CMP) sensor electrical connector (part of 180101)
2	12B637	Ignition coil electrical connector
3	6K817	PCV valve tube
4	14A464	PCV valve electrical connector (part of 12A580)
5	-	Spark plug wire retainers

LH Valve Cover



Item	Part Number	Description
1	13A506	Wiring harness retainer (2 required)
2	14A464	Fuel injector electrical connector (3 required)

3	6C519	Valve cover fastener (6 required)
4	6A505	LH valve cover
5	6584	LH valve cover gasket

Removal and Installation

1. Remove the intake manifold. For additional information, refer to Intake Manifold in this section.
2. Disconnect the Camshaft Position (CMP) sensor electrical connector.
3. Disconnect the ignition coil electrical connector. Detach the wiring harness retainer.
4. Disconnect the 3 fuel injector electrical connectors. Detach the wiring harness retainers.
5. Remove the PCV valve tube.
6. Disconnect the PCV valve electrical connector.
7. Detach the spark plug wire retainers.
8. Remove the 6 bolts and the valve cover.
    - To install, tighten to 10 Nm (89 lb-in).
9. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the old valve cover gasket.**

   Clean and inspect the sealing surfaces and the gasket. Install a new gasket if necessary.
10. To install, reverse the removal procedure.

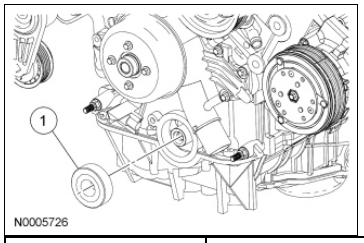
Crankshaft Front Seal

Special Tool(s)

 ST2439-A	Aligner, Front Cover 303-093 (T74P-6019-A)
 ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1288-A	Remover, Crankshaft Front Oil Seal 303-107 (T74P-6700-A)

Material

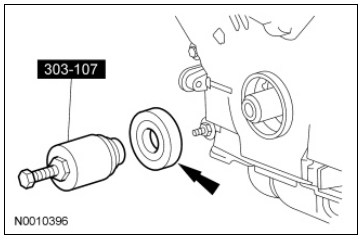
Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



Item	Part Number	Description
1	6700	Front crankshaft seal

Removal

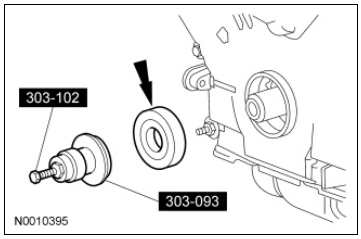
1. Remove the crankshaft pulley. For additional information, refer to Crankshaft Pulley in this section.
2. Using the Crankshaft Front Oil Seal Remover, remove and discard the crankshaft front seal.



Installation

1. **NOTE:** Lubricate the new front seal with clean engine oil.

   Using the Front Cover Aligner and the Crankshaft Vibration Damper Installer, install a new crankshaft front seal.



2. Install the crankshaft pulley. For additional information, refer to Crankshaft Pulley in this section.

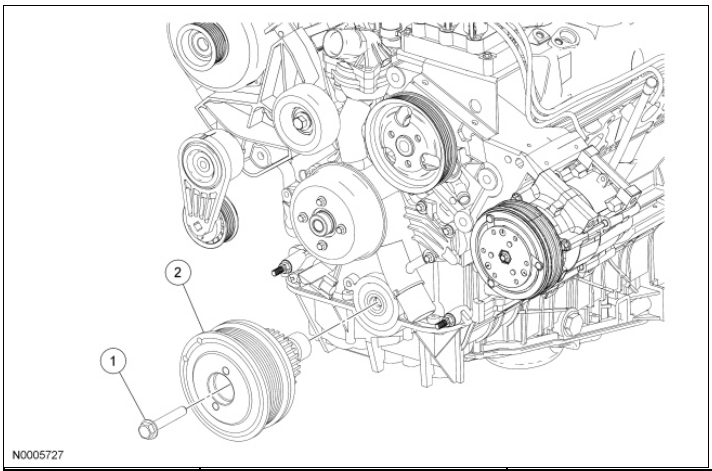
Crankshaft Pulley

Special Tool(s)

 ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1784-A	Remover, Crankshaft Vibration Damper 303-101 (T74P-3616-A)
 ST2697-A	Remover, Crankshaft Vibration Damper 303-773
 ST1438-A	Strap Wrench 303-D055 (D85L-6000-A) or equivalent

General Equipment

8-mm x 1.25 x 100-mm bolts (2 required)



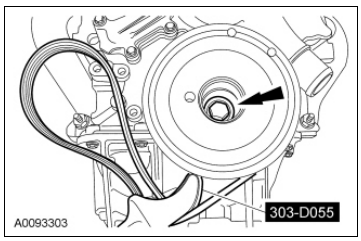
Item	Part Number	Description
1	E800511	Crankshaft pulley bolt
2	6B321	Crankshaft pulley

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the fan shroud. For additional information, refer to Section 303-03 .
3. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

4. **NOTE:** This bolt is torque-to-yield and cannot be reused.

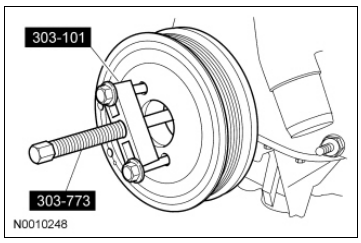
   Using the Strap Wrench to hold the crankshaft pulley, remove the bolt.



5. **NOTE:** If the pulley bolt is not installed, the tool will bottom out before the pulley is off.

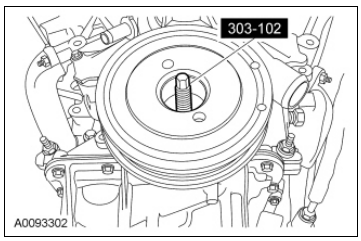
   Install the crankshaft pulley bolt 2 to 3 turns. Using the 2 Crankshaft Vibration Damper Removers and the two 8-mm bolts, remove the crankshaft pulley.

   - Discard the crankshaft pulley bolt.

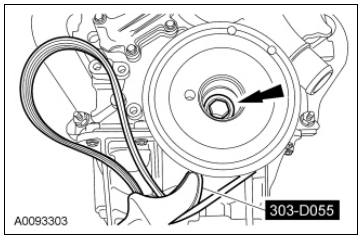


Installation

1. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.



2. Using the Strap Wrench to hold the crankshaft pulley, install a new crankshaft pulley bolt. Tighten the bolt in 2 stages.
   - Stage 1: Tighten to 55 Nm (41 lb-ft).
   - Stage 2: Tighten an additional 85 degrees.

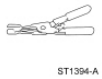


3. Install the accessory drive belt. For additional information, refer to Section 303-05 .

4. Install the fan shroud. For additional information, refer to Section 303-03 .

Cylinder Head

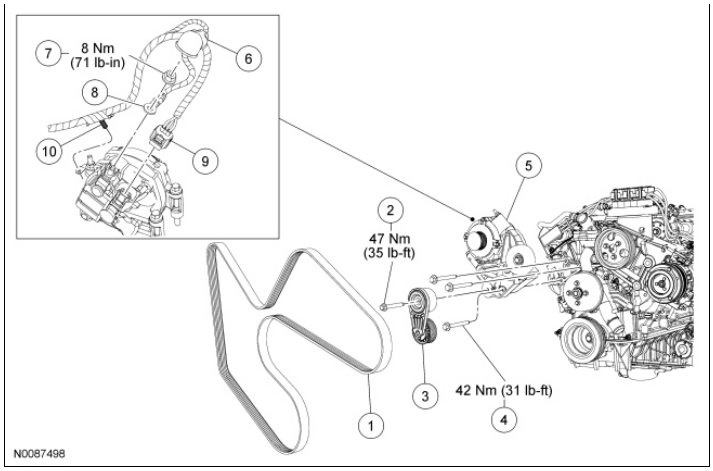
Special Tool(s)

 ST1776-A	Adapter for 303-564 303-578 (T97T-6256-A) or equivalent
 ST1777-A	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B) or equivalent
 ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)
 ST1781-A	Socket, Camshaft Sprocket Nut 303-565 (T97T-6256-G) or equivalent
 ST1780-A	Torque Wrench Extension 303-575 (T97T-6256-F) or equivalent

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

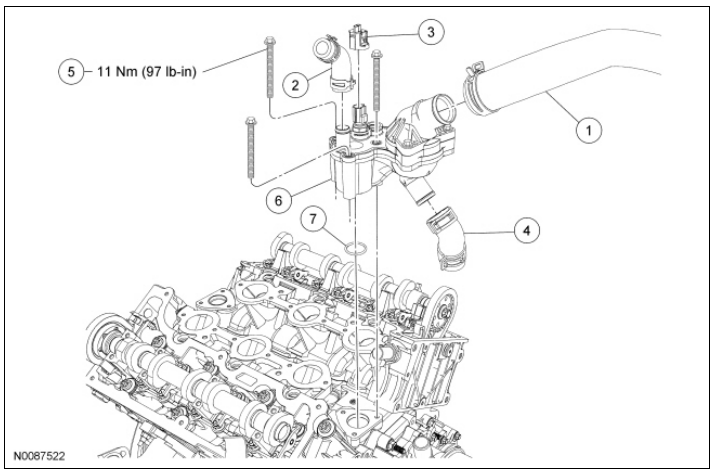
Accessory Drive Belt, Tensioner and Generator Bracket



Item	Part Number	Description
1	8620	Accessory drive belt

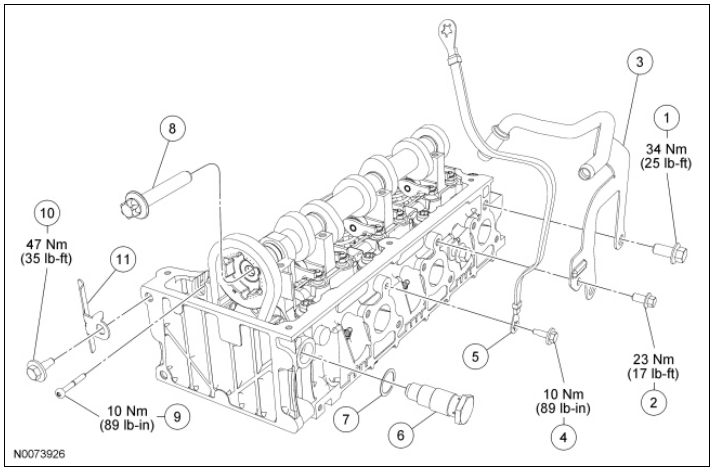
2	W500325	Accessory drive belt tensioner bolt
3	6B209	Accessory drive belt tensioner
4	N807938	Generator bracket bolt (3 required)
5	10239	Generator bracket
6	14A240	Generator B+ terminal cover (part of 12A280)
7	-	Generator B+ terminal nut
8	14463	Generator B+ terminal (part of 14A280)
9	14A464	Generator electrical connector (part of 14A280)
10	13A506	Wiring harness retainer (part of 14A280)

Thermostat Housing



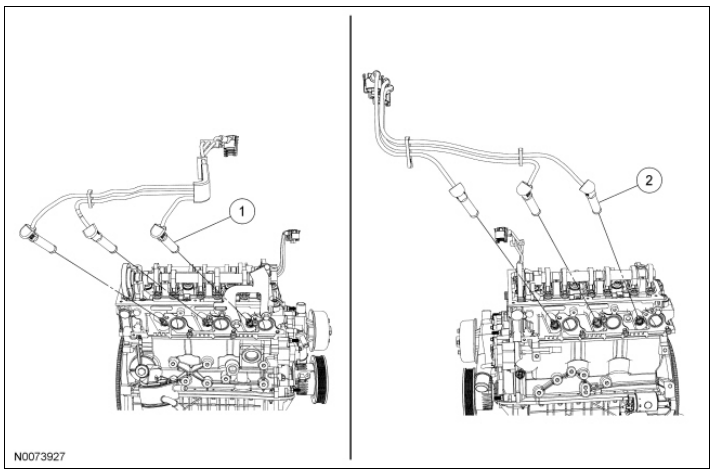
Item	Part Number	Description
1	8B274	Upper radiator hose
2	18472	Heater hose
3	14A464	Engine Coolant Temperature (ECT) sensor electrical connector (part of 12B637)
4	8548	Bypass hose
5	W702527	Thermostat housing bolt (3 required)
6	9K478	Thermostat housing
7	8255	O-ring seal

RH Cylinder Head Attachments



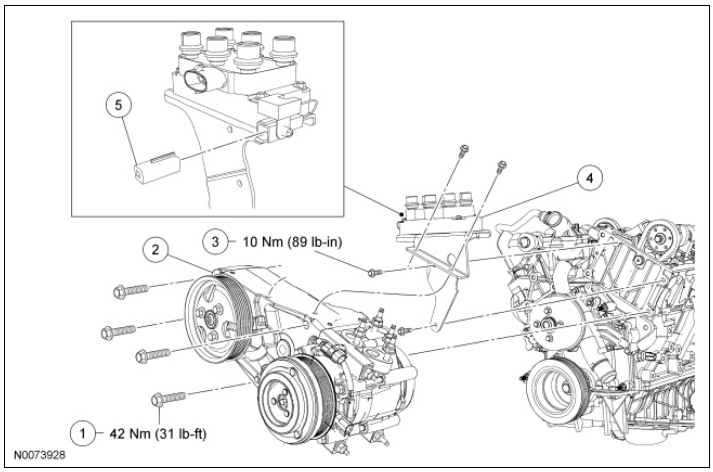
Item	Part Number	Description
1	W500041	Heater tube assembly front bolt
2	W500022	Heater tube assembly rear bolt
3	18696	Heater tube assembly
4	W505421	Engine ground strap bolt
5	19A095	Engine ground strap
6	6K254	RH hydraulic timing chain tensioner
7	-	RH hydraulic timing chain tensioner washer
8	6M276	RH camshaft sprocket bolt
9	6U000	RH timing cassette-to-cylinder head bolt
10	W505430	Wiring harness retainer bolt
11	14C508	Wiring harness retainer (part of 12B637)

Spark Plug Wires



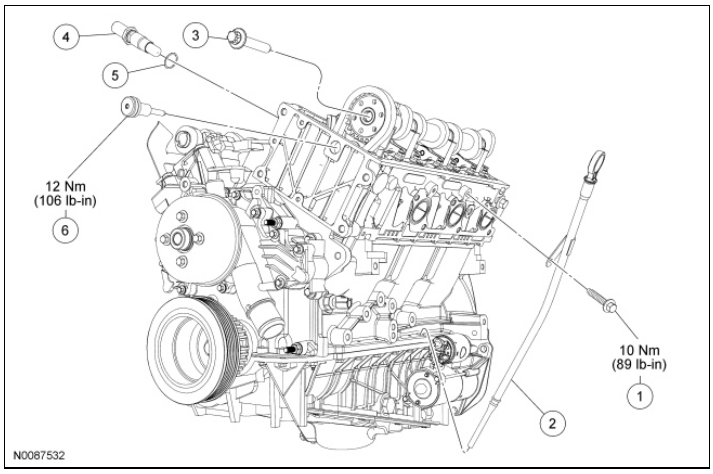
Item	Part Number	Description
1	12280	RH spark plug wire (3 required)
2	12281	LH spark plug wire (3 required)

Power Steering Pump and A/C Compressor Bracket and Ignition Coil



Item	Part Number	Description
1	N807938	A/C compressor and power steering pump bracket bolt (4 required)
2	19E708	A/C compressor and power steering pump bracket
3	-	Ignition coil and bracket assembly bolt (4 required)
4	12A310	Ignition coil and bracket assembly
5	14A464	Radio ignition interference capacitor electrical connector (part of 12B637)

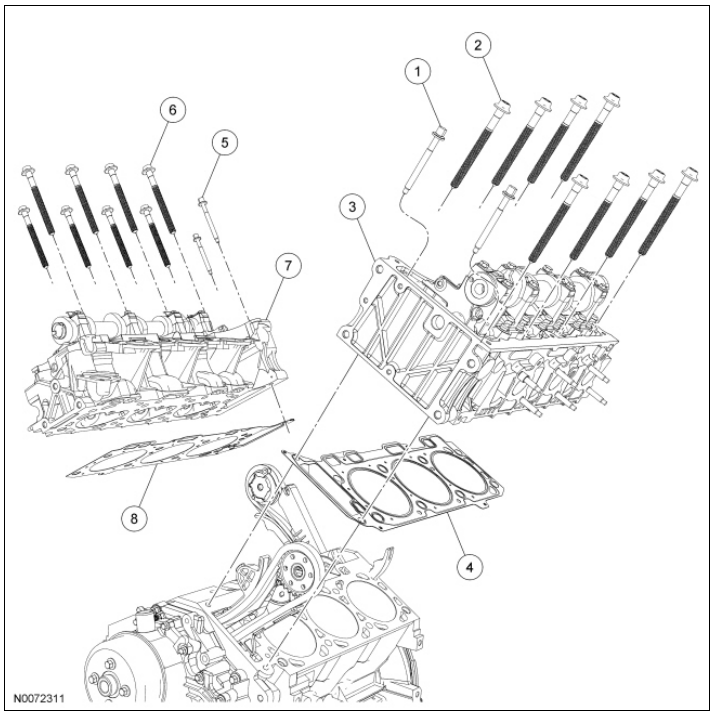
LH Cylinder Head Attachments



Item	Part Number	Description
1	-	Oil level indicator tube assembly bolt
2	6754	Oil level indicator tube assembly
3	6M276	LH camshaft sprocket bolt
4	6K254	LH hydraulic timing chain tensioner
5	-	LH hydraulic timing chain tensioner washer

6	6U001	LH timing cassette-to-cylinder head bolt

Cylinder Heads

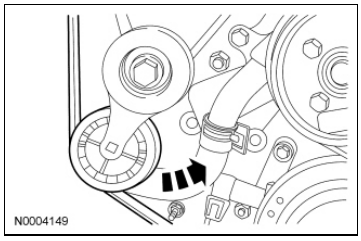


Item	Part Number	Description
1	6065	LH cylinder head bolt (M8) (2 required)
2	6065	LH cylinder head bolt (M12) (8 required)
3	6M099	LH cylinder head
4	6083	LH cylinder head gasket
5	6065	RH cylinder head bolt (M8) (2 required)
6	6065	RH cylinder head bolt (M12) (8 required)
7	6049	RH cylinder head
8	6051	RH cylinder head gasket

Removal

Both sides

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Drain the engine cooling system. For additional information, refer to Section 303-03 .
3. Remove the roller followers. For additional information, refer to Camshaft Roller Follower in this section.
4. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.

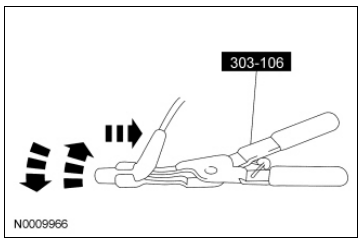


RH side

5. Remove the 2 bolts and position the heater hose tube bracket aside.
6. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
7. Disconnect the generator electrical connections.
8. Remove the bolt and the accessory drive belt tensioner.
9. Remove the 3 bolts and the generator mounting bracket assembly.
10. Disconnect the heater hose from the thermostat housing.
11. Disconnect the Engine Coolant Temperature (ECT) sensor electrical connector.
12. Disconnect the upper radiator hose from the thermostat housing.
13. Position the bypass hose clamp aside.
14. Remove the 3 bolts and the thermostat housing.
15. Remove the bolt and position the engine wiring harness aside.
16. Remove the engine ground strap.
17. ***NOTICE:*** **It is important to twist the spark plug wire boot while pulling upward to avoid damage to the spark plug wire.**

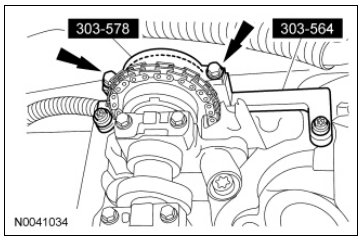
    NOTE: Spark plug wires must be connected to the correct spark plug. Mark the spark plug wires for installation reference.

    With a twisting motion, use the Spark Plug Wire Remover to pull the spark plug wires from the RH spark plugs.



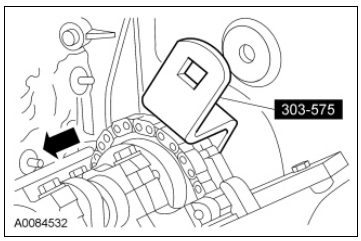
18. Remove the RH exhaust manifold. For additional information, refer to Exhaust Manifold - RH in this section.
19. Remove the RH hydraulic timing chain tensioner.

20. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564.
    - Tighten to 10 Nm (89 lb-in).



21. ***NOTICE:*** **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

    Using the Torque Wrench Extension with the Camshaft Sprocket Nut Socket, remove the RH camshaft bolt.

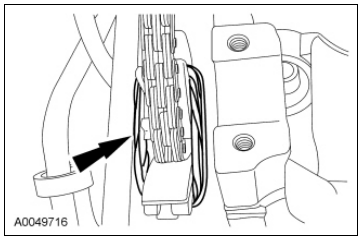


22. Remove the RH side cassette-to-cylinder head bolt.

23. ***NOTICE:*** **Remove the camshaft sprocket from the timing chain to gain clearance to remove the cylinder head. Leaving the sprocket in place can damage the cassette and prevent the cylinder head from being removed.**

    NOTE: Hold the timing chain and cassette with a rubber band to aid in removal and to prevent the timing chain from falling into the cylinder block.

    Remove the RH camshaft sprocket from the timing chain. Install a rubber band around the cassette and the timing chain.



LH side

24. Disconnect the radio ignition interference capacitor electrical connector.

25. Remove the 2 ignition coil and bracket assembly-to-A/C compressor and power steering pump bracket bolts.

26. Remove the 4 bolts and position the A/C compressor and power steering pump bracket aside.

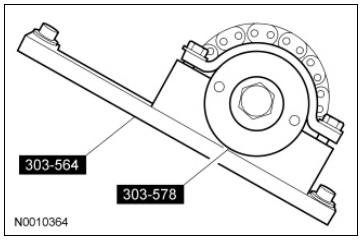
27. Remove the 2 ignition coil and bracket assembly-to-cylinder head bolts and the ignition coil and bracket assembly.

28. Remove the bolt and the oil level indicator tube.

29. Remove the LH exhaust manifold. For additional information, refer to Exhaust Manifold - LH in this section.

30. Remove the LH hydraulic timing chain tensioner.

31. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564.
    - Tighten the top clamp bolts to 10 Nm (89 lb-in).



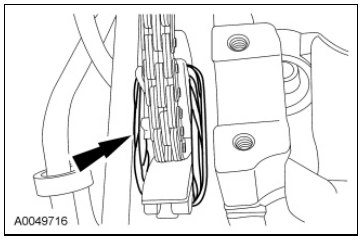
32. Remove the LH side camshaft sprocket bolt.

33. Remove the LH timing cassette-to-cylinder head bolt.

34. ***NOTICE:*** **Remove the camshaft sprocket from the timing chain to gain clearance to remove the cylinder head. Leaving the sprocket in place can damage the cassette and prevent the cylinder head from being removed.**

    NOTE: Hold the timing chain and cassette with a rubber band to aid in removal and to prevent the timing chain from falling into the cylinder block.

    Remove the LH camshaft sprocket from the timing chain. Install a rubber band around the cassette and the timing chain.



Both sides

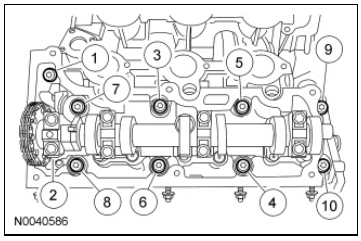
35. ***NOTICE:*** **To avoid damage to the timing chain cassette, an assistant will be required to help lift the cylinder head from the vehicle.**

    NOTICE: **On the RH side, when lifting the cylinder head, be careful to avoid contacting the Air Conditioning (A/C) tube or the A/C tube can be damaged.**

    NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

    Remove the cylinder heads.

    - Remove the 10 bolts from each cylinder head in the sequence shown. Discard all bolts.
    - Remove and discard the head gasket.



36. *NOTICE:* **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

    Clean and inspect the mating surfaces.

37. Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to Section 303-00 .

Installation

Both sides

1. Clean the cylinder head bolt holes in the cylinder block. Make sure all coolant, oil or other foreign material is removed.

2. Position the cylinder head gasket on the block.

RH side

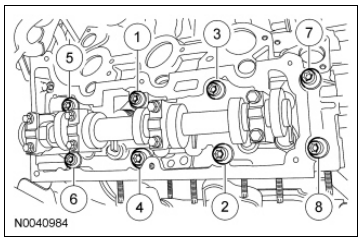
3. *NOTICE:* **To avoid damage to the timing chain cassette, an assistant will be required to help position the cylinder head in the vehicle.**

   NOTICE: **On the RH side, when positioning the cylinder head, be careful to avoid contacting the Air Conditioning (A/C) tube or the A/C tube can be damaged.**

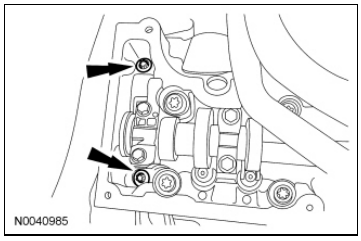
   NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

   Install the cylinder head. Install 8 new 12-mm bolts and tighten in the sequence shown in 2 stages.

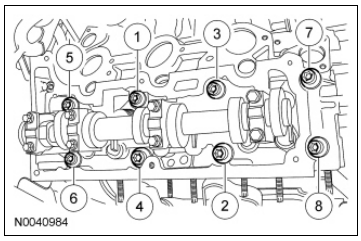
   - Stage 1: Tighten to 12 Nm (106 lb-in).
   - Stage 2: Tighten to 25 Nm (18 lb-ft).



4. Install 2 new 8-mm bolts.
   - Tighten to 32 Nm (24 lb-ft).



5. Tighten the 8 new 12-mm bolts in the sequence shown in 2 stages.
   - Stage 1: Tighten 90 degrees.
   - Stage 2: Tighten an additional 90 degrees.



6. ***NOTICE:*** **The camshaft gear must turn freely on the camshaft. DO NOT tighten the bolt at this time. Tightening the bolt can result in incorrect engine timing.**

   NOTICE: **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

   Remove the rubber band. Install the camshaft sprocket and bolt.

7. Install the RH timing cassette-to-cylinder head bolt.
   - Tighten to 10 Nm (89 lb-in).

8. Install the RH exhaust manifold. For additional information, refer to Exhaust Manifold - RH in this section.

9. **NOTE:** Apply silicone brake caliper grease and dielectric compound to the inside of the spark plug boots.

   Connect the spark plug wires to the RH spark plugs.

10. Install the engine ground strap and the bolt.
    - Tighten to 10 Nm (89 lb-in).

11. Position the engine wiring harness and install the bolt.
    - Tighten to 47 Nm (35 lb-ft).

12. **NOTE:** Inspect the O-ring seal. Install a new O-ring seal if necessary.

    Install the thermostat housing and the 3 bolts.

    - Tighten to 11 Nm (97 lb-in).

13. Position the coolant bypass hose clamp.

14. Install the upper radiator hose to the thermostat housing.

15. Connect the Engine Coolant Temperature (ECT) sensor electrical connector.

16. Connect the heater hose to the thermostat housing.

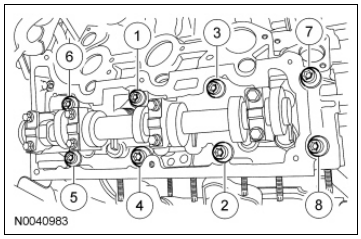
LH side

17. ***NOTICE:*** **To avoid damage to the timing chain cassette, an assistant will be required to help position the cylinder head in the vehicle.**

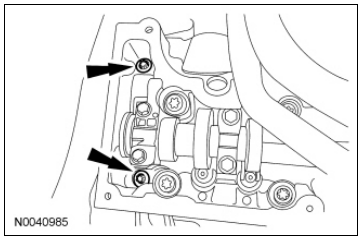
    NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

    Install the cylinder head. Install 8 new 12-mm bolts and tighten in the sequence shown in 2 stages.

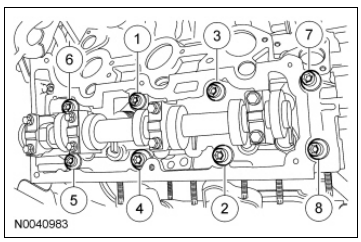
    - Stage 1: Tighten to 12 Nm (106 lb-in).
    - Stage 2: Tighten to 25 Nm (18 lb-ft).



18. Install 2 new 8-mm bolts.
    - Tighten to 32 Nm (24 lb-ft).



19. Tighten the 8 new 12-mm bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten 90 degrees.
    - Stage 2: Tighten an additional 90 degrees.



20. ***NOTICE:*** **The camshaft gear must turn freely on the camshaft. DO NOT tighten the bolt at this time. Tightening the bolt can result in incorrect engine timing.**

    Remove the rubber band. Install the camshaft sprocket and bolt.

21. Install the LH timing cassette-to-cylinder head bolt.
    - Tighten to 12 Nm (106 lb-in).

22. Install the LH exhaust manifold. For additional information, refer to Exhaust Manifold - LH in this section.

23. **NOTE:** Apply silicone brake caliper grease and dielectric compound to the inside of the spark plug boots.

    Connect the spark plug wires to the LH spark plugs.

24. Install the oil level indicator tube and the bolt.
    - Tighten to 10 Nm (89 lb-in).

Both sides

25. Time the camshafts. For additional information, refer to Camshaft Timing in this section.

RH side

26. Install the generator mounting bracket assembly and the 3 bolts.
    - Tighten to 42 Nm (31 lb-ft).

27. Position the accessory drive belt tensioner and install the bolt.
    - Tighten to 47 Nm (35 lb-ft).

28. Connect the generator electrical connections.
    - Tighten to 8 Nm (71 lb-in).

29. Connect the battery ground cable. For additional information, refer to Section 414-01 .

30. Position the heater hose tube bracket and install the 2 bolts.
    - Tighten the rear bolt to 23 Nm (17 lb-ft).
    - Tighten the front bolt to 34 Nm (25 lb-ft).

LH side

31. Position the ignition coil and bracket assembly and install the 2 bracket-to-cylinder head bolts.
    - Tighten to 10 Nm (89 lb-in).

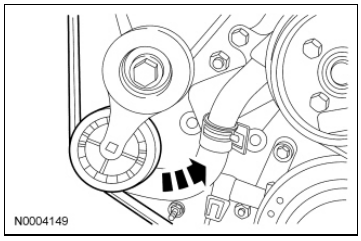
32. Position the A/C compressor and power steering pump bracket and install the 4 bolts.
    - Tighten to 42 Nm (31 lb-ft).

33. Install the 4 ignition coil bracket-to-A/C compressor and power steering pump bracket bolts.
    - Tighten to 10 Nm (89 lb-in).

34. Connect the radio ignition interference capacitor electrical connector.

Both sides

35. Rotate the accessory drive belt tensioner counterclockwise and install the accessory drive belt.



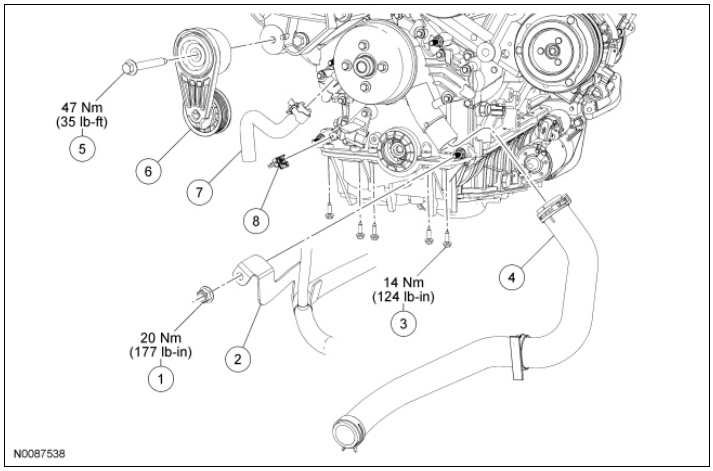
36. Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

Engine Front Cover

Material

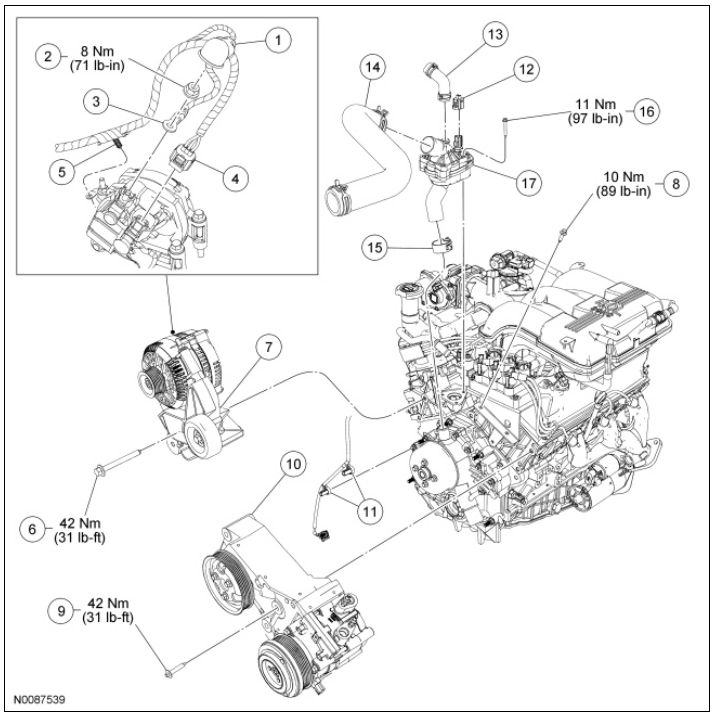
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

Lower End Components



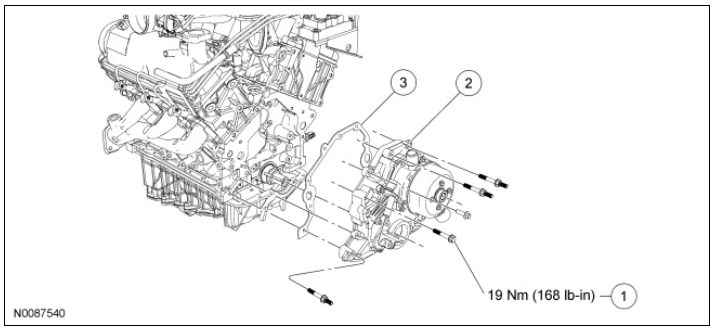
Item	Part Number	Description
1	W520102	Wiring harness bracket nut
2	10A779	Wiring harness bracket (part of 14A280)
3	W503275	Cylinder block cradle-to-front cover bolt (5 required)
4	8260	Lower radiator hose
5	-	Accessory drive belt tensioner bolt
6	6B209	Accessory drive belt tensioner
7	-	Heater hose
8	14A464	Crankshaft Position (CKP) sensor electrical connector

Accessory Drive Brackets



Item	Part Number	Description
1	14A240	Generator B+ terminal cover (part of 12A280)
2	-	Generator B+ terminal nut
3	14463	Generator B+ terminal (part of 14A280)
4	14A464	Generator electrical connector (part of 14A280)
5	13A506	Wiring harness retainer (part of 14A280)
6	-	Generator bracket bolt (3 required)
7	-	Generator bracket
8	-	Ignition coil bracket-to-A/C compressor and power steering pump bracket bolt
9	-	A/C compressor and power steering pump bracket bolt (4 required)
10	-	A/C compressor and power steering pump bracket
11	-	Wiring harness routing clips
12	-	Engine Coolant Temperature (ECT) sensor electrical connector
13	18472	Heater hose
14	8260	Upper radiator hose
15	-	Bypass hose clamp
16	-	Thermostat housing bolt (3 required)
17	-	Thermostat housing

Engine Front Cover



Item	Part Number	Description
1	-	Engine front cover bolt (10 required)
2	-	Engine front cover
3	-	Gasket

Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Drain the cooling system. For additional information, refer to Section 303-03 .
3. Remove the crankshaft front seal. For additional information, refer to Crankshaft Front Seal in this section.
4. Remove the nut and detach the wiring harness bracket from the front cover.
5. Remove the 5 oil pan-to-front cover bolts.
6. Disconnect the lower radiator hose.
7. Remove the bolt and the drive belt tensioner.
8. Disconnect the heater hose from the coolant pump.
9. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
10. Remove the nut and disconnect the generator B+ terminal.
11. Disconnect the generator electrical connector and detach the wiring harness retainer.
12. Remove the 3 generator bracket bolts and the generator bracket.
13. Remove the coil bracket-to-A/C compressor and power steering pump bracket bolt.
14. Remove the 4 bolts and the A/C compressor and power steering pump bracket.
15. Remove and discard the CKP sensor wiring harness retainers.
16. Disconnect the Engine Coolant Temperature (ECT) sensor electrical connector.
17. Disconnect the upper radiator hose from the thermostat housing.
18. Disconnect the heater hose from the thermostat housing.

19. **NOTE:** The bypass hose will be removed with the thermostat housing.

    Release the bypass hose clamp from the coolant pump end.

20. Remove the 3 bolts and the thermostat housing.

21. **NOTE:** Note the positions of the stud bolts for installation reference.

    Remove the 10 bolts, the engine front cover and the gasket. Discard the gasket.

Installation

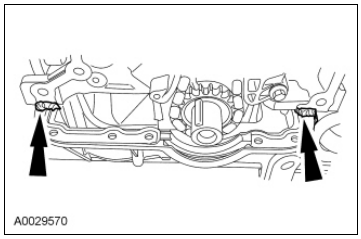
1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the old front cover gasket and the silicone sealer.**

   Clean and inspect the gasket mating surfaces. Use silicone gasket remover and metal surface prep and a plastic scraping tool. Follow the directions on the packaging.

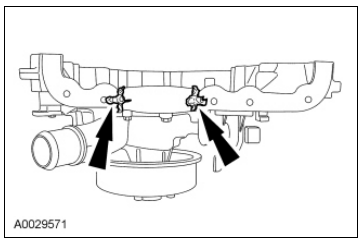
2. Position the front cover gasket.

NOTICE: **If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.**

3. Apply silicone gasket and sealant to the oil pan and engine block mating surfaces.



4. Apply silicone gasket and sealant to the front cover in 2 places as shown.



5. **NOTE:** Make sure the stud bolts are installed in their original positions.

   Position the engine front cover and install the 10 bolts.

   - Tighten to 19 Nm (168 lb-in).

6. **NOTE:** Make sure the coolant bypass hose is attached to the coolant pump.

   Position the thermostat housing and install the 3 bolts.

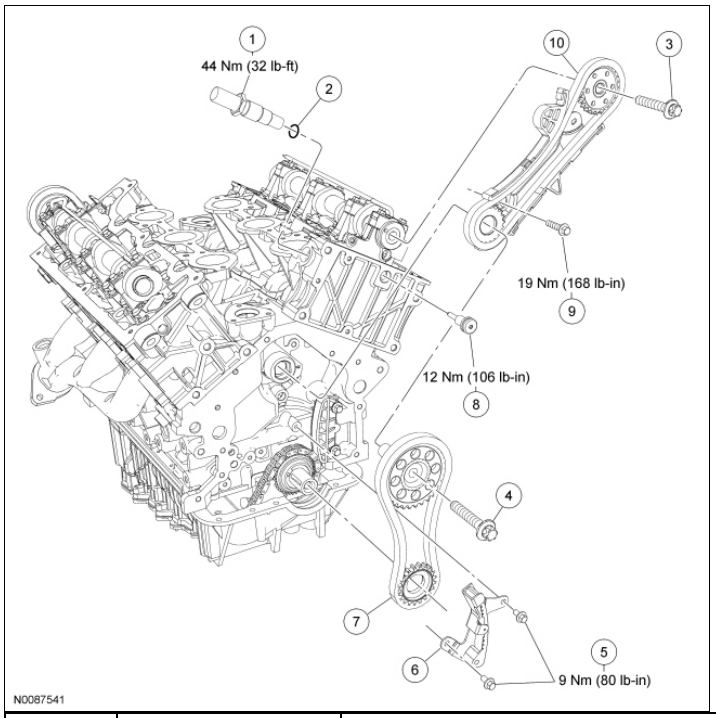
- Tighten to 11 Nm (97 lb-in).

7. Position the bypass hose clamp.
8. Connect the upper radiator hose to the thermostat housing.
9. Connect the heater hose to the thermostat housing.
10. Connect the ECT sensor electrical connector.
11. Install new wiring harness retainers and position the CKP sensor wiring.
12. Connect the CKP sensor electrical connector.
13. Position the A/C compressor and power steering pump bracket and install the 4 bolts.
    - Tighten to 42 Nm (31 lb-ft).
14. Install the ignition coil bracket-to-A/C compressor and power steering pump bracket bolt.
    - Tighten to 10 Nm (89 lb-in).
15. Position the generator bracket and install the 3 bolts.
    - Tighten to 42 Nm (31 lb-ft).
16. Connect the generator electrical connector and attach the wiring harness retainer.
17. Connect the generator B+ terminal and install the nut.
    - Tighten to 8 Nm (71 lb-in).
18. Connect the heater hose to the coolant pump.
19. Position the accessory drive belt tensioner and install the bolt.
    - Tighten to 47 Nm (35 lb-ft).
20. Connect the lower radiator hose.
21. Install the 5 cylinder block cradle-to-front cover bolts.
    - Tighten to 14 Nm (124 lb-in).
22. Position the wiring harness bracket and install the nut.
    - Tighten to 20 Nm (177 lb-in).
23. Install the crankshaft front seal. For additional information, refer to Crankshaft Front Seal in this section.
24. Connect the battery ground cable. For additional information, refer to Section 414-01 .
25. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Camshaft Drive Cassette - LH

Special Tool(s)

 ST1776-A	Adapter for 303-564 303-578 (T97T-6256-A)
 ST1777-A	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256)
 ST2694-A	Holding Tool, Crankshaft 303-674



Item	Part Number	Description
1	6K254	Hydraulic chain tensioner
2	-	Hydraulic chain tensioner washer
3	6M276	Camshaft sprocket bolt
4	6M276	Jackshaft sprocket bolt
5	W500011	Jackshaft chain tensioner bolts (2 required)
6	6M271	Jackshaft chain tensioner
7	-	Jackshaft chain and sprocket assembly
8	6U001	LH cassette upper bolt
9	W500110	LH cassette lower bolt

10	6M289	LH cassette

Removal

1. Remove the valve covers. For additional information, refer to Valve Cover - RH and Valve Cover - LH in this section.

2. Remove the fuel rail. For additional information, refer to Section 303-04A .

3. Remove the engine front cover. For additional information, refer to Engine Front Cover in this section.

4. Remove the thermostat housing. For additional information, refer to Section 303-03 .

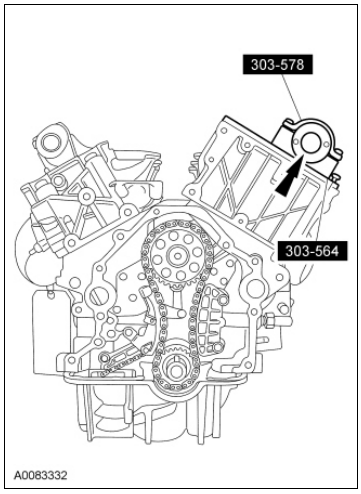
5. Remove all of the roller followers. For additional information, refer to Camshaft Roller Follower in this section.

6. **NOTE:** The LH and RH camshafts must be retimed when either camshaft is disturbed.

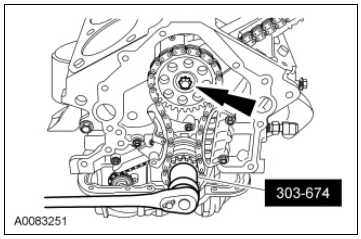
   Turn the crankshaft clockwise to position the No. 1 cylinder at Top Dead Center (TDC).

7. Remove the LH hydraulic chain tensioner.
   - Discard the washer.

8. Remove the LH camshaft sprocket bolt.
   - Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 and tighten the bolts to 10 Nm (89 lb-in).
   - Remove the LH camshaft sprocket bolt.

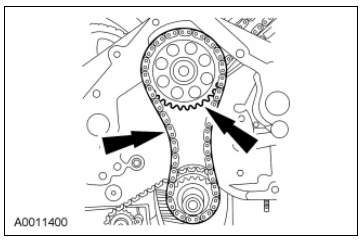


9. Using the Crankshaft Holding Tool to prevent the crankshaft from turning, remove the jackshaft sprocket bolt.



10. Remove the 2 bolts and the primary chain tensioner.

11. Remove the primary chain and sprockets as an assembly.



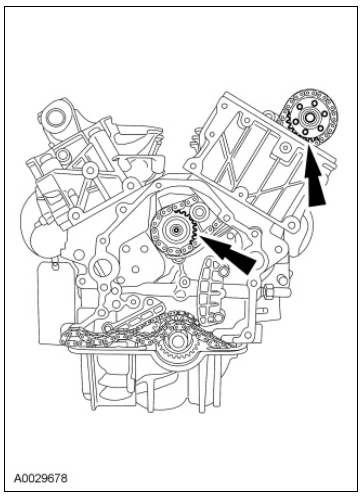
12. Remove the LH cassette upper bolt.

13. Remove the LH cassette lower bolt and the LH cassette.

Installation

1. **NOTE:** The camshaft chain sprockets must be oriented correctly.

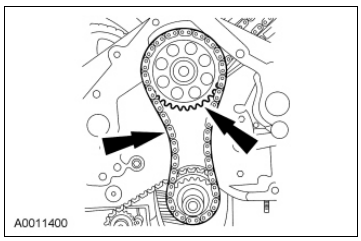
   Position the LH cassette.



2. Install the LH cassette lower bolt.
   - Tighten to 19 Nm (168 lb-in).

3. Install the LH cassette upper bolt.
   - Tighten to 12 Nm (106 lb-in).

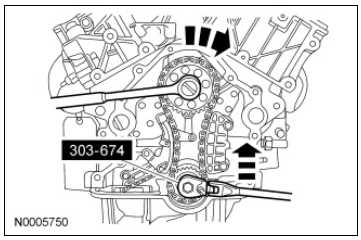
4. Install the jackshaft chain and sprockets as an assembly.



5. Install the jackshaft chain tensioner and the 2 bolts.
   - Tighten to 9 Nm (80 lb-in).

6. Using the Crankshaft Holding Tool to prevent the crankshaft from turning, tighten the jackshaft sprocket bolt in 2 stages.

- Stage 1: Tighten to 45 Nm (33 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



7. Loosely install the camshaft sprocket bolt.

8. Install the engine front cover. For additional information, refer to Engine Front Cover in this section.

9. **NOTE:** The LH and RH camshafts must be retimed when either camshaft is disturbed.

   NOTE: Install the LH hydraulic chain tensioner during camshaft timing.

   Retime the LH and RH camshafts. For additional information, refer to Camshaft Timing in this section.

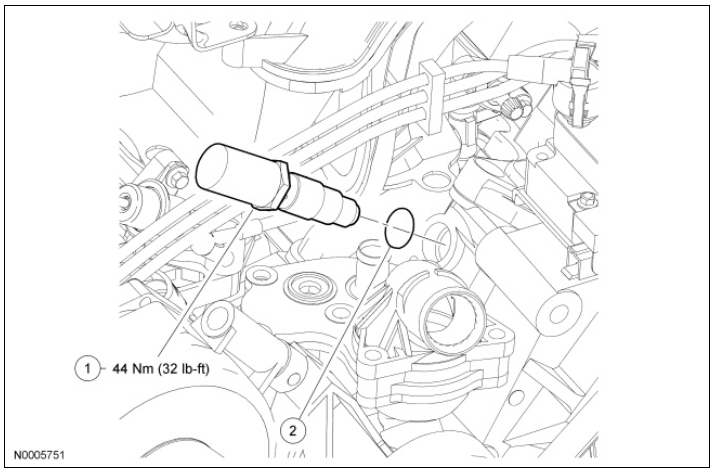
10. Install the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.

11. Install the fuel rail. For additional information, refer to Section 303-04A .

12. Install the valve covers. For additional information, refer to Valve Cover - RH and Valve Cover - LH in this section.

13. Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

Hydraulic Timing Chain Tensioner - LH



Item	Part Number	Description
1	6K524	LH hydraulic timing chain tensioner
2	-	LH hydraulic timing chain tensioner washer

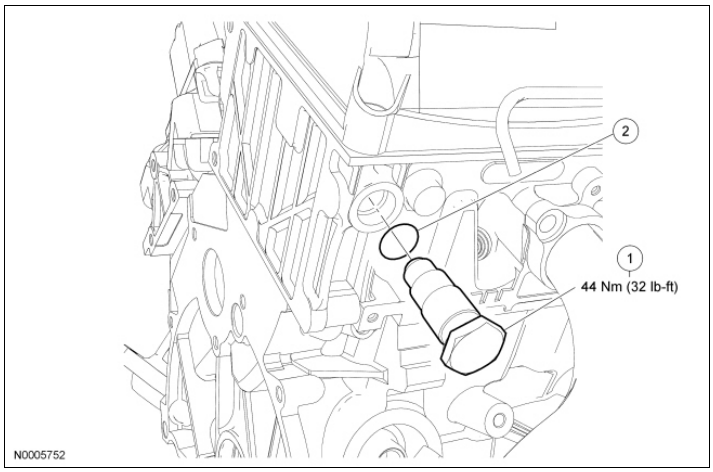
Removal and Installation

1. Remove the hydraulic timing chain tensioner.
   - To install, tighten to 44 Nm (32 lb-ft).

2. Remove and discard the washer.

3. To install, reverse the removal procedure.
   - Install a new hydraulic timing chain tensioner washer.

Hydraulic Timing Chain Tensioner - RH



Item	Part Number	Description
1	6K254	RH hydraulic timing chain tensioner
2	-	RH hydraulic timing chain tensioner washer

Removal and Installation

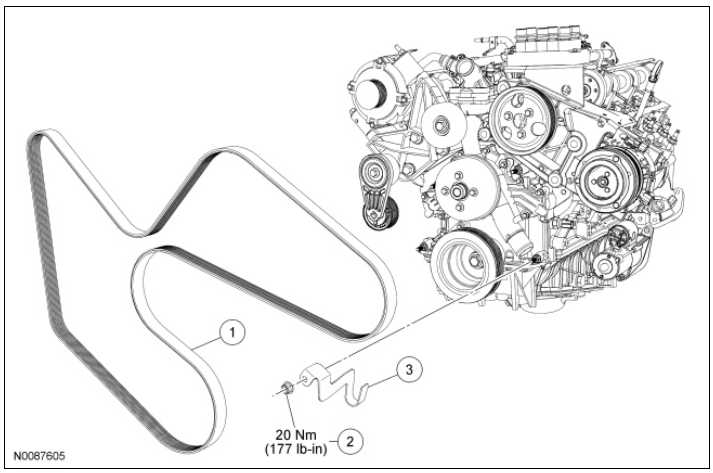
1. Remove the hydraulic timing chain tensioner.
   - To install, tighten to 44 Nm (32 lb-ft).

2. Remove and discard the washer.

3. To install, reverse the removal procedure.
   - Install a new hydraulic timing chain tensioner washer.

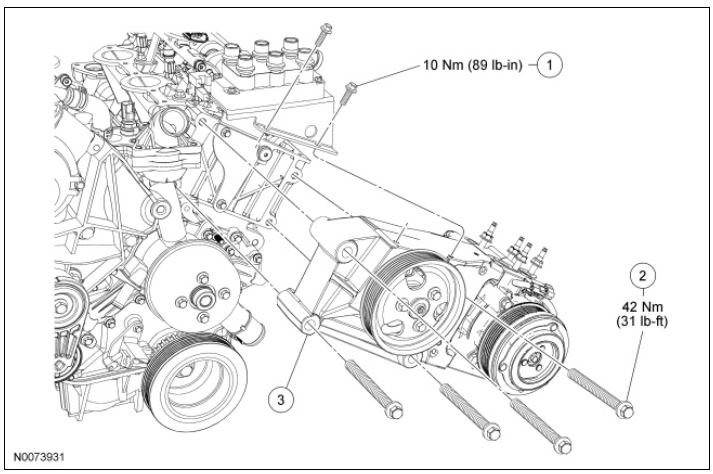
Valve Train Components - Exploded View

Accessory Drive Belt and Wiring Harness Bracket



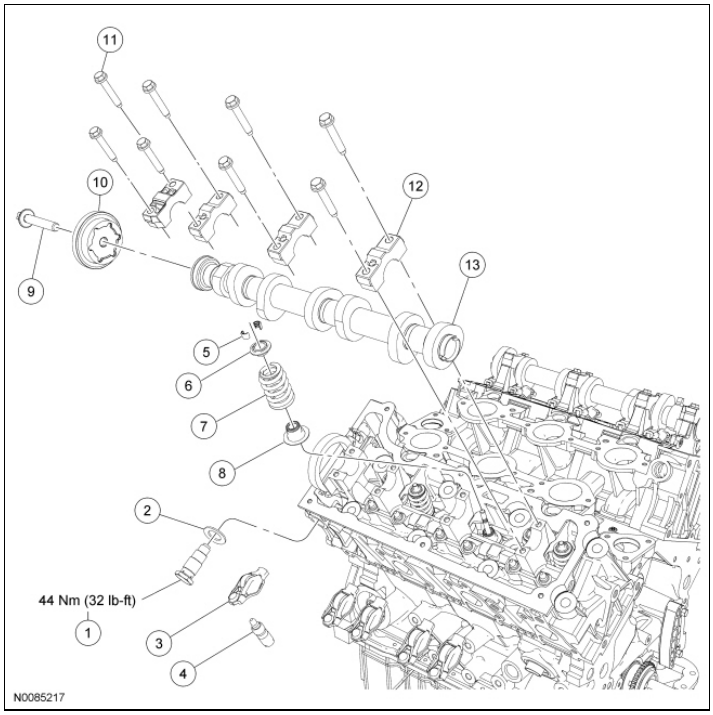
Item	Part Number	Description
1	8620	Accessory drive belt
2	W520102	Wiring harness bracket nut
3	10A779	Wiring harness bracket (part of 14A280)

A/C Compressor and Power Steering Pump Bracket



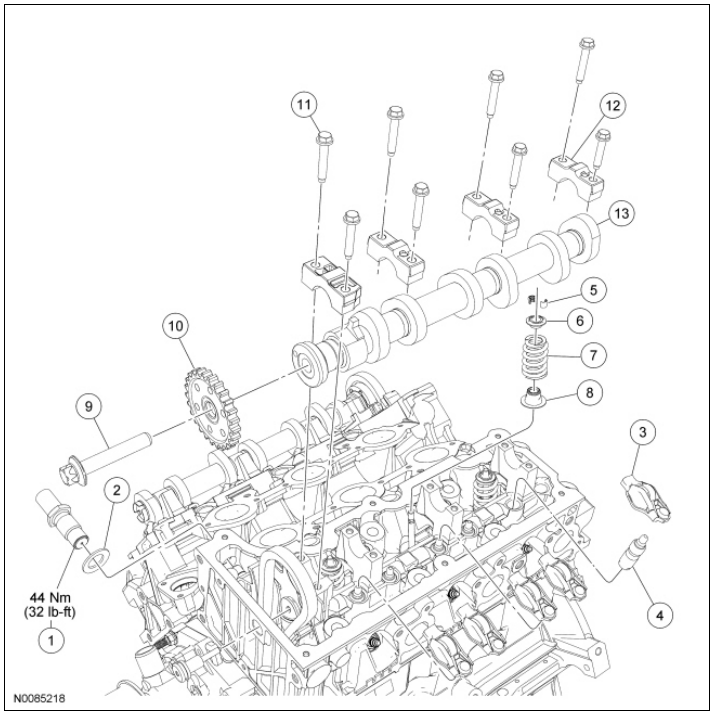
Item	Part Number	Description
1	-	Ignition coil bracket-to-A/C compressor and power steering pump bracket bolt (2 required)
2	N807938	A/C compressor and power steering pump bracket bolt (4 required)
3	19E708	A/C compressor and power steering pump bracket

Valve Train Components - RH



Item	Part Number	Description
1	6K254	RH hydraulic timing chain tensioner
2	-	RH hydraulic timing chain tensioner washer
3	6529	Camshaft roller follower (6 required)
4	6C501	Hydraulic lash adjuster
5	6518	Valve spring retainer key (12 required)
6	6A536	Valve spring retainer (6 required)
7	6513	Valve spring (6 required)
8	6571	Valve seal (6 required)
9	6M276	RH camshaft sprocket bolt
10	6256	RH camshaft sprocket
11	W702341	Camshaft bearing cap bolt (8 required)
12	6A258	Camshaft bearing cap (4 required)
13	6250	RH camshaft

Valve Train Components - LH



Item	Part Number	Description
1	6K254	LH hydraulic timing chain tensioner
2	-	LH hydraulic timing chain tensioner washer
3	6529	Camshaft roller follower (6 required)
4	6C501	Hydraulic lash adjuster
5	6518	Valve spring retainer key (12 required)
6	6A536	Valve spring retainer (6 required)
7	6513	Valve spring (6 required)
8	6571	Valve seal (6 required)
9	6M276	LH camshaft sprocket bolt
10	6M267	LH camshaft sprocket
11	W702341	Camshaft bearing cap bolt (8 required)
12	6A258	Camshaft bearing cap (4 required)
13	6A274	LH camshaft

1. For additional information, refer to the procedures in this section.

Camshafts

Special Tool(s)

 ST1776-A	Adapter for 303-564 303-578 (T97T-6256-A) or equivalent
 ST1780-A	Extension, Torque Wrench 303-575 (T97T-6256-F) or equivalent
 ST1777-A	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B) or equivalent
 ST1781-A	Socket, Camshaft Sprocket Nut 303-565 (T97T-6256-G)
 ST1775-A	Timing Tool, Crankshaft TDC 303-573 (T97T-6303-A) or equivalent

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Removal

Both sides

1. Remove the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.

2. Remove the nut and position the wiring harness bracket aside.

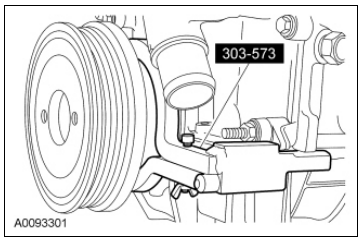
3. **NOTE:** Carry out the RH and LH camshaft timing procedure when either camshaft is serviced.

   Rotate the crankshaft clockwise to position the No. 1 cylinder at Top Dead Center (TDC).

4. ***NOTICE:*** **Do not rotate the engine counterclockwise. Rotating the engine counterclockwise will result in damage to the damper crankshaft sensor speed wheel and incorrect timing of the engine.**

NOTE: The Crankshaft TDC Timing Tool must be installed on the damper and should contact the engine block. This positions the piston at TDC .

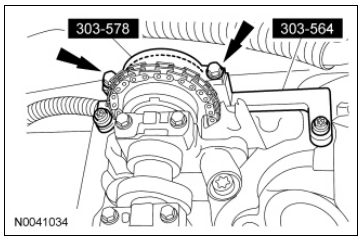
Install the Crankshaft TDC Timing Tool.



RH side

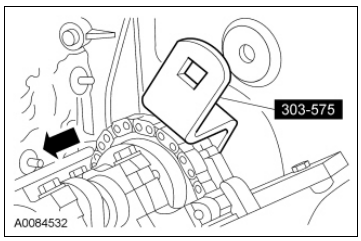
5. Remove the RH hydraulic timing chain tensioner.
   - Discard the washer.

6. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the rear of the RH cylinder head and tighten the top 2 clamp bolts to 10 Nm (89 lb-in).



7. ***NOTICE:*** **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

   Using the Torque Wrench Extension and the Camshaft Sprocket Nut Socket, loosen the camshaft sprocket bolt.

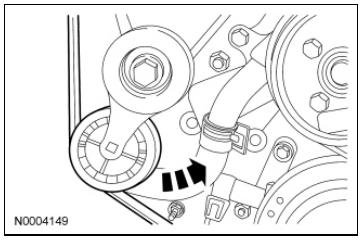


8. Remove the bolt and position the camshaft sprocket aside.

LH side

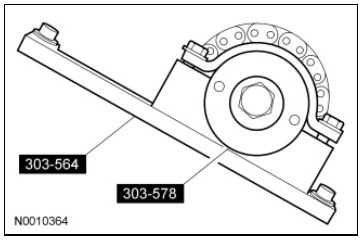
9. Remove the LH hydraulic timing chain tensioner.
   - Discard the washer.

10. Rotate the accessory drive belt tensioner counterclockwise and detach the accessory drive belt from the A/C compressor and power steering pump pulleys.



11. Remove the bolts and position the A/C compressor and power steering pump bracket aside.

12. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the front of the LH camshaft and tighten the 2 top clamp bolts to 10 Nm (89 lb-in).

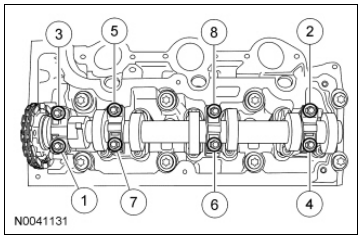


13. Remove the bolt and position the camshaft sprocket aside.

Both sides

14. **NOTE:** Mark the position of the camshaft bearing caps so they can be installed in their original positions.

    Remove the 8 bolts for each set of camshaft bearing caps in the sequence shown and remove the camshaft bearing caps.



15. Remove the camshaft.

Installation

NOTE: Lubricate the camshaft journal bearing surfaces on the cylinder head, the camshaft journals and the camshaft bearing caps with clean engine oil.

Both sides

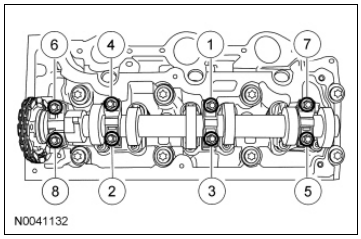
1. Install the camshaft.

2. **NOTE:** The camshaft bearing caps must be installed in their original positions.

   NOTE: After installing the bolts, check the camshaft for free rotation.

   Position the camshaft bearing caps and the 8 bolts for each set of camshaft bearing caps.

- Tighten the bolts in the sequence shown in 2 stages.
  - ♦ Stage 1: Tighten to 6 Nm (53 lb-in).
  - ♦ Stage 2: Tighten to 16 Nm (142 lb-in).



RH side

3. ***NOTICE:*** **The camshaft gear must turn freely on the camshaft. DO NOT tighten the bolt at this time. Tightening the bolt may result in incorrect engine timing.**

   NOTICE: **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

   Install the camshaft sprocket and loosely install the bolt.

LH side

4. ***NOTICE:*** **The camshaft gear must turn freely on the camshaft. DO NOT tighten the bolt at this time. Tightening the bolt may result in incorrect engine timing.**

   Install the camshaft sprocket and loosely install the bolt.

Both sides

5. Time the camshafts. For additional information, refer to Camshaft Timing in this section.

Camshaft Roller Follower

Special Tool(s)

 ST1330-A	Compressor, Valve Spring 303-581 (T97T-6565-A)

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

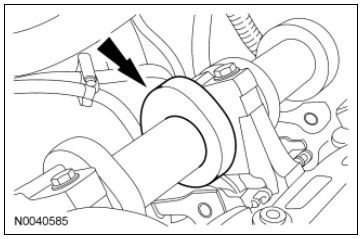
Removal and Installation

1. Remove the LH and RH valve covers. For additional information, refer to Valve Cover - RH and Valve Cover - LH in this section.

2. Remove the fuel rail. For additional information, refer to Section 303-04A .

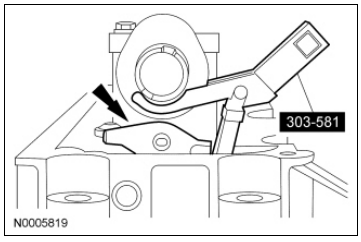
3. Remove the cooling fan. For additional information, refer to Section 303-03 .

4. Rotate the crankshaft until the camshaft for the cylinder being serviced is at base circle.



5. **NOTE:** Mark each camshaft roller follower to make sure it is returned to its original position.

   Using the Valve Spring Compressor, remove the camshaft roller followers.



6. **NOTE:** The camshaft roller followers must be installed in their original positions.

   NOTE: Lubricate the camshaft roller followers with clean engine oil.

   To install, reverse the removal procedure.

Valve Springs

Special Tool(s)

 ST1330-A	Compressor, Valve Spring 303-581 (T97T-6565-A)

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Removal and Installation

1. Remove the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.

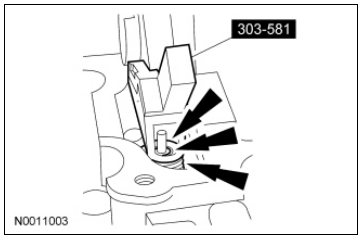
2. Position the piston of the cylinder being serviced at Top Dead Center (TDC).

3. ***NOTICE:*** **If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal.**

   Hold the valves in the cylinder head.

   - Remove the spark plug of the cylinder being serviced.
   - Use a suitable tool to apply air pressure to the cylinder.

4. Using the Valve Spring Compressor, remove the valve spring retainer keys, the valve spring retainers and the valve springs.



5. **NOTE:** Lubricate the valve springs, the retainers and the retainer keys with clean engine oil.

   To install, reverse the removal procedure.

Valve Seals

Special Tool(s)

 ST1824-A	Installer, Valve Stem Seal 303-370 (T90T-6571-A)

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

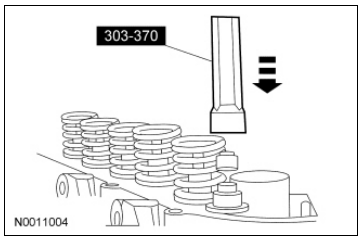
Removal

1. Remove the valve springs. For additional information, refer to Valve Springs in this section.
2. Remove the valve seals.

Installation

1. **NOTE:** Lubricate the valve seals with clean engine oil.

   Using the Valve Stem Seal Installer, install the valve seal.



2. Install the valve springs. For additional information, refer to Valve Springs in this section.

Hydraulic Lash Adjuster

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Removal and Installation

1. Remove the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.

2. **NOTE:** Mark each hydraulic lash adjuster to make sure it is returned to its original position.

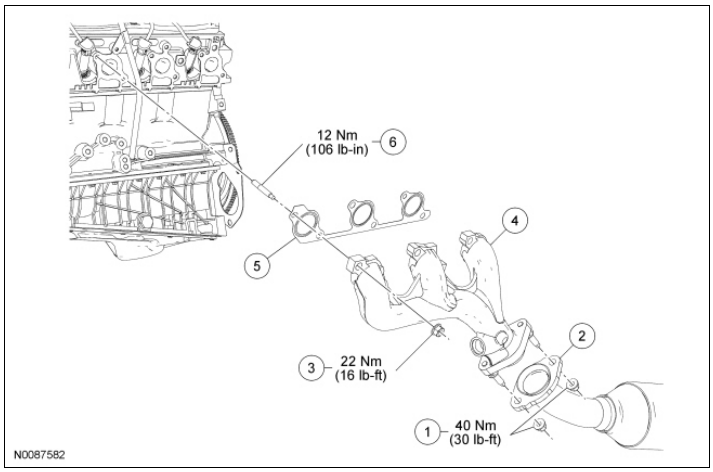
   Remove the hydraulic lash adjusters.

3. **NOTE:** The hydraulic lash adjusters must be installed in their original positions.

   NOTE: Lubricate the hydraulic lash adjusters with clean engine oil.

   To install, reverse the removal procedure.

Exhaust Manifold - LH



Item	Part Number	Description
1	W701706	Exhaust manifold-to-dual converter Y-pipe nuts (4 required)
2	5F250	Dual converter Y-pipe
3	W701706	LH exhaust manifold nut (6 required)
4	9431	LH exhaust manifold
5	9448	LH exhaust manifold gasket
6	W705495	LH exhaust manifold stud (6 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 4 exhaust manifold-to-dual converter Y-pipe nuts and position the dual converter Y-pipe aside.
   - Discard the nuts.

3. Remove the 6 nuts, the LH exhaust manifold and the gasket.
   - Discard the nuts and the gasket.

4. Remove and discard the 6 LH exhaust manifold studs.

Installation

1. Inspect the LH exhaust manifold gasket surfaces for flatness. For additional information, refer to Section 303-00 .

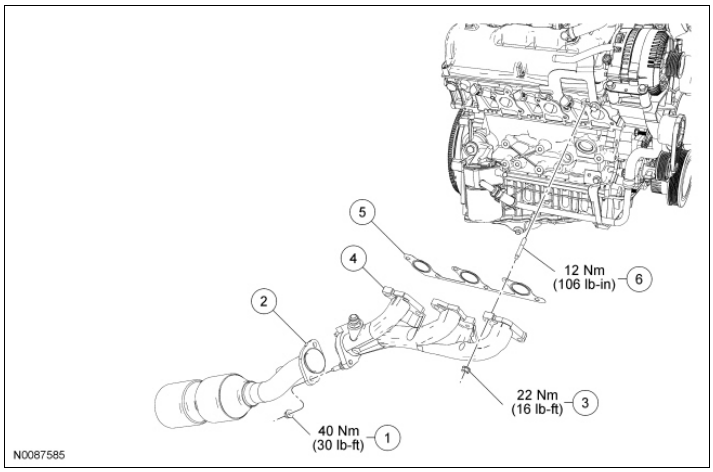
2. Install 6 new LH exhaust manifold studs.
   - Tighten to 12 Nm (106 lb-in).

3. Position a new gasket, the LH exhaust manifold and install 6 new nuts.

- Tighten to 22 Nm (16 lb-ft).

4. Position the dual converter Y-pipe and install 4 new nuts.
   - Tighten to 40 Nm (30 lb-ft).

Exhaust Manifold - RH



Item	Part Number	Description
1	W701706	Exhaust manifold-to-dual converter Y-pipe nut (4 required)
2	5F250	Dual converter Y-pipe
3	W701706	RH exhaust manifold nut (6 required)
4	9430	RH exhaust manifold
5	9448	RH exhaust manifold gasket
6	W705495	RH exhaust manifold stud (6 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the EGR tube. For additional information, refer to Section 303-08 .

3. Remove the 4 exhaust manifold-to-dual converter Y-pipe nuts and position the dual converter Y-pipe aside.
   - Discard the nuts.

4. Remove the 6 nuts, the RH exhaust manifold and the gasket.
   - Discard the nuts and the gasket.

5. Remove and discard the 6 RH exhaust manifold studs.

Installation

1. Inspect the RH exhaust manifold gasket surfaces for flatness. For additional information, refer to Section 303-00 .

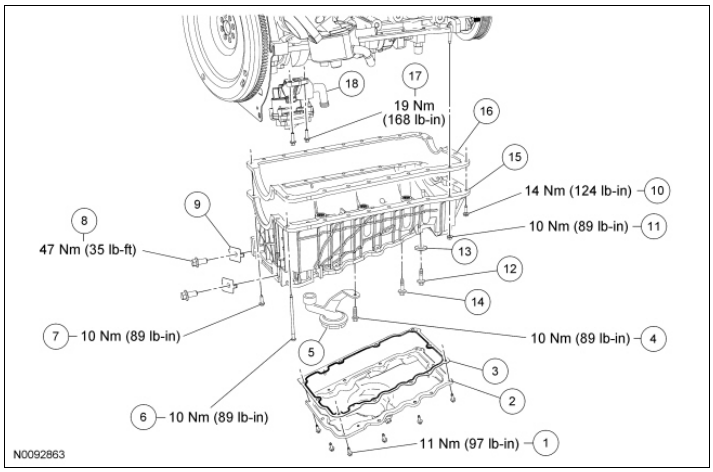
2. Install 6 new RH exhaust manifold studs.
   - Tighten to 12 Nm (106 lb-in).

3. Position a new gasket, the RH exhaust manifold and install 6 new nuts.
    - Tighten to 22 Nm (16 lb-ft).

4. Position the dual converter Y-pipe and install 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

5. Install the EGR tube. For additional information, refer to Section 303-08 .

Engine Lubrication Components - Exploded View



Item	Part Number	Description
1	E802185	Oil pan bolt (10 required)
2	6675	Oil pan
3	6710-A	Oil pan gasket
4	W500214	Oil pump screen and pickup tube bolt
5	6617	Oil pump screen and pickup tube
6	E804588	Cylinder block cradle Torx bolt
7	W709198-S437	Cylinder block cradle Torx bolt
8	E802185	Transmission-to-cylinder block cradle bolt (2 required)
9	6C629	Bell housing-to-cylinder block cradle spacer (2 required)
10	W503275	Cylinder block cradle bolt (outside) (20 required)
11	E822125	Cylinder block cradle nut (2 required)
12	W702323	Cylinder block cradle bolt (inside) (2 required)
13	6734	Washer (2 required)
14	W702323	Cylinder block cradle bolt (inside) (6 required)
15	6F092	Cylinder block cradle
16	6710	Cylinder block cradle gasket
17	W708582	Oil pump bolt (2 required)
18	6600	Oil pump

1. For additional information, refer to the procedures in this section.

Oil Pan

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the drain plug and drain the engine oil.
   - To install, tighten to 26 Nm (19 lb-ft).

3. Remove the 10 bolts, the oil pan and the gasket. Discard the gasket.
   - To install, tighten to 11 Nm (97 lb-in).

4. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the old oil pan gasket.**

   Clean and inspect the sealing surfaces.

5. To install, reverse the removal procedure.

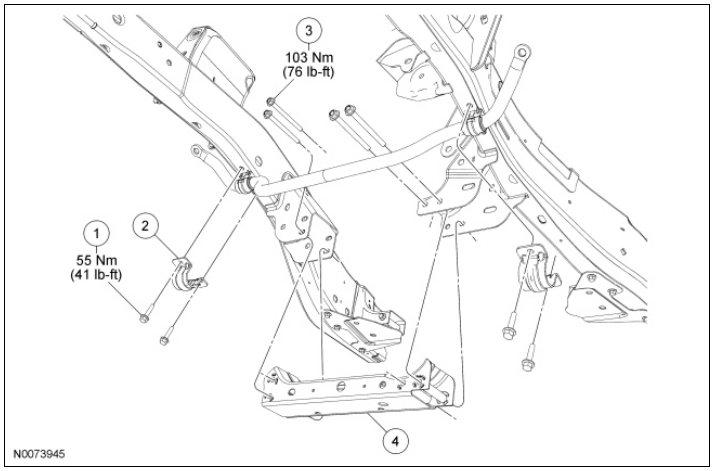
6. Fill the engine with clean engine oil.

Cylinder Block Cradle

Material

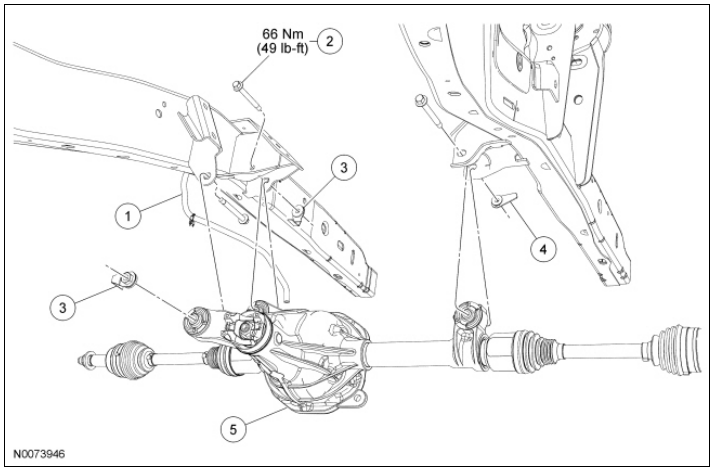
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

Stabilizer Bar and Crossmember



Item	Part Number	Description
1	W707472	Stabilizer bar bracket bolt (4 required)
2	3B353	Stabilizer bar bracket (2 required)
3	5D120	Crossmember bolt (4 required)
4	5E138	Crossmember

Front Axle - Four-Wheel Drive (4WD) Vehicles



Item	Part Number	Description
1	3B476	Axle housing vent hose
2	W506549	Axle housing bolt (3 required)
3	W706348	Axle housing flagnuts (2 required)
4	W708348	Axle housing flagnut
5	3002	Axle housing

Removal

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the starter. For additional information, refer to Section 303-06 .
4. Remove the oil pump screen and pickup tube. For additional information, refer to Oil Pump Screen and Pickup Tube in this section.

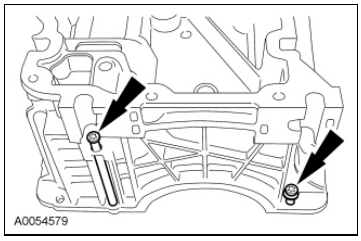
All-Wheel Drive (AWD) vehicles

5. Remove the 4 bolts and the 2 stabilizer bar brackets.
6. Remove the 4 bolts and the crossmember.

All vehicles

7. Remove the 2 transmission-to-cylinder block cradle bolts.
8. **NOTE:** Cylinder block cradle is shown removed for clarity. Note the location of the 2 Torx head bolts at the rear of the cylinder block cradle.

   Remove the 2 cylinder block cradle rear bolts.



9. Remove the 20 bolts and 2 nuts along the outside of the cylinder block cradle.

10. **NOTE:** Note the location of the 2 silver-colored bolts that have washer seals. They must be installed in the same position with new washer seals.

    Remove the 8 cylinder block cradle inner bolts and the 2 washer seals.

    - Discard the washer seals.

AWD vehicles

11. ⚠ **WARNING: Secure the assembly to the jack. Avoid any obstructions while lowering and raising the jack. Contact with obstructions may cause the assembly to fall off the jack, which may result in serious personal injury.**

    Support the front axle with a suitable transmission jack.

12. Disconnect the vent hose from the axle housing vent tube.

13. ***NOTICE:*** **Any time bolts, washers, spacers or nuts are loosened in the axle housing for any reason, install new components to prevent damage.**

    Remove and discard the 3 axle housing bolts and 3 flagnuts. Lower the axle.

All vehicles

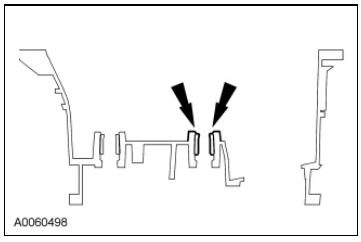
14. Remove the cylinder block cradle.

Installation

All vehicles

1. ***NOTICE:*** **Failure to back off the set screws may result in damage to the cylinder block cradle.**

   Back the set screws off until they are below the cylinder block cradle boss.

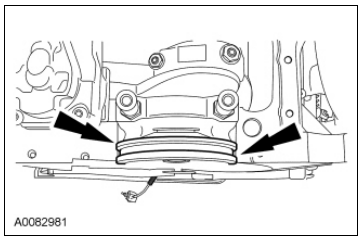


2. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the old cylinder block cradle gasket and**

sealant.

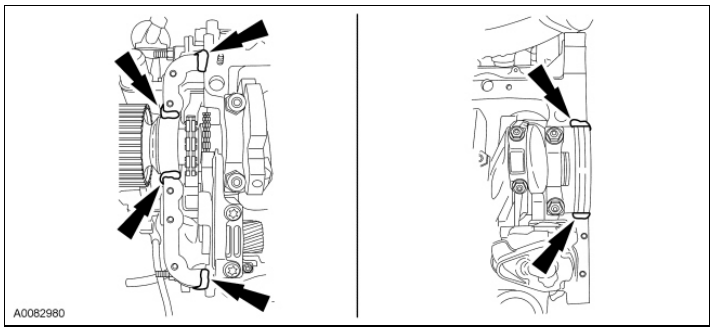
NOTE: Gasket material as well as silicone sealant may be present in the cavities in the main bearing cap. This material must be removed completely prior to assembly.

Clean the gasket mating surfaces, making sure all the sealant is removed from the cavities on the rear main bearing cap. To clean the sealing area, use a plastic scraping tool, silicone gasket remover and metal surface prep. Follow the directions on the packaging.



3. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure may cause future oil leakage.

   Apply silicone in the 6 places shown.



4. Position a new gasket and the cylinder block cradle. Install the outer 20 bolts and 2 nuts finger-tight.

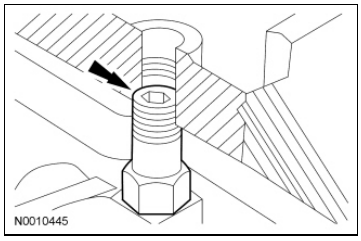
5. Install the 2 cylinder block cradle rear Torx bolts finger-tight.

6. Install the 2 transmission-to-cylinder block cradle bolts.
   - Tighten to 47 Nm (35 lb-ft).

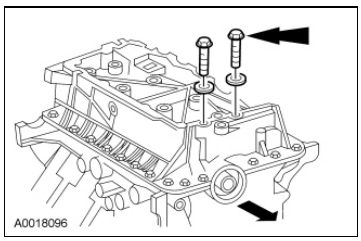
7. Tighten the outer 20 bolts and 2 nuts.
   - Tighten the nuts to 10 Nm (89 lb-in).
   - Tighten the bolts to 14 Nm (124 lb-in).

8. Tighten the 2 cylinder block cradle rear Torx bolts.
   - Tighten to 10 Nm (89 lb-in).

9. Tighten the 8 inserts.
   - Tighten to 3 Nm (27 lb-in).

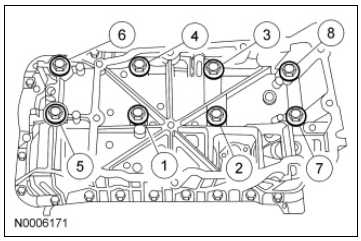


10. Install the 2 silver-colored bolts and new washer seals finger-tight.



11. Install the 6 remaining inner bolts finger-tight.

12. Tighten the 8 inner bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 15 Nm (133 lb-in).
    - Stage 2: Tighten to 34 Nm (25 lb-ft).



AWD vehicles

13. ***NOTICE:*** **Any time bolts, washers, spacers or nuts are loosened in the axle housing for any reason, install new components to prevent damage.**

    Raise the axle housing into position and install 3 new bolts and nuts.

    - Tighten to 66 Nm (49 lb-ft).

14. Connect the vent hose to the differential housing vent tube.

15. Position the crossmember and install the 4 bolts.
    - Tighten to 103 Nm (76 lb-ft).

16. Position the 2 stabilizer bar brackets and install the 4 bolts.
    - Tighten to 55 Nm (41 lb-ft).

All vehicles

17. Install the oil pump screen and pickup tube. For additional information, refer to Oil Pump Screen and Pickup Tube in this section.

18. Install the starter. For additional information, refer to Section 303-06 .

19. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Oil Pump

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

1. Remove the cylinder block cradle. For additional information, refer to Cylinder Block Cradle in this section.

2. Remove the 2 bolts and the oil pump.
   - To install, tighten to 19 Nm (168 lb-in).

3. To install, reverse the removal procedure.
   - Lubricate the oil pump with clean engine oil.

Oil Pump Screen and Pickup Tube

Removal and Installation

1. Remove the oil pan. For additional information, refer to Oil Pan in this section.

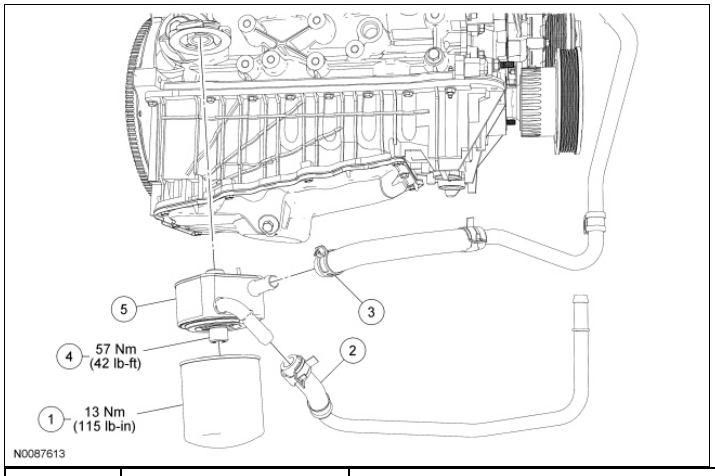
2. Remove the bolt and the oil pump screen and pickup tube.
   - To install, tighten to 10 Nm (89 lb-in).

3. To install, reverse the removal procedure.

Oil Cooler

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



Item	Part Number	Description
1	6714	Oil filter
2	6N867	Oil cooler inlet hose
3	84947	Heater hose
4	-	Oil cooler threaded insert (part of 6A642)
5	6A642	Oil cooler

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the cooling system. For additional information, refer to Section 303-03 .

3. Remove and discard the oil filter.
   - To install, tighten to 13 Nm (115 lb-in).

4. Disconnect the oil cooler inlet hose from the oil cooler.

5. Disconnect the heater hose from the oil cooler.

6. Loosen the threaded insert and remove the oil cooler.

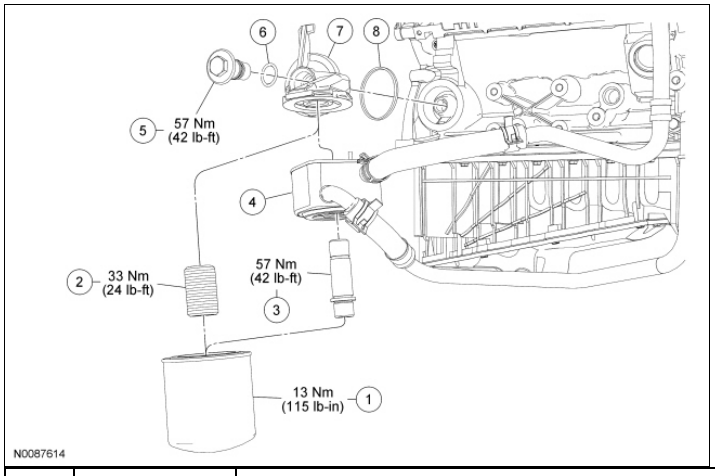
- To install, tighten to 57 Nm (42 lb-ft).

7. To install, reverse the removal procedure.
   - Install a new oil filter.
   - Check the engine oil and fill as necessary.

Oil Filter Adapter

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



Item	Part Number	Description
1	6714	Oil filter
2	6890	Oil filter adapter threaded insert (vehicles without an oil cooler)
3	-	Oil cooler threaded insert (part of 6A642) (oil cooler equipped vehicles only)
4	6A642	Oil cooler (oil cooler equipped vehicles only)
5	6895	Oil filter adapter bolt
6	E853188	Oil filter adapter bolt O-ring seal
7	6884	Oil filter adapter
8	6L621	Oil filter adapter gasket

Removal and Installation

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the RH exhaust manifold. For additional information, refer to Exhaust Manifold - RH in this section.

3. Remove and discard the oil filter.
   - To install, tighten to 13 Nm (115 lb-in).

Vehicles equipped with an oil cooler

4. **NOTE:** The oil cooler threaded insert is part of the oil cooler and is not removed.

   Loosen the oil cooler threaded insert and position the oil cooler aside.

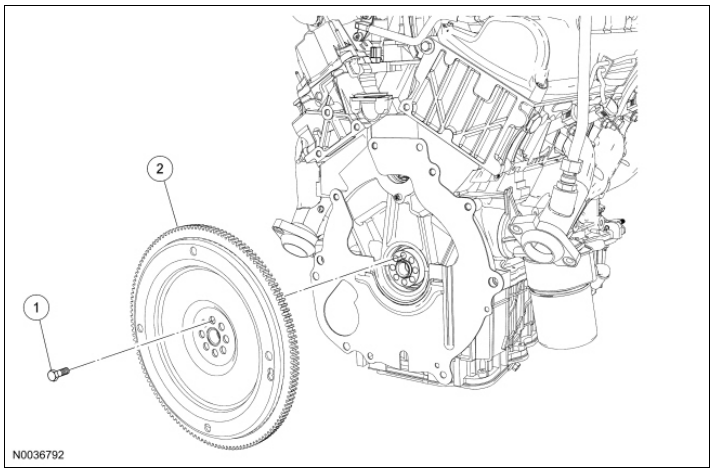
   - To install, tighten to 57 Nm (42 lb-ft).

All vehicles

5. Remove the bolt and the oil filter adapter.
   - To install, tighten to 57 Nm (42 lb-ft).

6. To install, reverse the removal procedure.
   - Install a new oil filter.
   - Check the engine oil and fill as necessary.

Flexplate



Item	Part Number	Description
1	6379	Flexplate bolt (8 required)
2	6375	Flexplate

Removal

1. Remove the transmission. For additional information, refer to Section 307-01A .

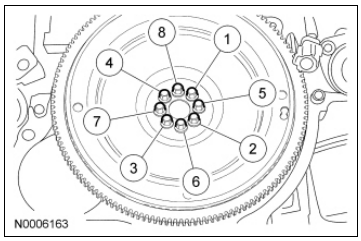
2. Remove the 8 bolts and the flexplate.
   - Discard the bolts.

Installation

1. **NOTE:** New flexplate bolts must be installed. They are a torque-to-yield design and cannot be reused.

   Install the flexplate. Tighten the 8 new bolts in 3 stages in the sequence shown.

   - Stage 1: Tighten to 13 Nm (115 lb-in).
   - Stage 2: Tighten to 50 Nm (37 lb-ft).
   - Stage 3: Tighten an additional 90 degrees.



2. Install the transmission. For additional information, refer to Section 307-01A .

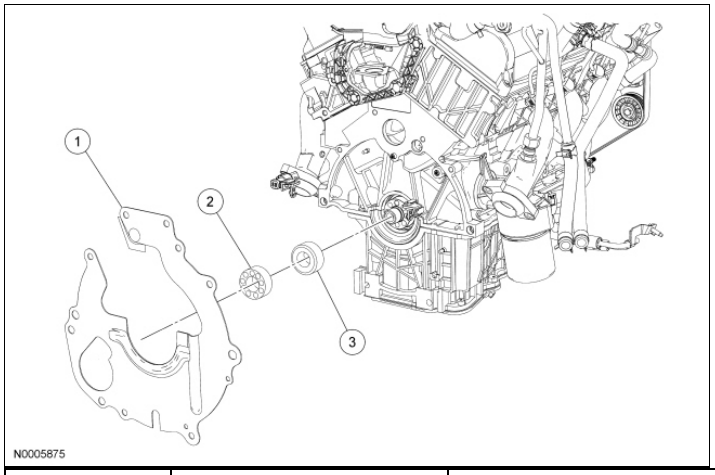
Crankshaft Rear Seal

Special Tool(s)

 ST3078-A	Adapter for 303-579 303-527 (T95T-6701-A3)
 ST2132-A	Installer, Crankshaft Rear Oil Seal 303-579 (T97T-6701-A)
 ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
 ST3077-A	Screws, Crankshaft Rear Oil Seal 303-528 (T95T-6701-A4)

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



Item	Part Number	Description
1	6A373	Spacer plate
2	6434	Flexplate-to-crankshaft spacer

3	6701	Crankshaft rear seal

Removal

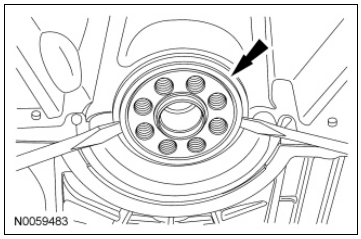
1. Remove the flexplate. For additional information, refer to Flexplate in this section.

2. Remove the spacer plate.

3. Remove the flexplate-to-crankshaft spacer.

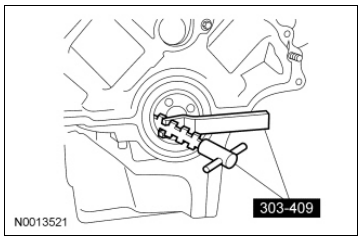
4. **NOTE:** The original crankshaft rear seal does not have a metal speedy sleeve. Replacement rear crankshaft seals come with a speedy sleeve. If present, this sleeve must be removed before attempting to remove the seal.

   If necessary, remove the speedy sleeve using 2 screwdrivers or small pry bars.



5. ***NOTICE:*** **Avoid scratching or damaging the crankshaft rear seal running surface during removal of the crankshaft rear seal. Scratches or other damage to the crankshaft may cause oil leaks.**

   Using the Oil Seal Remover, remove the crankshaft rear seal.



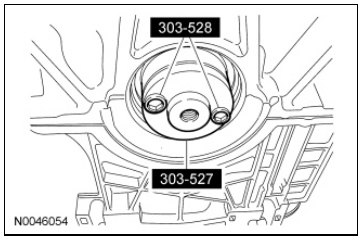
Installation

1. **NOTE:** The new replacement crankshaft rear seal comes with a speedy sleeve. The speedy sleeve must be installed with the crankshaft rear seal.

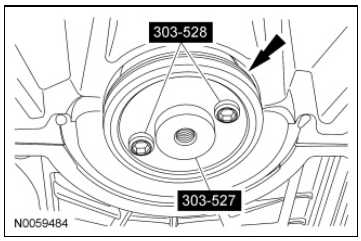
   NOTE: Be sure the crankshaft rear sealing surface is clean and free of any rust or corrosion. To clean the crankshaft rear seal surface area, use extra-fine emery cloth or extra-fine 0000 steel wool with metal surface prep.

   Lubricate the crankshaft rear oil seal with clean engine oil.

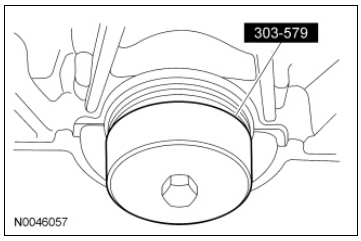
2. Install the Adapter for 303-579 and the Crankshaft Rear Oil Seal Screws.



3. Position the crankshaft rear seal with speedy sleeve on the Adapter for 303-579 and the Crankshaft Rear Oil Seal Screws.



4. Using the Crankshaft Rear Oil Seal Installer, install the crankshaft rear seal with speedy sleeve.



5. Install the flexplate-to-crankshaft spacer.

6. Install the spacer plate.

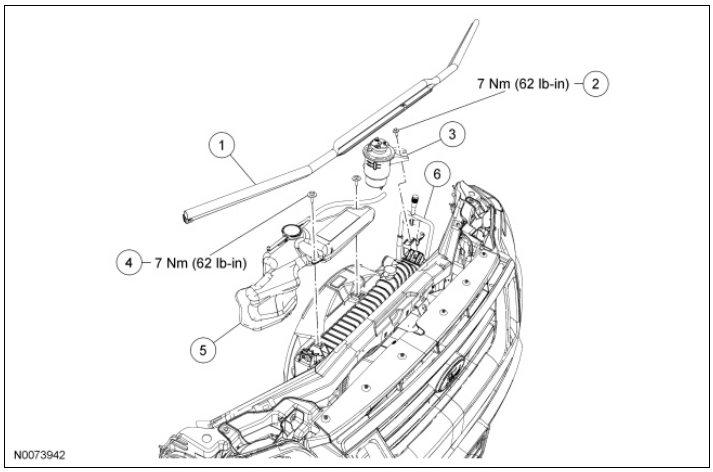
7. Install the flexplate. For additional information, refer to Flexplate in this section.

Engine Support Insulators

Special Tool(s)

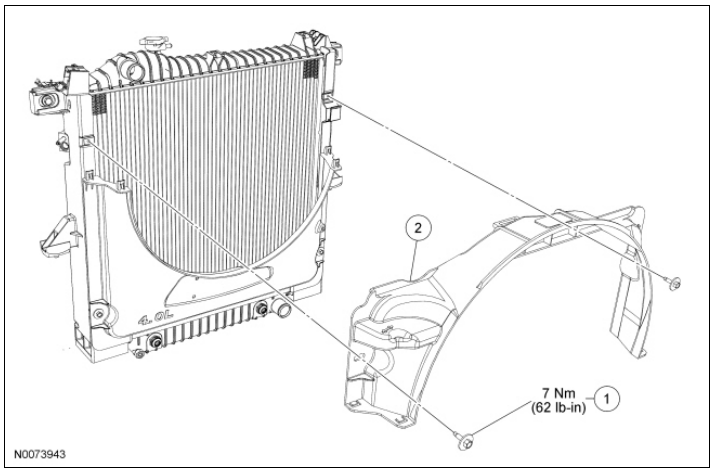
 ST2378-A	Adapter for 303-290A 303-290-01
 ST2379-A	Adapter for 303-290A 303-290A-03A
 ST1595-A	Lifting Bracket, Engine 303-050 (T70P-6000)
 ST2363-A	Support Bar, Engine 303-290A

Front End Components



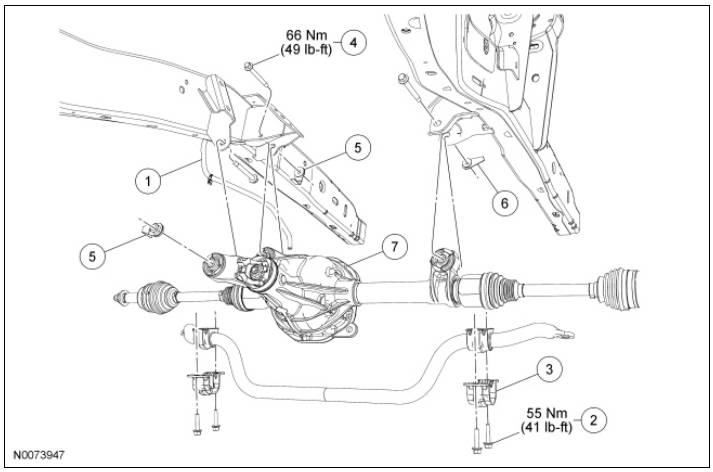
Item	Part Number	Description
1	16C824	Weatherstrip
2	W503924	Power steering fluid reservoir bolt
3	3R700	Power steering fluid reservoir
4	W709027	Coolant expansion tank bolt (2 required)
5	8C045	Coolant expansion tank
6	19972	A/C tube

Upper Cooling Fan Shroud



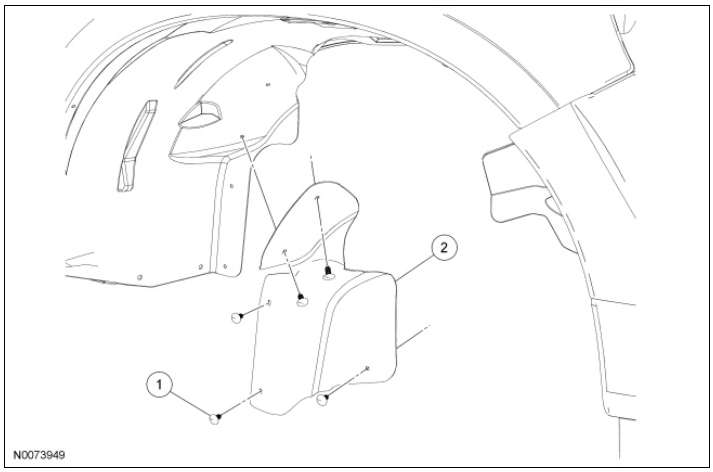
Item	Part Number	Description
1	W713417	Upper cooling fan shroud bolt (2 required)
2	8K618	Upper cooling fan shroud

Front Axle - Four-Wheel Drive (4WD) Vehicles



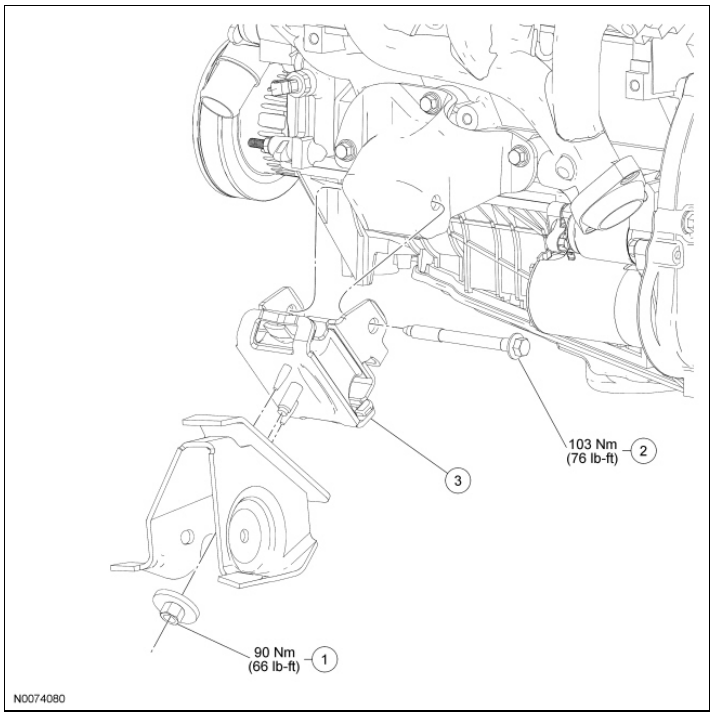
Item	Part Number	Description
1	3B476	Axle housing vent hose
2	W707472	Stabilizer bar bracket bolt (4 required)
3	3B353	Stabilizer bar bracket (2 required)
4	W506549	Axle housing bolt (3 required)
5	W706348	Axle housing flagnuts (2 required)
6	W708348	Axle housing flagnut
7	3010	Axle housing

RH Inner Fender Splash Shield



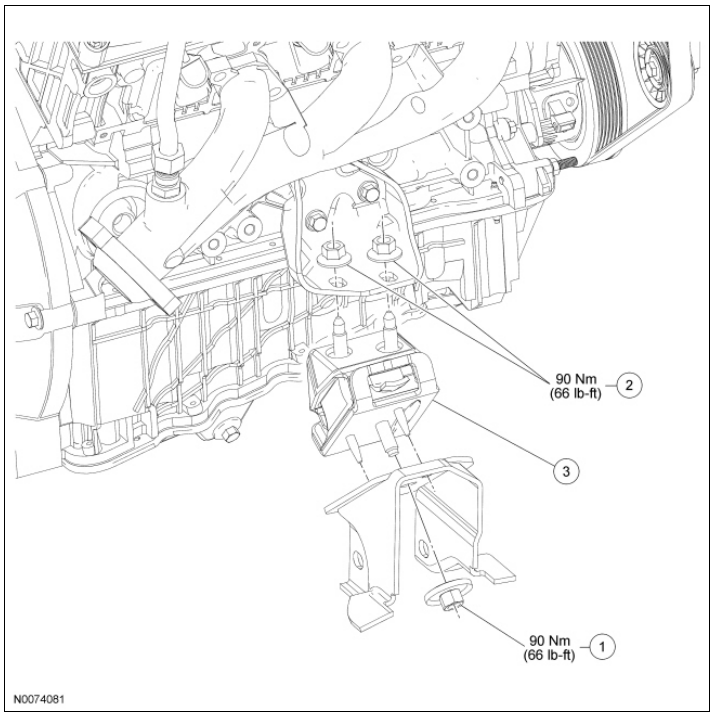
Item	Part Number	Description
1	388577	Inner fender splash shield pushpin (5 required)
2	16034	Inner fender splash shield

Engine Support Insulator - LH



Item	Part Number	Description
1	N802330	LH engine support insulator nut
2	W705694	LH engine support insulator through bolt
3	6038B	LH engine support insulator

Engine Support Insulator - RH



Item	Part Number	Description
1	N802330	RH engine support insulator lower nut
2	N802653	RH engine support insulator upper nuts (2 required)
3	6038A	RH engine support insulator

Removal and Installation

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the weatherstrip.

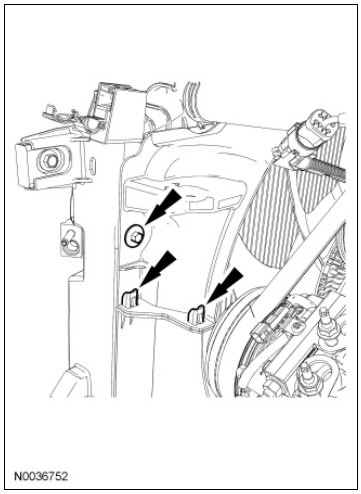
4. Remove the bolt and position the power steering fluid reservoir aside.
   - To install, tighten to 7 Nm (62 lb-in).

5. ***NOTICE:*** **Allow the engine to cool before removing the coolant expansion tank. The radiator draws coolant from the coolant expansion tank as the engine cools. If the coolant expansion tank is removed before the engine cools, the radiator will draw air into the system, resulting in possible engine damage.**

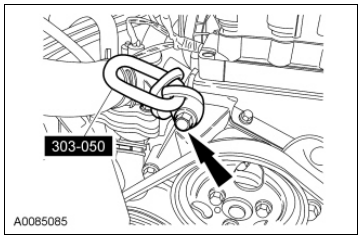
   Disconnect the coolant overflow hose. Remove the 2 bolts and the coolant expansion tank.

   - To install, tighten to 7 Nm (62 lb-in).

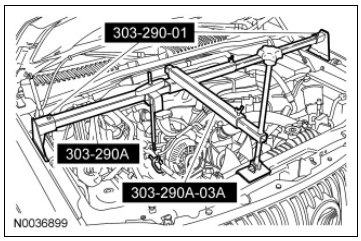
6. Remove the 2 bolts, unclip the clips and remove the upper fan shroud.
   - To install, tighten to 7 Nm (62 lb-in).



7. Remove the bolt and install the Engine Lifting Bracket.
    - Tighten to 42 Nm (31 lb-ft).



8. Install the Engine Support Bar and the 2 Adapters for 303-290A.



9. Remove the LH engine support insulator through bolt.
    - To install, tighten to 103 Nm (76 lb-ft).

10. Remove the 5 pushpins and the RH inner fender splash shield.

11. Remove the 3 RH engine support insulator nuts.
    - To install, tighten to 90 Nm (66 lb-ft).

12. Raise the engine approximately 60 mm (2.36 in).

13. Remove the RH engine support insulator.

All-Wheel Drive (AWD) vehicles

14. Remove the 4 bolts and the 2 stabilizer bar brackets. Allow the stabilizer bar to hang freely.
    - To install, tighten to 55 Nm (41 lb-ft).

15. ⚠ **WARNING: Secure the assembly to the jack. Avoid any obstructions while lowering and raising the jack. Contact with obstructions may cause the assembly to fall off the jack, which may result in serious personal injury.**

Support the axle housing with a suitable jack.

16. Disconnect the axle housing vent hose from the axle housing vent tube.

17. ***NOTICE:*** **Any time bolts, washers, spacers or nuts are loosened in the axle housing for any reason, install new components to prevent damage.**

    Remove and discard the 3 axle housing bolts and 3 flagnuts. Lower the axle housing approximately 25 mm (1 in).

    - To install, tighten to 66 Nm (49 lb-ft).

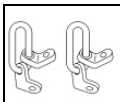
All vehicles

18. Remove the nut and the LH engine support insulator.
    - To install, tighten to 90 Nm (66 lb-ft).

19. To install, reverse the removal procedure.

Engine

Special Tool(s)

 ST1595-A	Lifting Bracket, Engine 303-050 (T70P-6000)
 ST2673-A	Spreader Bar 303-D701 or equivalent

Removal

NOTICE: **Rotating the crankshaft pulley bolt counterclockwise could cause a reduction in clamp load on the crankshaft pulley and timing sprocket, which could cause severe engine damage.**

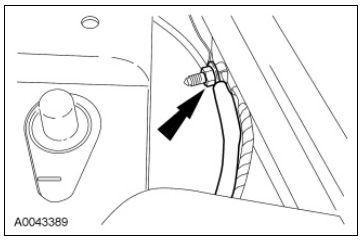
NOTICE: **If the fuel rail is used as a leverage device, it can be damaged. Care must be taken when working around the fuel rail.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

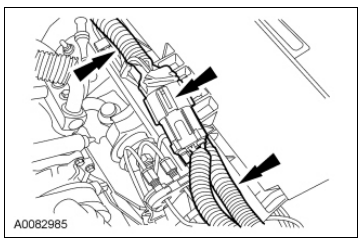
2. Disconnect the fuel supply tube spring lock coupling. For additional information, refer to Section 310-00 .

3. Disconnect the battery cables. For additional information, refer to Section 414-01 .

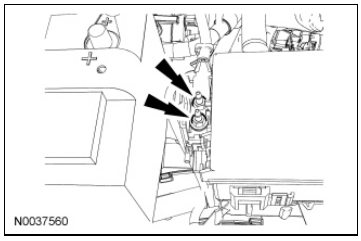
4. Remove the nut and disconnect the ground wire.


A0043389

5. Disconnect the electrical connector and detach the wiring harness retainers.


A0082985

6. Lift the cover, remove the 2 nuts and disconnect the battery cable connector.
   - Lay the wiring harness on top of the engine.



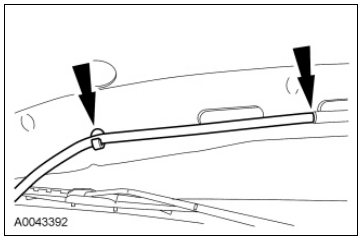
7. Recover the A/C system. For additional information, refer to Section 412-00 .

8. Drain the cooling system. For additional information, refer to Section 303-03 .

9. Remove the cooling fan. For additional information, refer to Section 303-03 .

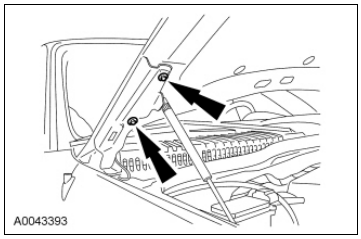
10. Remove the Air Cleaner (ACL) and the ACL outlet pipe. For additional information, refer to Section 303-12 .

11. Disconnect the windshield washer hose.

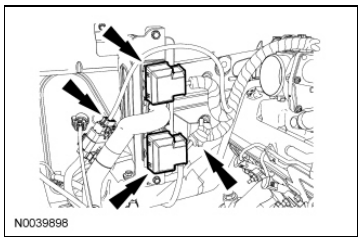


12. **NOTE:** Mark the hinge locations for installation reference.

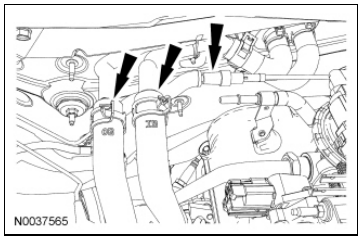
    Remove the 4 bolts and the hood.



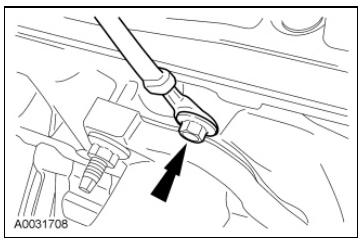
13. Disconnect the wiring harness electrical connector and the engine wiring harness-to-PCM electrical connectors. Detach the wiring harness retainer.



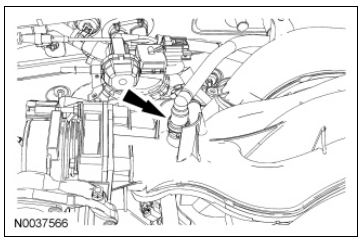
14. Disconnect the heater hoses and the vacuum hose.
    - Disconnect the heater control valve vacuum hose.



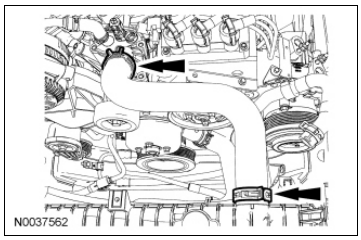
15. Remove the bolt and position the ground wire aside.



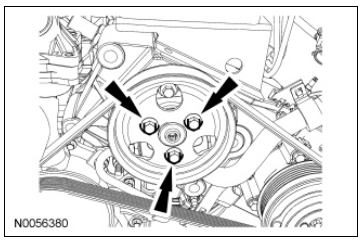
16. Disconnect the Evaporative Emission (EVAP) hose.



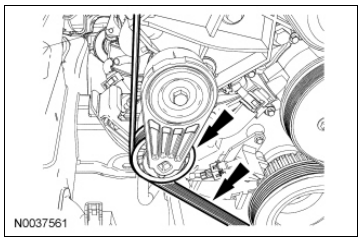
17. Remove the upper radiator hose.



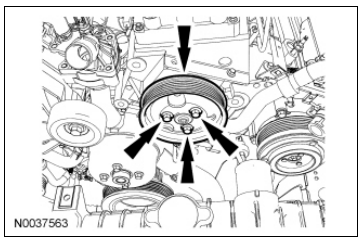
18. Loosen the 3 power steering pump pulley bolts.



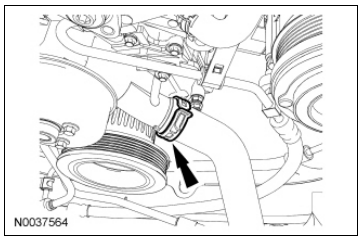
19. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.



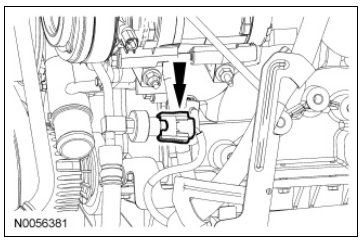
20. Remove the 3 bolts and the power steering pump pulley.



21. Disconnect the lower radiator hose from the coolant pump.

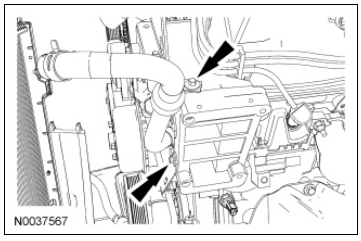


22. Disconnect the Power Steering Pressure (PSP) switch electrical connector.

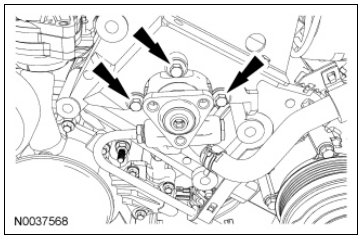


23. **NOTE:** A/C compressor removed from art for clarity.

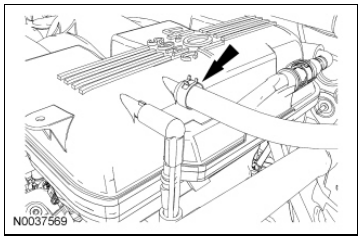
    Remove the PSP hose and the 2 power steering reservoir-to-power steering pump supply hose bracket bolts.



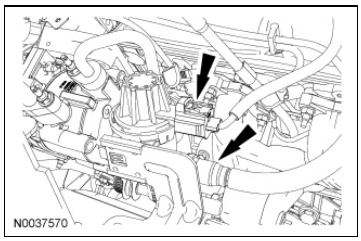
24. Remove the 3 bolts and position the power steering pump aside.



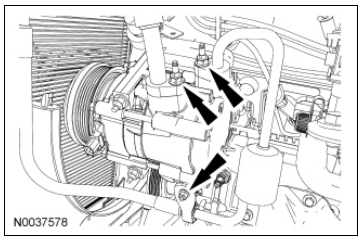
25. Disconnect the brake booster vacuum hose.



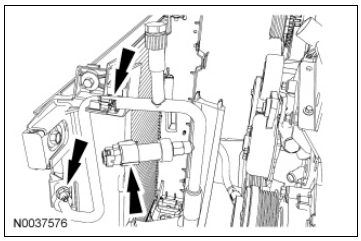
26. Disconnect the EVAP canister purge valve electrical connector. Disconnect and remove the EVAP hose.



27. Remove the 2 nuts and detach the A/C tubes.

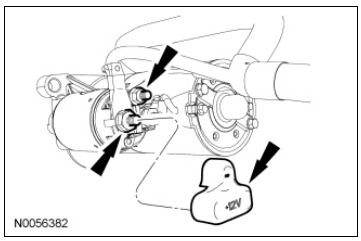


28. Disconnect the A/C high pressure switch, remove the nut, open the retaining clip and remove the A/C tube.

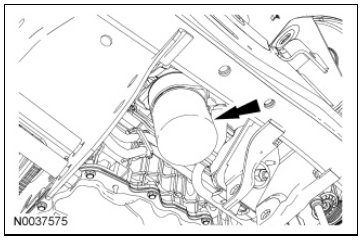


29. Remove the transmission. For additional information, refer to Section 307-01A .

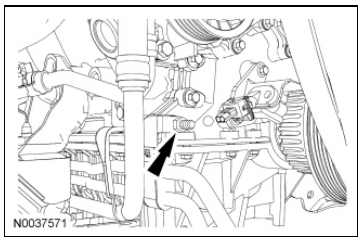
30. Remove the terminal cover. Remove the 2 nuts, detach the wires and remove the starter.



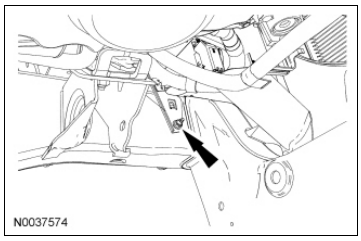
31. Remove the oil filter.



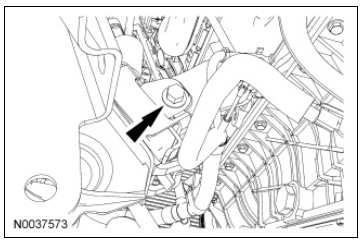
32. Remove the nut and detach the transmission cooler tube bracket.
    - Support the transmission cooler tubes with mechanic's wire.



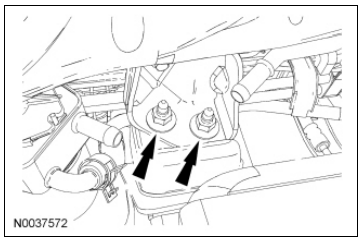
33. Remove the nut and detach the battery cable harness bracket from the frame rail.



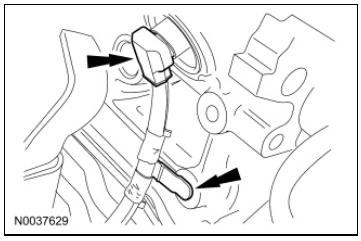
34. Remove the LH engine support insulator through bolt.



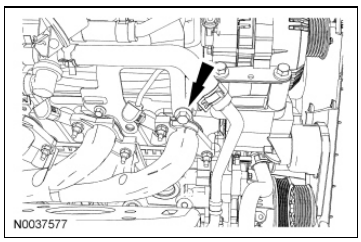
35. Remove the 2 RH engine support insulator nuts.



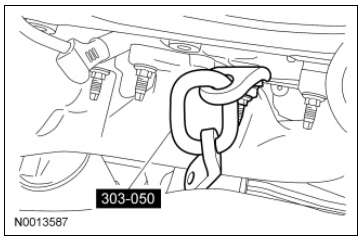
36. If equipped, disconnect the block heater electrical connector and wiring harness retainer.



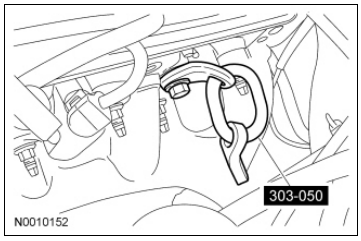
37. Remove the heater tube bracket bolt.



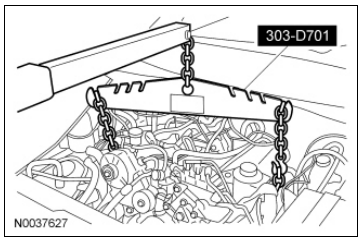
38. Install the Engine Lifting Bracket on the RH side of the engine.
    - Tighten to 37 Nm (27 lb-ft).



39. Install the Engine Lifting Bracket on the LH side of the engine.



40. Attach the Spreader Bar and using a suitable floor crane, remove the engine.



Engine

Special Tool(s)

 ST1776-A	Adapter for 303-564 303-578 (T97T-6256-A)
 ST1330-A	Compressor, Valve Spring 303-581 (T97T-6565-A)
 ST1777-A	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B)
 ST1595-A	Lifting Bracket, Engine 303-050 (T70P-6000)
 ST1288-A	Remover, Crankshaft Front Oil Seal 303-107 (T74P-6700-A)
 ST1784-A	Remover, Crankshaft Vibration Damper 303-101 (T74P-3616-A)
 ST2697-A	Remover, Crankshaft Vibration Damper 303-773
 ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)
 ST2191-A	Socket, Rear Jack Shaft 303-634
 ST1438-A	Strap Wrench 303-D055 (D85L-6000-A) or equivalent

General Equipment

8 mm x 1.25 x 100 mm bolts (2 required)

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-

Motorcraft® Silicone Gasket Remover ZC-30	-

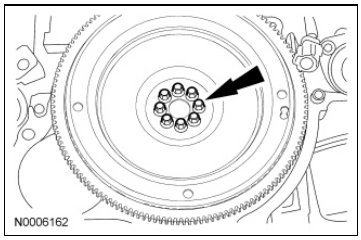
NOTICE: **Remove the cylinder heads before removing the crankshaft. Failure to do so may result in engine damage.**

NOTICE: **If the fuel rail is used as a leverage device, it may be damaged. Care must be taken when working around the fuel rail.**

NOTE: During the repair or replacement of fuel-related components, cap, tape or otherwise appropriately protect all liquid and vapor fuel openings to prevent the ingress of dirt or foreign material. Remove all caps, tape and other protective materials prior to installation.

NOTE: For additional information, refer to the exploded views under Engine in the Assembly portion of this section.

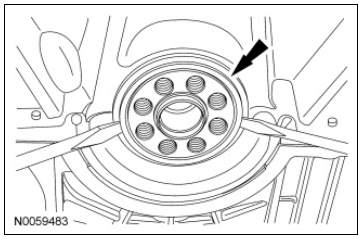
1. Remove the 8 bolts and the flexplate.
   - Discard the bolts.



2. Remove the spacer plate and the flexplate spacer.

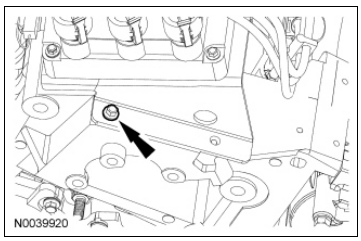
3. **NOTE:** The original crankshaft rear seal does not have a metal speedy sleeve. Replacement crankshaft rear seals come with a speedy sleeve. If present, this sleeve must be removed before attempting to remove the seal.

   If necessary, remove the speedy sleeve using 2 screwdrivers or small pry bars.

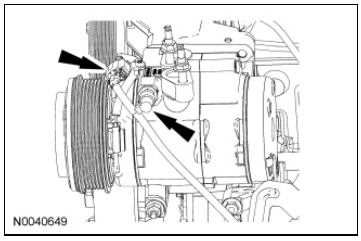


4. Install the engine on a suitable stand. Remove the engine lifting equipment and the Engine Lifting Brackets.

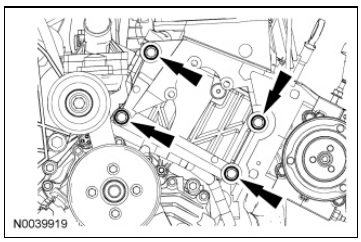
5. Remove the bolt.



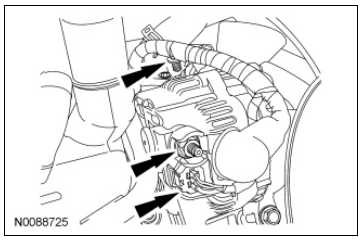
6. Disconnect the A/C compressor electrical connector and wire harness retainer.



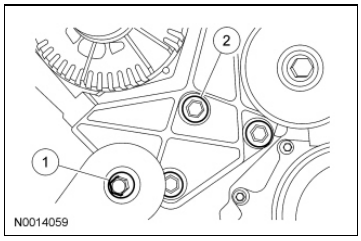
7. Remove the 4 bolts and the A/C compressor and power steering pump bracket.



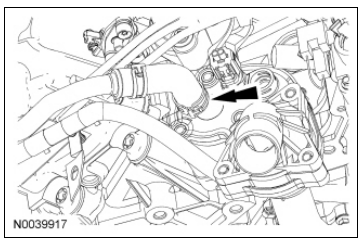
8. Remove the nut and disconnect the generator B+ cable and the electrical connector and detach the wiring harness retainer.



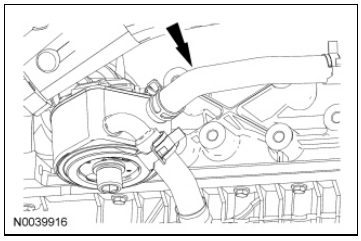
9. Remove the generator mounting bracket.
    1. Remove the bolt and the drive belt tensioner.
    2. Remove the 3 generator mounting bracket bolts.



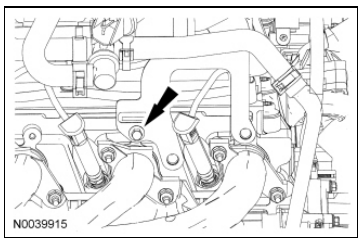
10. Disconnect the heater hose from the thermostat housing.



11. Disconnect the hose from the oil cooler.



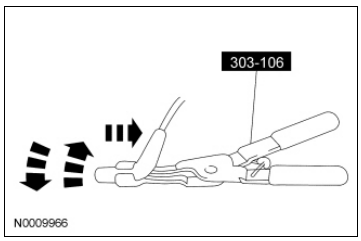
12. Remove the bolt, the heater hose tube bracket and the hoses as an assembly.



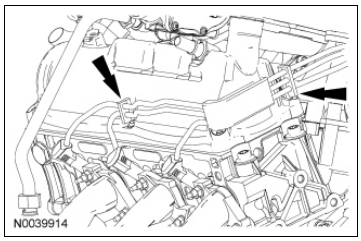
13. ***NOTICE:*** **It is important to twist the spark plug wire boots while pulling upward to avoid possible damage to the spark plug wires.**

    NOTE: Spark plug wires must be connected to the correct ignition coil terminal. Mark spark plug wire locations before removing them.

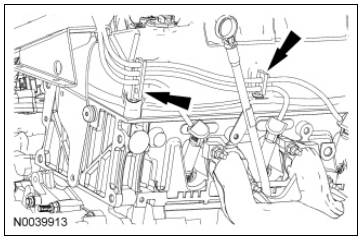
    Using the Spark Plug Wire Remover, disconnect the spark plug wires from the spark plugs.



14. Detach the RH spark plug wire retainers.

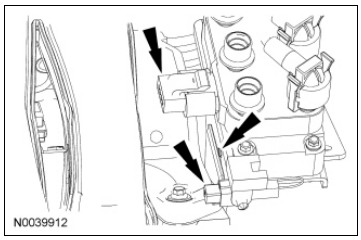


15. Detach the LH spark plug wire retainers.

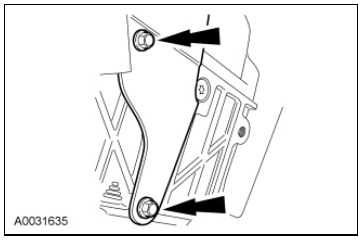


16. **NOTE:** RH spark plug wires removed for clarity.

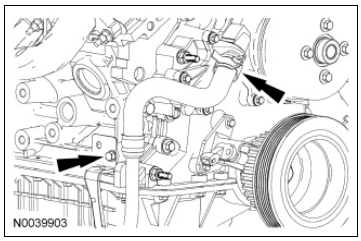
Disconnect the coil and the radio interference capacitor electrical connectors and detach the wiring harness retainer.



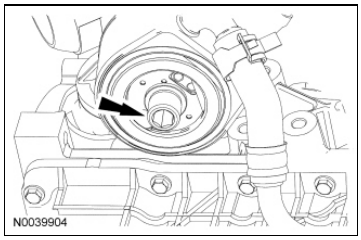
17. Remove the 2 bolts. Remove the coil, bracket and spark plug wires as an assembly.



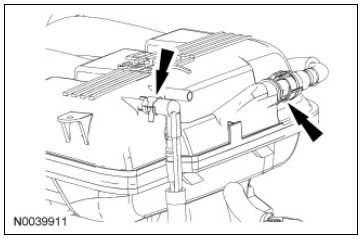
18. Remove the oil cooler hose bracket bolt, if equipped. Disconnect the oil cooler or heater hose.



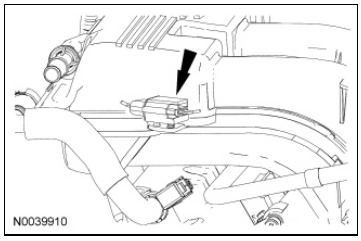
19. If equipped, remove the oil cooler and hose.



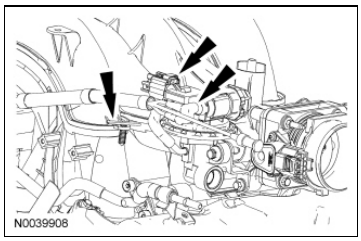
20. Disconnect the vacuum and PCV hoses from the intake manifold.



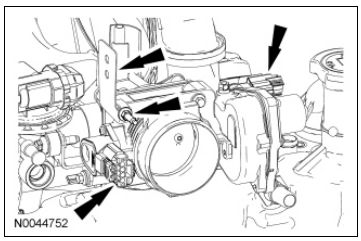
21. Disconnect the Knock Sensor (KS) electrical connector.
    - Detach the wiring harness pin-type retainer.



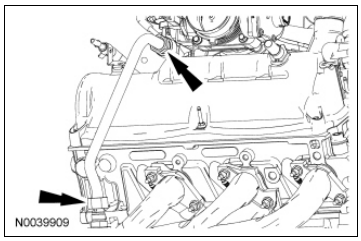
22. Disconnect the EGR system module vacuum hose and electrical connector. Detach the wiring harness pin-type retainer.



23. Disconnect the Electronic Throttle Body (ETB) and Throttle Position (TP) sensor electrical connectors. Remove the nut and detach the wiring harness bracket.

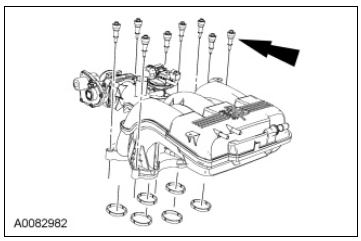


24. Remove the exhaust manifold-to-EGR system module tube.

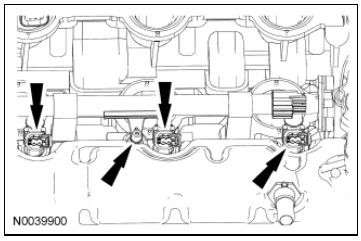


25. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

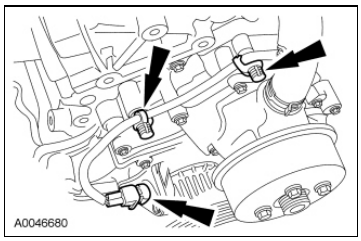
    Remove the 8 bolts and the intake manifold and 6 gaskets.



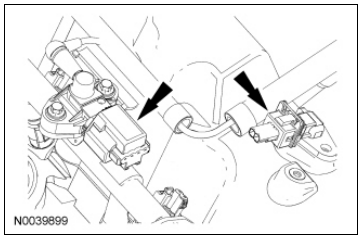
26. Disconnect the 6 fuel injector electrical connectors and detach the wiring harness retainers.



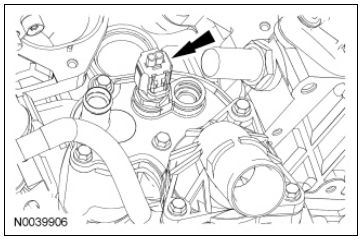
27. Disconnect the Crankshaft Position (CKP) sensor electrical connector and the wiring anchors. Discard the wiring anchors.



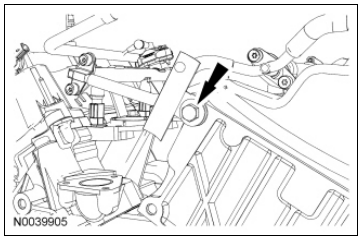
28. Disconnect the fuel rail pressure and temperature sensor and the Camshaft Position (CMP) sensor electrical connectors.



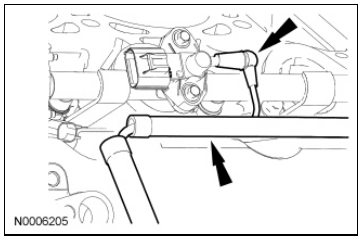
29. Disconnect the Engine Coolant Temperature (ECT) sensor electrical connector.



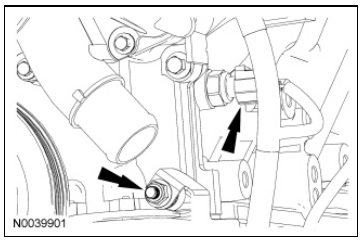
30. Remove the engine wiring harness retainer bolt and remove the engine wiring harness.



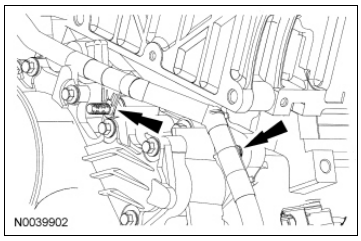
31. Disconnect the fuel pressure and temperature sensor vacuum hose fitting.
    - Remove the vacuum harness.



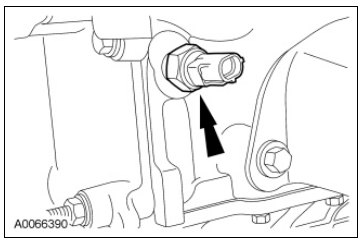
32. Disconnect the Engine Oil Pressure (EOP) switch electrical connector, remove the nut and detach the battery cable and harness bracket.



33. Detach the retainers and remove the battery cable and harness.

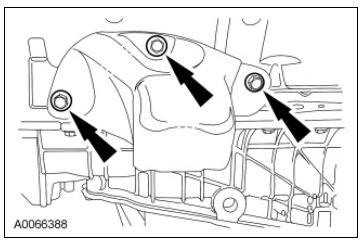


34. Remove the EOP switch.

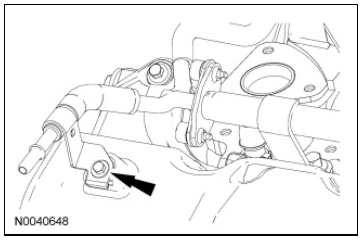


35. **NOTE:** LH shown, RH similar.

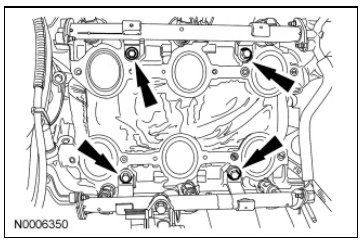
    Remove the 3 RH and the 3 LH insulator bolts and brackets.



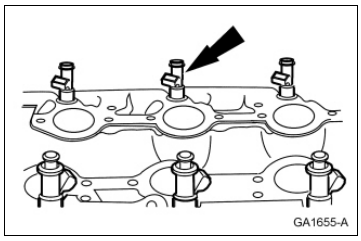
36. Remove the fuel supply tube bolt.



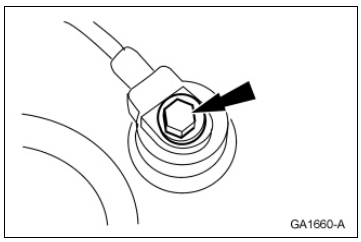
37. Remove the 4 bolts and the fuel rail.



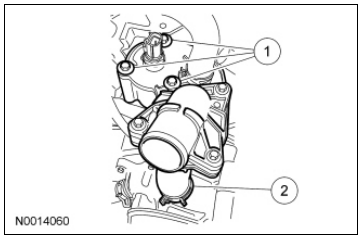
38. Remove the fuel injectors.
    - Remove and discard the O-ring seals.



39. Remove the bolt and the KS .

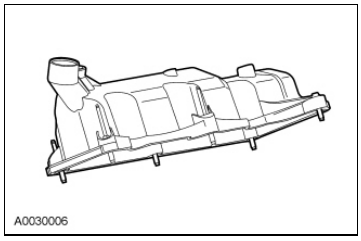


40. Remove the thermostat housing.
    1. Remove the 3 bolts.
    2. Release the bypass hose clamp and remove the thermostat housing.

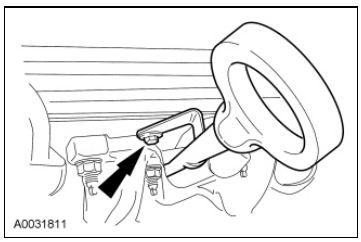


41. **NOTE:** RH shown, LH similar.

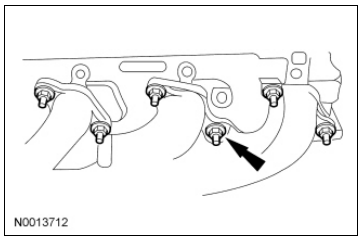
    Loosen the 12 bolts and remove the valve covers.



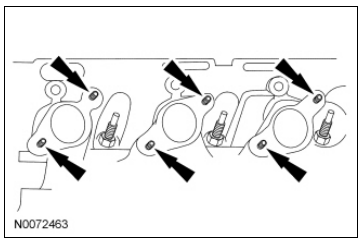
42. Remove the bolt and the oil level indicator tube.



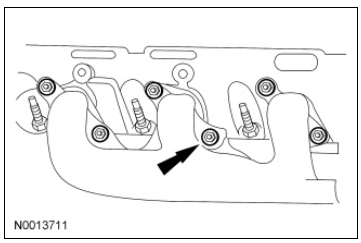
43. Remove the 6 nuts and the RH exhaust manifold and gasket.
    - Discard the nuts and the gasket.



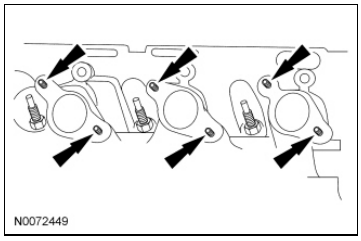
44. Remove and discard the 6 RH exhaust manifold studs.



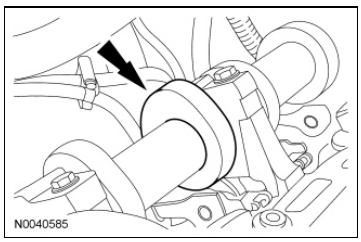
45. Remove the 6 nuts and the LH exhaust manifold and gasket.
    - Discard the nuts and the gasket.



46. Remove and discard the 6 LH exhaust manifold studs.

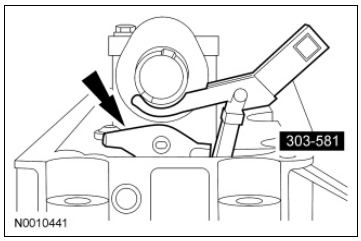


47. Rotate the crankshaft until the cam lobe of the cylinder being serviced is in the up position.



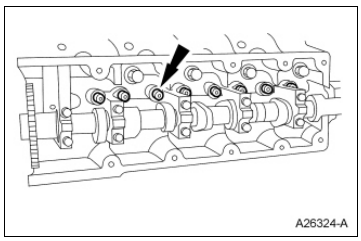
48. **NOTE:** Mark each camshaft roller follower to make sure it is installed in its original position during reassembly.

    Using the Valve Spring Compressor, remove the camshaft roller followers.

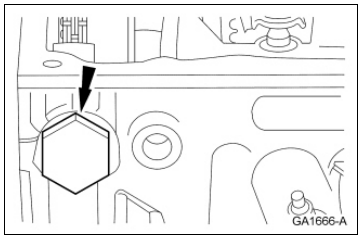


49. **NOTE:** Mark each hydraulic lash adjuster to make sure it is installed in its original position.

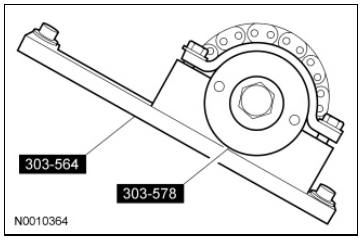
    Remove the hydraulic lash adjuster.



50. Remove the RH hydraulic chain tensioner.

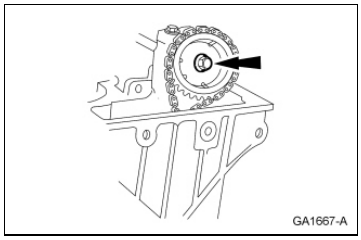


51. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the RH cylinder head and tighten the top 2 clamp bolts.
    - Tighten to 10 Nm (89 lb-in).

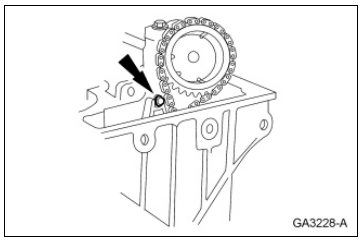


52. *NOTICE:* **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

    Remove the RH camshaft sprocket bolt.



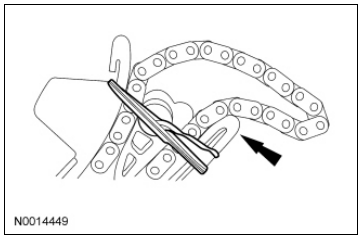
53. Remove the bolt.



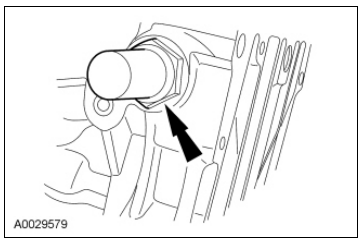
54. **NOTE:** Remove the camshaft sprocket from the timing chain to gain clearance to remove the cylinder head.

    NOTE: Hold the timing chain and cassette with a rubber band to aid in removal and to prevent the timing chain from falling into the cylinder block.

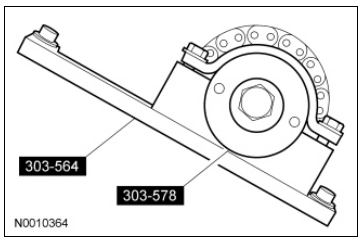
    Remove the RH camshaft sprocket from the timing chain. Install a rubber band around the cassette and the timing chain.



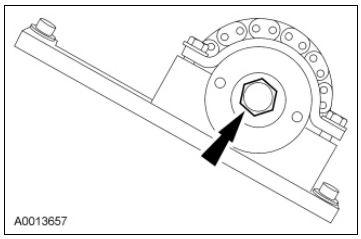
55. Remove the LH hydraulic chain tensioner.



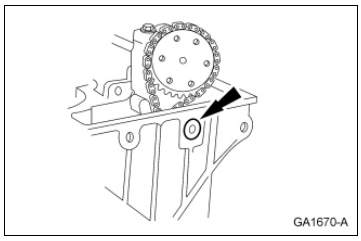
56. Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the LH cylinder head.



57. Remove the LH camshaft sprocket bolt.



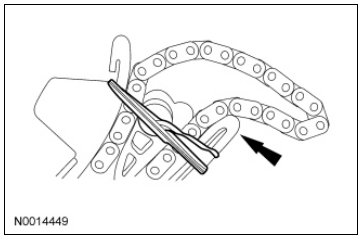
58. Remove the bolt.



59. **NOTE:** Remove the camshaft sprocket from the timing chain to gain clearance to remove the cylinder head.

    NOTE: Hold the timing chain and cassette with a rubber band to aid in removal and to prevent the timing chain from falling into the cylinder block.

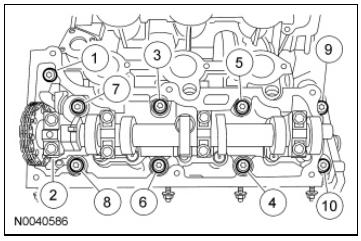
    Remove the LH camshaft sprocket from the timing chain. Install a rubber band around the cassette and the timing chain.



60. **NOTE:** New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

    Remove the 10 bolts in the sequence shown and remove the cylinder heads.

    - Discard the gaskets and the bolts.



61. ***NOTICE:*** **Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore. Failure to follow these instructions may result in engine damage.**

    NOTICE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gaskets.**

    NOTE: Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

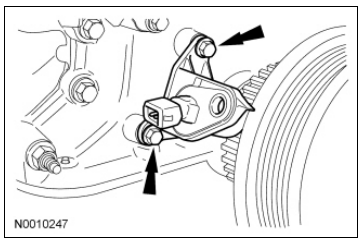
    NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

    Clean the cylinder head-to-cylinder block mating surface of both the cylinder head and the cylinder block in the following sequence.

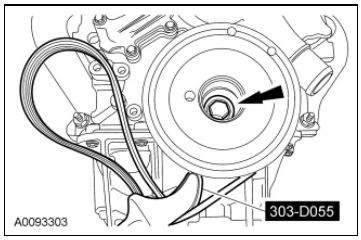
    1. Remove any large deposits of silicone gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

62. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to Section 303-00 .

63. Remove the 2 bolts and the CKP sensor.



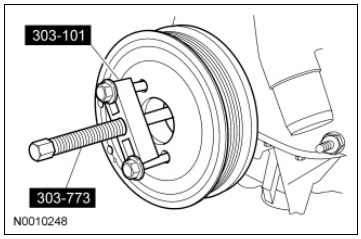
64. Using the Strap Wrench to hold the crankshaft pulley, remove the bolt.



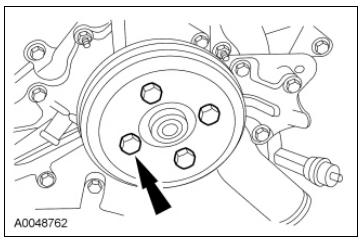
65. **NOTE:** If the pulley bolt is not installed, the tool will bottom out before the pulley is off.

    Install the crankshaft pulley bolt 2 to 3 turns. Using the 2 Crankshaft Vibration Damper Removers and the two 8-mm bolts, remove the crankshaft pulley.

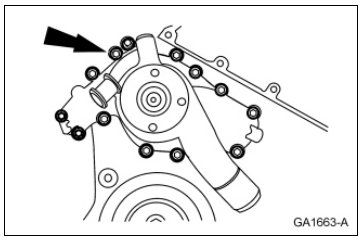
    - Discard the crankshaft pulley bolt.



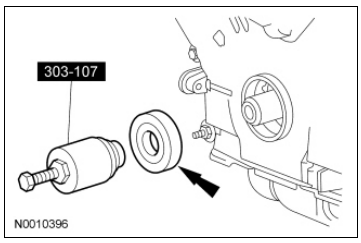
66. Remove the 4 bolts and the coolant pump pulley.



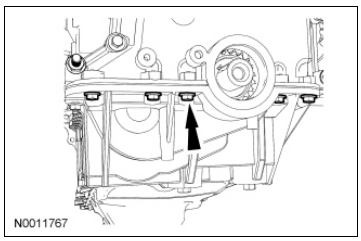
67. Remove the 13 bolts and the coolant pump.



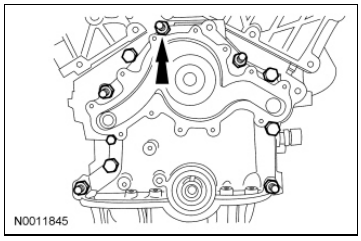
68. Using the Crankshaft Front Oil Seal Remover, remove the crankshaft front oil seal.



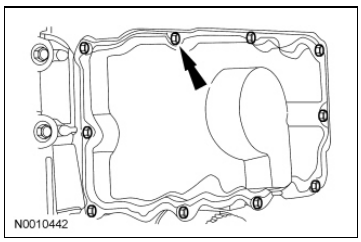
69. Remove the 5 cylinder block cradle-to-engine front cover bolts.



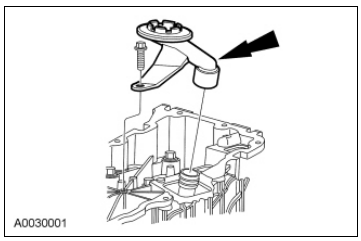
70. Remove the 5 bolts, 5 stud bolts and the engine front cover.



71. Remove the 10 bolts and the oil pan.

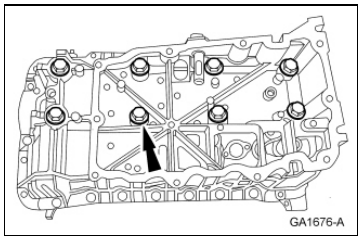


72. Remove the bolt and the oil pump screen cover and tube.

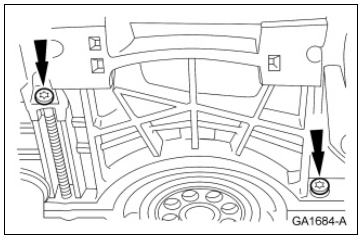


73. **NOTE:** Note the location of the 2 silver-colored bolts with the washer seals. These bolts must be installed in the same position from which they were removed with new washer seals.

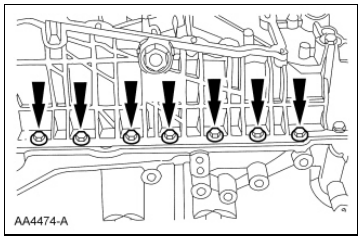
    Remove the 8 cylinder block cradle inner bolts. Remove and discard the 2 washer seals.



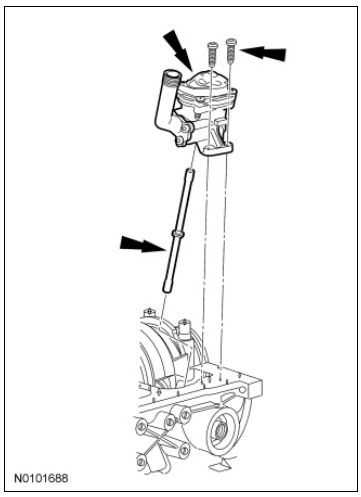
74. Remove the 2 cylinder block cradle Torx bolts.



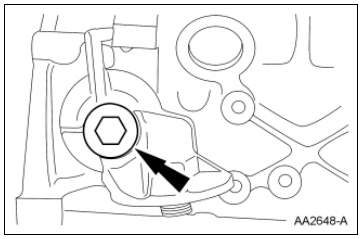
75. Remove the 15 bolts and the 2 nuts. Remove the cylinder block cradle.



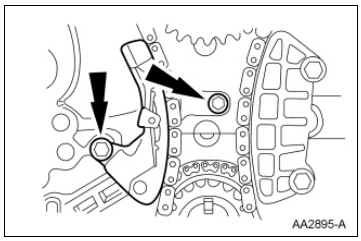
76. Remove the 2 bolts, the oil pump pickup tube, the oil pump and the oil pump intermediate shaft.



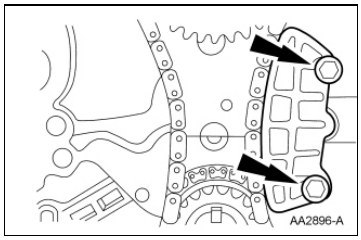
77. Remove the bolt and the oil filter adapter.



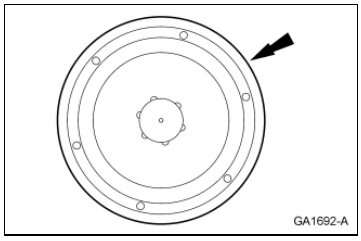
78. Remove the 2 bolts and the jackshaft chain tensioner.



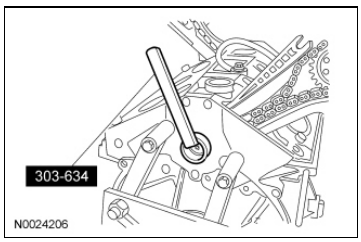
79. Remove the 2 bolts and the jackshaft chain guide.



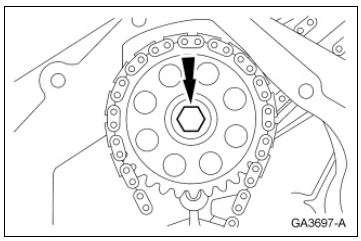
80. Remove the jackshaft rear plug.



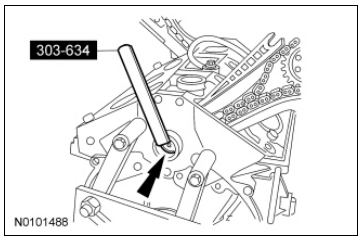
81. Install the Rear Jack Shaft Socket on the rear of the jackshaft.



82. Using the Rear Jack Shaft Socket to hold the jackshaft, loosen the jackshaft sprocket bolt.

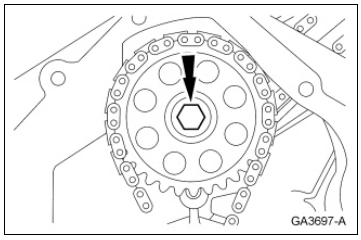


83. Using the Rear Jack Shaft Socket to hold the jackshaft, loosen the rear jackshaft sprocket bolt.

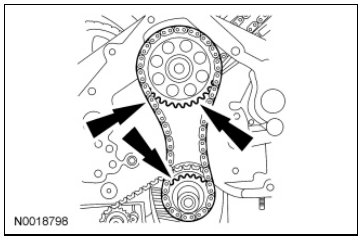


84. **NOTE:** It may be necessary to hold the oil pump intermediate shaft, using an E-12 external Torx socket, in order to remove the bolt if the bolt does not turn out easily at this time.

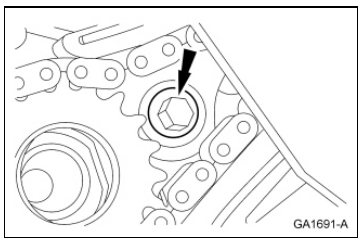
    Remove the jackshaft sprocket bolt.



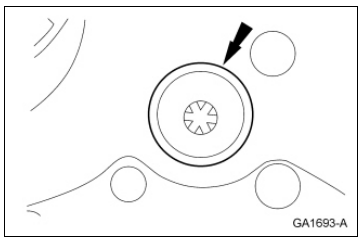
85. Remove the jackshaft and crankshaft sprockets and the chain.
    - Remove the crankshaft key.



86. Remove the bolt and the LH camshaft drive cassette.

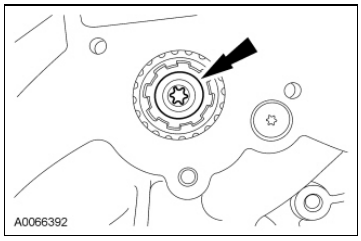


87. Remove the RH camshaft drive cassette bolt and spacer.

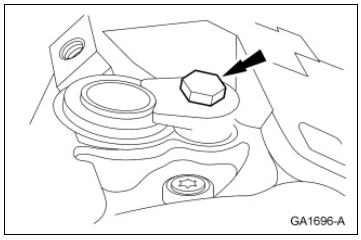


88. **NOTE:** It may be necessary to hold the oil pump intermediate shaft, using an E-12 external Torx socket, in order to remove the bolt if the bolt does not turn out easily at this time.

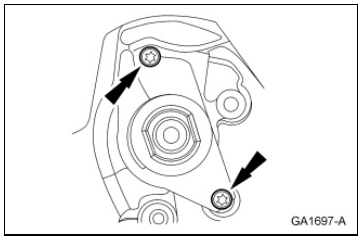
    Remove the rear jackshaft sprocket bolt and remove the RH camshaft drive cassette.



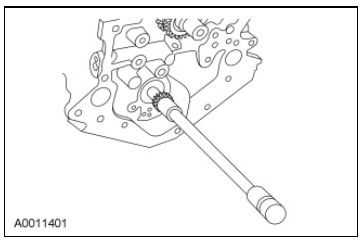
89. Remove the bolt, the hold down and the oil pump drive.



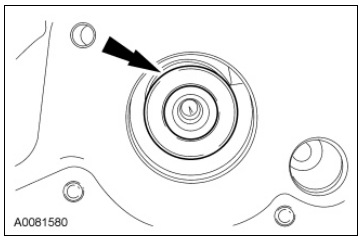
90. Remove the 2 bolts and the jackshaft thrust plate.



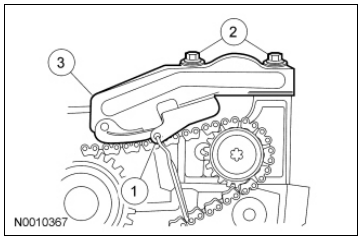
91. Remove the jackshaft.



92. Remove the jackshaft spacer.



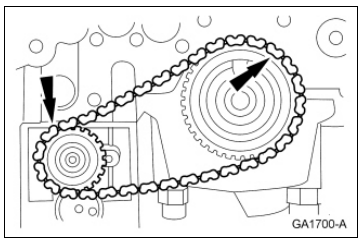
93. Remove the balance shaft tensioner.
    1. Install a pin in the balance shaft tensioner.
    2. Remove the 2 bolts.
    3. Remove the balance shaft tensioner.



94. Remove the 2 bolts and the balance shaft chain guide.

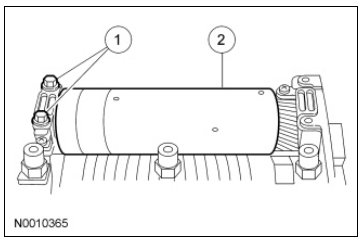
95. **NOTE:** DO NOT remove the balance shaft sprocket bolt.

    Remove the balance shaft chain and crankshaft sprocket.



96. Remove the balance shaft.
    1. Remove the 2 bolts.

2. Remove the balance shaft.

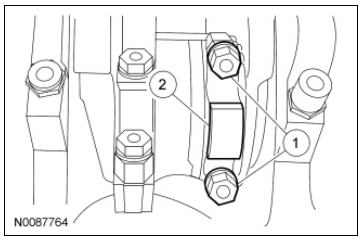


97. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following the manufacturer's instructions.

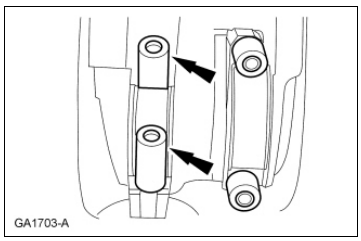
98. **NOTE:** Clearly mark the connecting rods and rod caps in numerical order for correct reassembly.

    Remove the connecting rod caps.

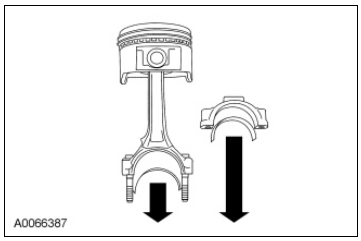
    1. Remove the 2 connecting rod nuts from each connecting rod.
    2. Remove the connecting rod cap.



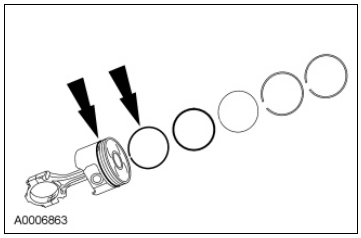
99. Install rubber hose pieces on the bolts to protect the crankshaft and remove the pistons.



100. Remove the connecting rod bearings.



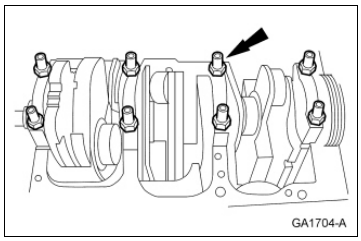
101. Remove the piston rings.



102. Clean and inspect the pistons. For additional information, refer to Section 303-00 .

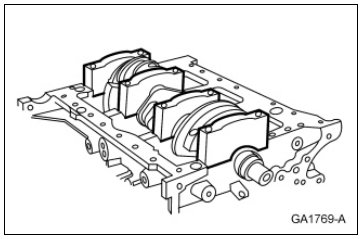
103. ***NOTICE:*** **Remove the cylinder heads before removing the crankshaft. Failure to do so can result in engine damage.**

    Remove the 8 bolts.

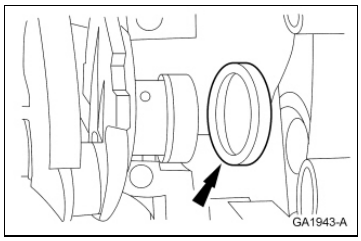


104. **NOTE:** Number (or mark) the crankshaft bearing caps before removing them.

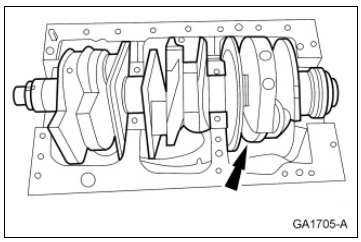
    Remove the 4 crankshaft main bearing caps.



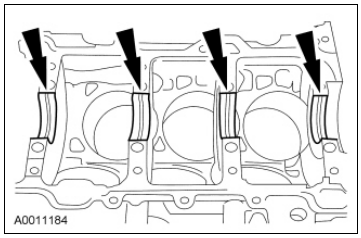
105. Remove the crankshaft rear oil seal from the crankshaft.



106. Remove the crankshaft.



107. Remove the crankshaft main bearings and the thrust bearing.


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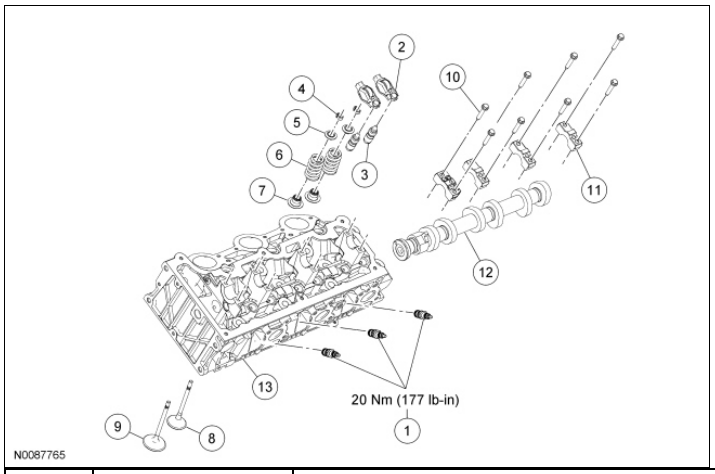
Cylinder Head

Special Tool(s)

 ST1330-A	Compressor, Valve Spring 303-581 (T97T-6565-A)
 ST1824-A	Installer, Valve Stem Oil Seal 303-370 (T90T-6571-A)

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



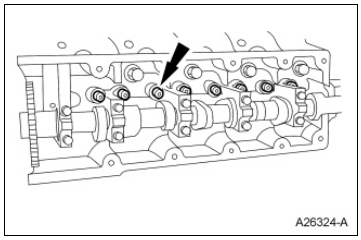
Item	Part Number	Description
1	12405	Spark plugs
2	6529	Camshaft roller follower
3	6C501	Hydraulic lash adjuster
4	6518	Valve spring retainer key (12 required)
5	6A536	Valve spring retainer
6	6513	Valve spring (6 required)
7	6571	Valve seal (6 required)
8	6505	Exhaust valve

9	6507	Intake valve
10	W702341	Camshaft bearing cap mounting bolt (8 required)
11	6A258	Camshaft bearing cap (4 required)
12	6A274	LH camshaft
13	6050	Cylinder head

Disassembly

1. Remove the spark plugs.
2. **NOTE:** Mark each hydraulic lash adjuster to make sure it is installed in its original position.

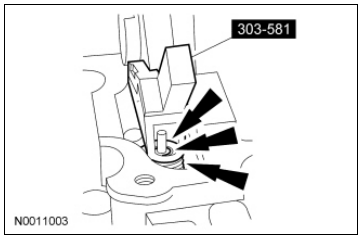
   Remove the hydraulic lash adjusters.



3. **NOTE:** Keep the valves, valve springs, retainers and retainer keys in order so they can be installed in their original positions.

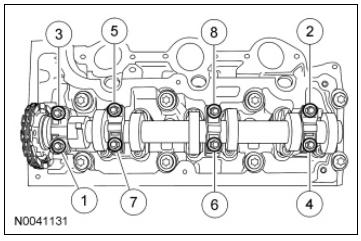
   Using the Valve Spring Compressor, remove the valve spring retainer keys, the valve spring and the retainer. Remove the valve.

   - Repeat the procedure until all of the valves are removed.



4. Remove and discard the valve seals.
5. **NOTE:** Mark the position of the camshaft bearing caps so they can be installed in their original positions.

   Remove the 8 bolts in the sequence shown and remove the 4 camshaft bearing caps.



6. Remove the camshaft.

Assembly

NOTE: Lubricate all parts with clean engine oil prior to assembly.

NOTE: Install the camshaft roller followers only after the cylinder head is installed in the vehicle and the timing procedure has been carried out.

1. Inspect the cylinder head. For additional information, refer to Section 303-00 .

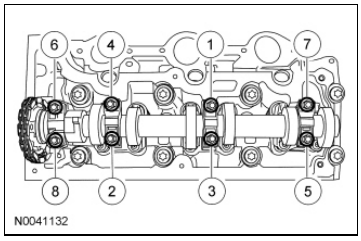
2. Position the camshaft.

3. **NOTE:** The camshaft bearing caps must be installed in their original positions.

   NOTE: After installing the bolts, check the camshaft for free rotation.

   Position the 4 camshaft bearing caps and the 8 bolts. Tighten the bolts in the sequence shown in 2 stages.

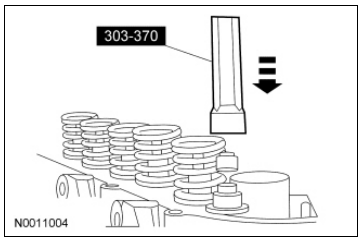
   - Stage 1: Tighten to 6 Nm (53 lb-in).
   - Stage 2: Tighten to 16 Nm (142 lb-in).



4. **NOTE:** Valves must be installed in the position from which they were removed.

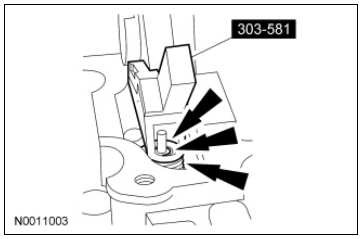
   Install the valve.

5. Using the Valve Stem Oil Seal Installer, install new valve stem seals.



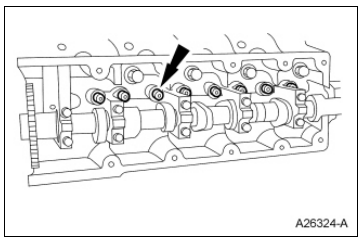
6. **NOTE:** The valve springs, retainers and retainer keys must be installed in the positions from which they were removed.

   Using the Valve Spring Compressor, install the valve spring, the retainer and the retainer keys.



7. **NOTE:** Install the hydraulic lash adjusters in the same positions from which they were removed.

Install the hydraulic lash adjusters.



8. Install the spark plugs.
    - Tighten to 20 Nm (177 lb-in).

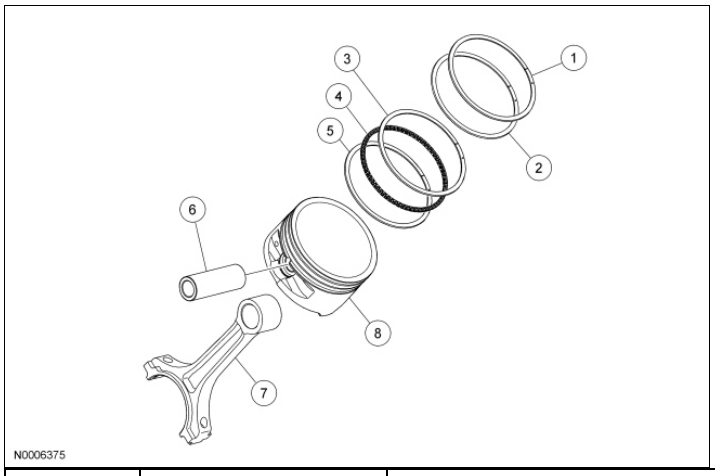
Piston

Special Tool(s)

 ST1336-A	Service Set, Piston Pin 303-S024 (T68P-6135-A)

Material

Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



Item	Part Number	Description
1	6150	Piston compression upper ring
2	6152	Piston compression lower ring
3	6159	Piston oil control upper segment ring
4	6161	Piston oil control spacer
5	6159	Piston oil control lower segment ring
6	6135	Piston pin
7	6200	Connecting rod
8	6110	Piston

Disassembly

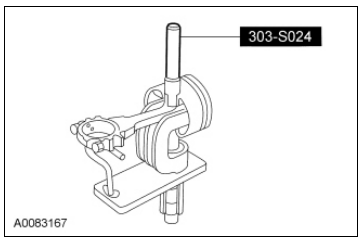
NOTE: The connecting rod bolts and nuts cannot be reused.

NOTE: Mark the position of the parts, so they can be installed in their original positions.

1. Remove the connecting rod bearings from the connecting rod and cap.

2. Remove the piston rings from the piston.

3. Using the Piston Pin Service Set, press the piston pin out of the connecting rod and piston assembly.



Assembly

NOTE: Lubricate all parts with clean engine oil.

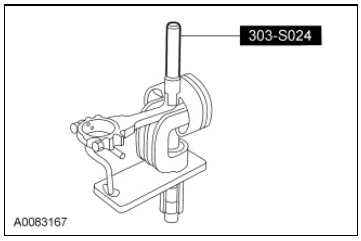
NOTE: Install the piston in the connecting rod with the cylinder number side of the rod and the indentation notch in the piston on the same side.

NOTE: The oil hole in the connecting rod must face the RH side of the cylinder block and the arrow on the piston must face the front of the engine block.

1. **NOTE:** If the piston pin is removed from the piston, a new piston and piston pin must be used. Do not reuse the piston or the piston pin.

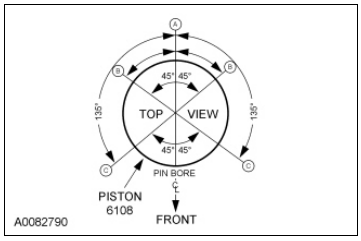
   Gradually heat the pin bore side of the connecting rod to approximately 232°C-316°C (467°F-626°F) and immediately install the piston pin.

2. Using the Piston Pin Service Set, press the piston pin into the piston and connecting rod assembly.



3. Install the piston rings.

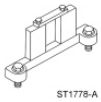
4. Make sure the ring gaps (oil spacer-A, oil ring-B, compression ring-C) are correctly spaced around the circumference of the piston.



5. Install the connecting rod bearings in the connecting rod and cap.

Engine

Special Tool(s)

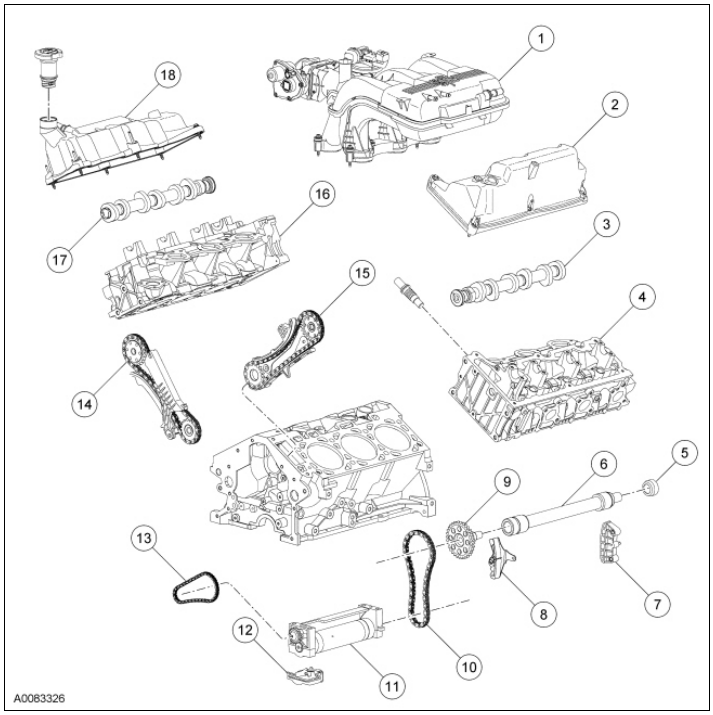
 ST1776-A	Adapter for 303-564 303-578 (T97T-6256-A)
 ST1779-A	Adapter for 303-577 303-576 (T97T-6256-D)
 ST3078-A	Adapter for 303-579 303-527 (T95T-6701-A3)
 ST2439-A	Aligner, Front Cover 303-093 (T74P-6019-A)
 ST1380-A	Compressor, Piston Ring 303-D032 (D81L-6002-C)
 ST1330-A	Compressor, Valve Spring 303-581 (T97T-6565-A)
 ST1778-A	Holding Tool, Camshaft 303-577 (T97T-6256-C)
 ST1777-A	Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B)
 ST2132-A	Installer, Crankshaft Rear Oil Seal 303-579 (T97T-6701-A)
 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1595-A	Lifting Bracket, Engine 303-050 (T70P-6000)
 ST3077-A	Screws, Crankshaft Rear Oil Seal 303-528 (T95T-6701-A4)
 ST2191-A	Socket, Rear Jackshaft 303-634

 ST2673-A	Spreader Bar 303-D701 or equivalent
 ST1438-A	Strap Wrench 303-D055 (85L-6000-A) or equivalent
 ST1774-A	Tensioner, Timing Chain 303-571 (T97T-6K254-A)
 ST1775-A	Timing Tool, Crankshaft TDC 303-573 (T97T-6303-A)

Material

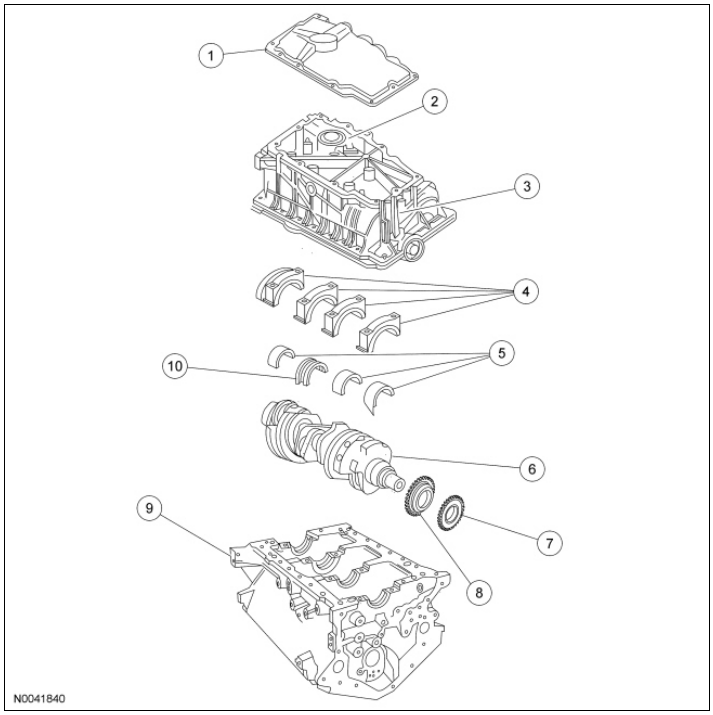
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

Upper End - 4.0L SOHC Engine



Item	Part Number	Description
1	9K479	Intake manifold
2	6A505	Valve cover, LH
3	6A274	Camshaft, LH
4	6050	Cylinder head, LH
5	6M296	Spacer
6	6M262	Jackshaft
7	6M272	Jackshaft chain guide
8	6M271	Jackshaft chain tensioner
9	6M264	Jackshaft sprocket
10	6M270	Jackshaft chain assembly
11	6A311	Balance shaft
12	6K355	Balance shaft chain tensioner
13	6A364	Balance shaft chain
14	6M289	LH cassette
15	6M290	RH cassette
16	6049	Cylinder head, RH
17	6250	Camshaft, RH
18	6582	Valve cover, RH

Lower End - 4.0L SOHC Engine



Item	Part Number	Description
1	6675	Oil pan
2	6617	Tube assembly oil pickup
3	6F092	Cylinder block cradle
4	-	Crankshaft main bearing caps
5	6A338	Crankshaft lower main bearings
6	6303	Crankshaft
7	6306	Jackshaft sprocket
8	6K350	Balance shaft sprocket
9	6010	Cylinder block
10	6A339	Crankshaft lower thrust main bearing

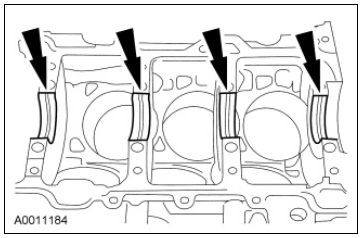
All vehicles

NOTICE: **If used as a leverage device, the fuel rail may be damaged. Care must be taken when working around the fuel rail.**

NOTE: During engine assembly it may be necessary to check the bearing clearances and crankshaft end play. For additional information, refer to Section 303-00 .

NOTE: Before engine assembly, use silicone gasket remover and metal surface prep and a suitable plastic or wooden scraper to clean the sealing surfaces. Follow the directions on the packaging. All sealing surfaces must be clean. Make sure coolant and oil passages are clear.

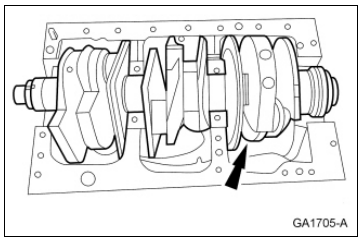
1. Install the crankshaft main bearings and the thrust bearing.
    - Lubricate the crankshaft main bearings with clean engine oil.



2. Install the lower main bearings in the bearing caps.

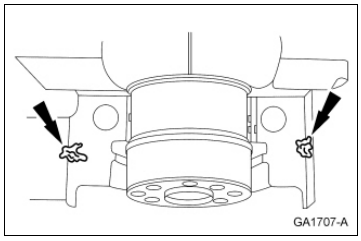
3. **NOTE:** The crankshaft main bearings are precision selective fit. Inspect the bearing clearance. For additional information, refer to Section 303-00 .

   Install the crankshaft.

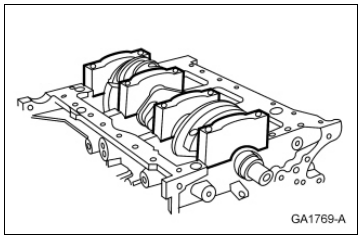


4. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

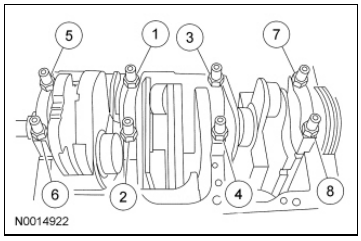
   Apply silicone gasket and sealant to the rear main bearing cap to cylinder block parting line.



5. Install the 4 main bearing caps in the same position from which they were removed.



6. Tighten the 8 bolts in the sequence shown in 2 stages.
   - Stage 1: Tighten to 35 Nm (26 lb-ft).
   - Stage 2: Tighten an additional 57 degrees.

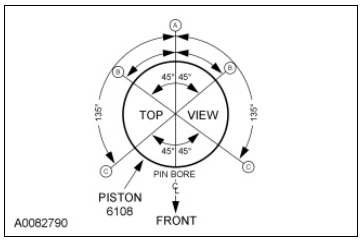


7. Check the piston to cylinder bore and ring clearance. For additional information, refer to Section 303-00 .

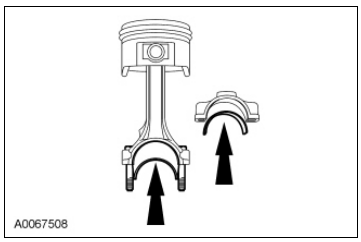
8. **NOTE:** Lubricate the piston rings with clean engine oil.

   Install the piston rings.

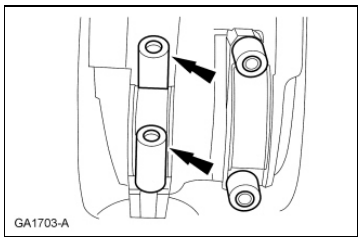
9. Make sure the ring gaps (oil spacer-A, oil ring-B, compression ring-C) are correctly spaced around the circumference of the piston.



10. Install the connecting rod bearings.



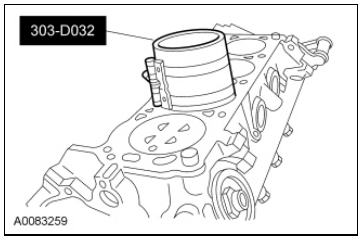
11. Install rubber hose pieces on the connecting rod bolts to protect the crankshaft.



12. **NOTE:** Position the piston with the indentation arrow toward the front of the cylinder block.

    Using the Piston Ring Compressor, install the pistons.

    - Rotate the crankshaft as necessary.



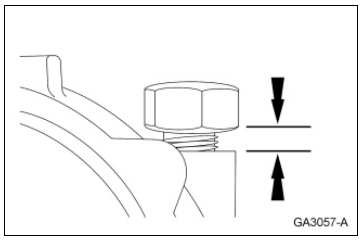
13. **NOTE:** The old nuts and bolts are used for checking clearances. New nuts and bolts must be used for reassembly.

    Check the clearance of each connecting rod bearing. For additional information, refer to Section 303-00 .

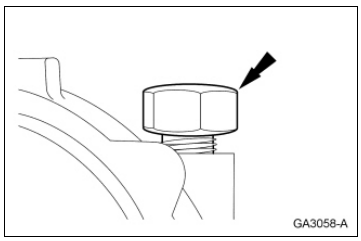
14. Rotate the crankshaft until the piston is at the bottom of its stroke.

15. **NOTE:** For cylinders 1, 2 and 3, remove the connecting rod nut at the oil split hole side first. For cylinders 4, 5 and 6, remove the opposite nut first.

    Loosen the first nut until the face is approximately 2 mm (0.08 in) over the end of the bolt.

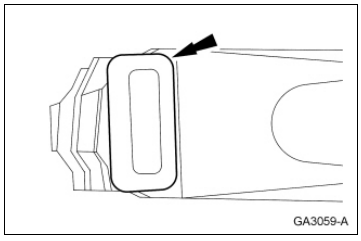


16. Tap on the nut until the bolt can be removed by hand.



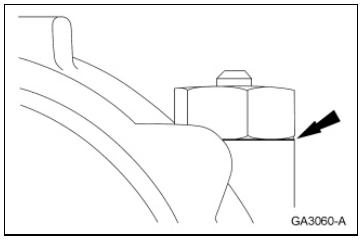
17. Repeat the previous 2 steps for the opposite bolt.

18. Install the 2 new bolts, making certain that the bolt head is parallel to the sideward face of the connecting rod.



19. Install the connecting rod cap in the original position.

20. Install and tighten the 2 connecting rod nuts finger-tight.

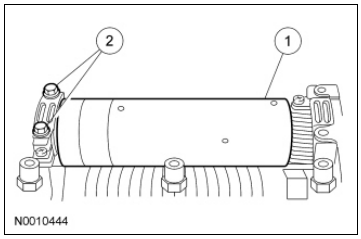


21. Tighten the 2 connecting rod nuts in 2 stages.
    - Stage 1: Tighten to 20 Nm (177 lb-in).
    - Stage 2: Tighten an additional 90 degrees.

22. Repeat the previous 4 steps for the remaining connecting rods.

23. Rotate the crankshaft until the No. 1 piston is at Top Dead Center (TDC).

24. Install the balance shaft.
    1. Install the balance shaft assembly.
    2. Install the 2 bolts and tighten in 2 stages.
        - Stage 1: Tighten to 15 Nm (133 lb-in).
        - Stage 2: Tighten an additional 90 degrees.

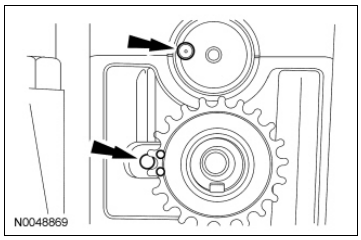


Early build vehicles

25. **NOTE:** Due to the gear ratio between the reversal shaft and the balance shaft, up to 7 complete turns of the balance shaft may be required to find the correct position.

    Align the timing marks.

    - Install a 4 mm (0.16 in) pin to hold the shaft in place.



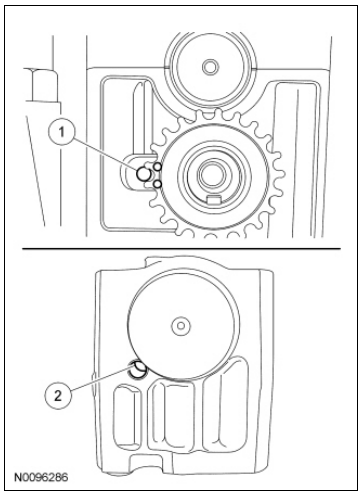
Late build vehicles

26. **NOTE:** Due to the gear ratio between the reversal shaft and the balance shaft, up to 7 complete turns of the balance shaft may be required to find the correct position.

    Align the timing marks.

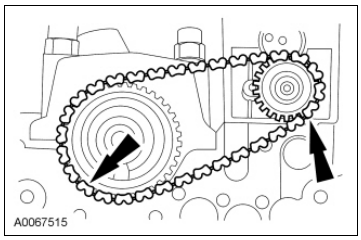
    1. Align the front balance shaft gear alignment marks with the hole in the balance shaft housing.

2. From the rear of the balance shaft, make sure the balance shaft gear alignment mark is visible through the hole in the balance shaft housing.

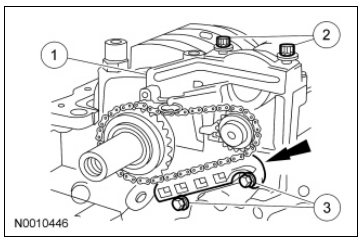


All vehicles

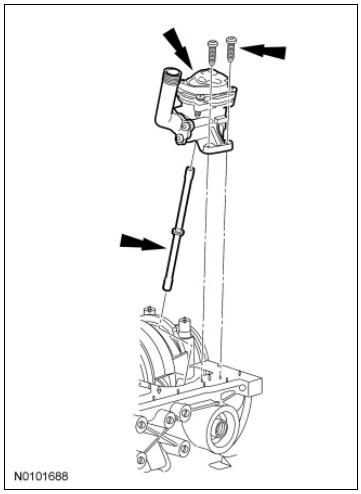
27. Install the balance shaft chain and crankshaft sprocket.



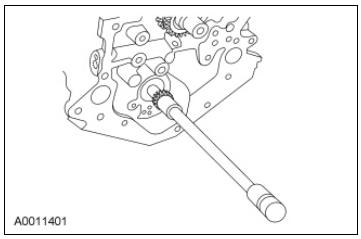
28. Install the balance shaft tensioner and chain guide.
    1. Install the balance shaft tensioner.
    2. Install the 2 bolts and tighten to 29 Nm (21 lb-ft).
    3. Position the balance shaft chain guide, install the 2 bolts and tighten to 10 Nm (89 lb-in).
    - Remove the pins from the tensioner and, if installed, the sprocket.



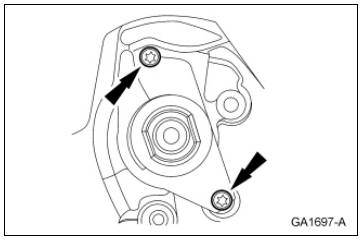
29. Install the oil pump intermediate shaft, the oil pump and the 2 bolts.
    - Tighten to 19 Nm (168 lb-in).



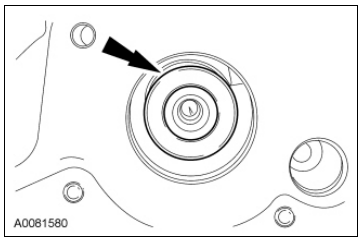
30. Install the jackshaft.



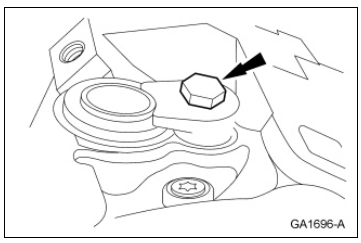
31. Install the jackshaft thrust plate and bolts.
    - Tighten to 11 Nm (97 lb-in).



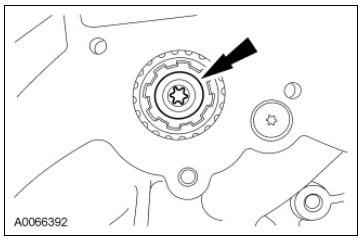
32. Install the jackshaft spacer.



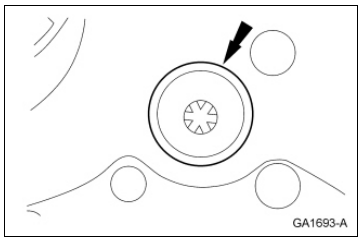
33. Install the oil pump drive and the hold down.
    - Tighten to 19 Nm (168 lb-in).



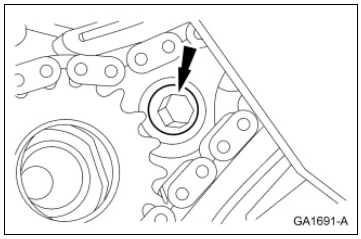
34. Position the RH camshaft drive cassette and install the sprocket bolt. Do not tighten the bolt at this time.



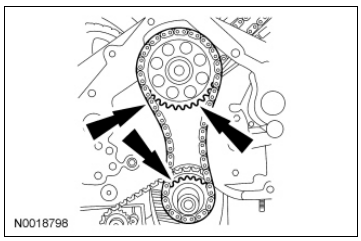
35. Install the RH drive cassette bolt and spacer.
    - Tighten to 18 Nm (159 lb-in).



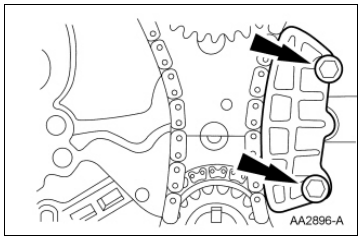
36. Install the LH cassette and the bolt.
    - Tighten to 19 Nm (168 lb-in).



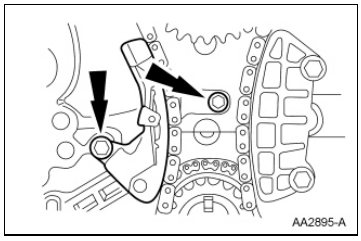
37. Install the crankshaft key. Position the jackshaft and crankshaft sprockets and the chain.



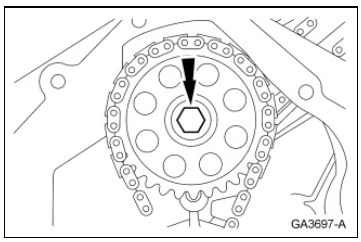
38. Install the chain guide and the 2 bolts.
    - Tighten to 19 Nm (168 lb-in).



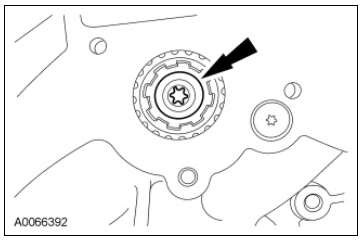
39. Install the chain tensioner and the 2 bolts.
    - Tighten to 9 Nm (80 lb-in).



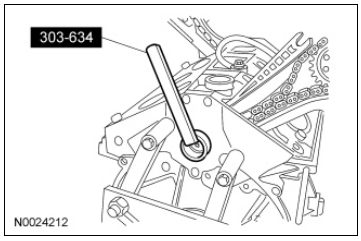
40. Install the jackshaft sprocket bolt. Do not tighten the bolt at this time.



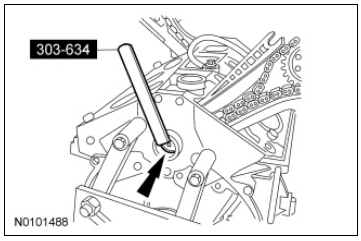
41. While holding the front jackshaft sprocket bolt secure, tighten the rear bolt.
    - Tighten to 20 Nm (177 lb-in).



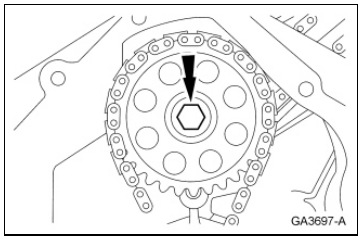
42. Install the Rear Jack Shaft Socket on the rear of the jackshaft.



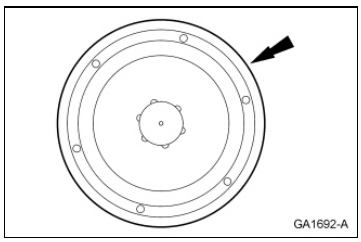
43. Using the Rear Jack Shaft Socket to hold the jackshaft, tighten the rear jackshaft bolt an additional 90 degrees.



44. Using the Rear Jack Shaft Socket to hold the jackshaft, tighten the front sprocket bolt in 2 stages.
    - Tighten to 45 Nm (33 lb-ft).
    - Tighten an additional 90 degrees.



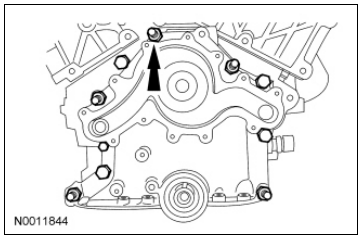
45. Remove the Rear Jack Shaft Sprocket and install the rear jackshaft plug.



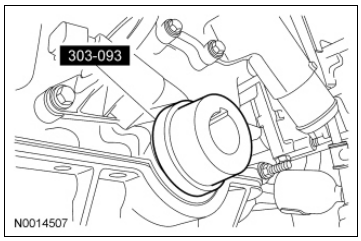
46. Position a new engine front cover gasket on the cylinder block.

47. **NOTE:** Apply thread sealant to the stud bolts and make sure that the stud bolts are installed in their original positions.

    Position the front cover and loosely install the 5 bolts and the 5 stud bolts.

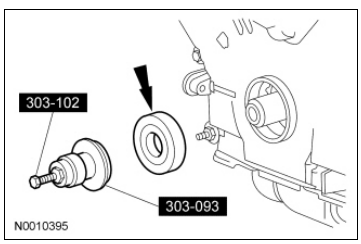


48. Install the Front Cover Aligner and tighten the 5 bolts and 5 stud bolts.
    - Tighten to 19 Nm (168 lb-in).



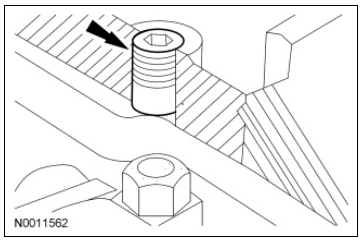
49. **NOTE:** Lubricate the seal lip with clean engine oil.

    Using the Front Cover Aligner and the Crankshaft Vibration Damper Installer, install the crankshaft front oil seal.



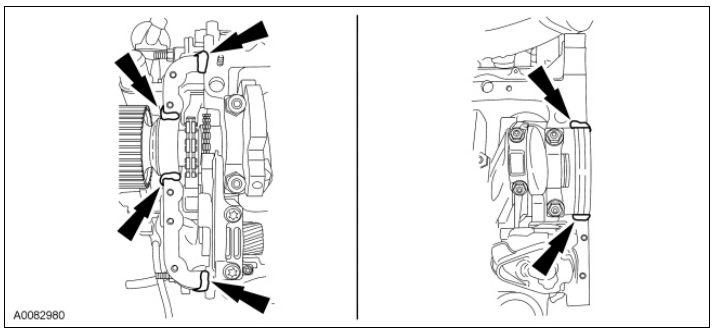
50. ***NOTICE:*** **The cylinder block cradle inserts must be loosened completely or damage to the cylinder block cradle or oil leaks can result.**

    Loosen the 8 cylinder block cradle inserts.

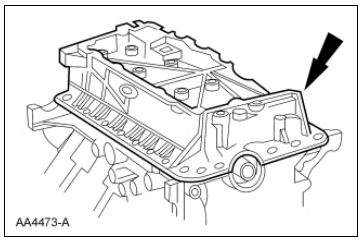


51. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

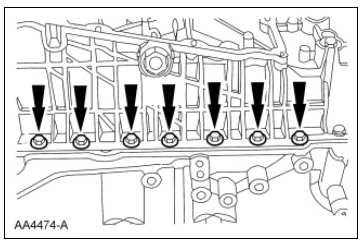
    Apply silicone gasket and sealant in the 6 places shown.



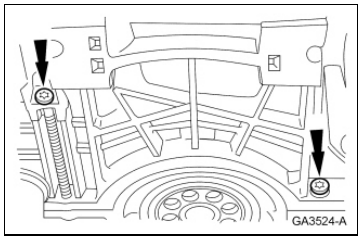
52. Position the cylinder block cradle and a new gasket assembly.



53. Install and finger-tighten the 20 bolts and 2 nuts.

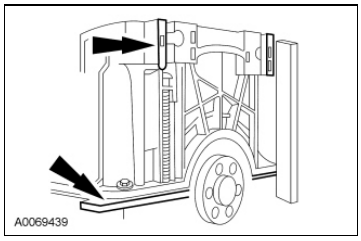


54. Install and finger-tighten the 2 Torx bolts.

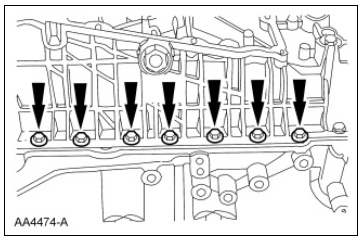


55. **NOTE:** The cylinder block cradle to the cylinder block alignment must be within a maximum mismatch of 0.25 mm (0.01 in) cylinder block cradle underflush or 0.05 mm (0.00196 in) cylinder block cradle protrusion.

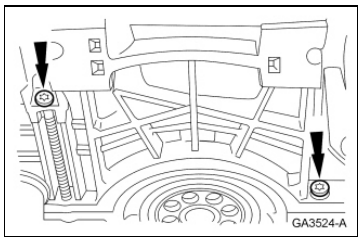
    Using a straightedge, align the transmission face of the cylinder block cradle with the rear face of the cylinder block.



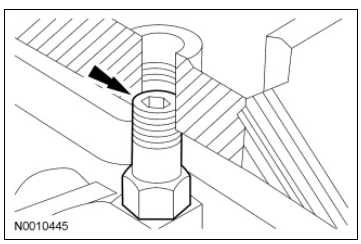
56. Tighten the 20 bolts and the 2 nuts.
    - Tighten the nuts to 10 Nm (89 lb-in).
    - Tighten the bolts to 14 Nm (124 lb-in).



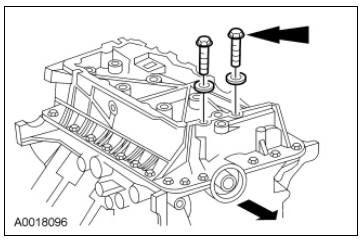
57. Tighten the Torx bolts.
    - Tighten to 10 Nm (89 lb-in).



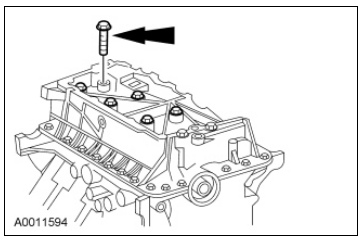
58. Tighten the 8 inserts.
    - Tighten to 3 Nm (27 lb-in).



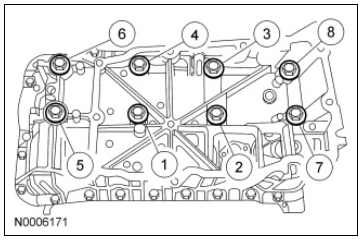
59. Install new seals on the 2 silver bolts and position them in the cylinder block cradle.



60. Position the 6 remaining bolts.



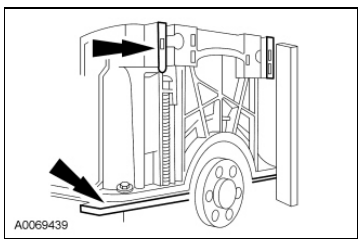
61. Tighten the 8 cylinder block cradle inner bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 15 Nm (133 lb-in).
    - Stage 2: Tighten to 34 Nm (25 lb-ft).



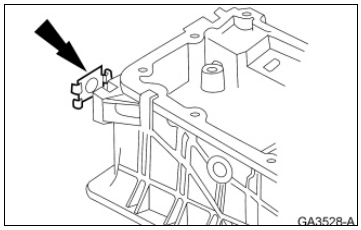
62. **NOTE:** The cylinder block cradle to the cylinder block alignment must be within a maximum mismatch of 0.25 mm (0.01 in) cylinder block cradle underflush or 0.05 mm (0.00196 in) cylinder block cradle protrusion.

    Measure the step between the rear face of the cylinder block and the transmission face of the cylinder block cradle.

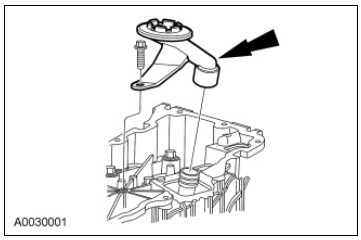
    - Cradles that exceed protrusion specification must be removed and the appropriate assembly steps repeated.
    - Cradles that exceed the underflush specification may be repaired by installing shims (next step).



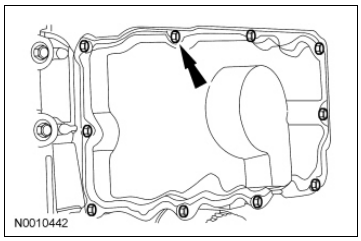
63. Repair all assemblies that exceed underflush specification by installing shims on one or both sides of the cylinder block cradle.



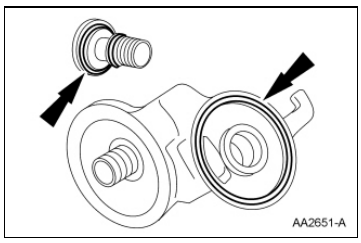
64. Install the oil pump screen cover and tube and the bolt.
    - Tighten to 10 Nm (89 lb-in).



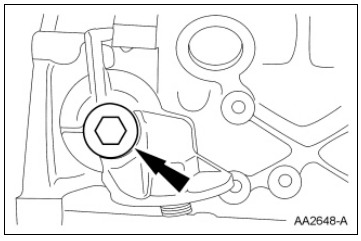
65. Install the gasket, the oil pan and the 10 bolts.
    - Tighten to 11 Nm (97 lb-in).



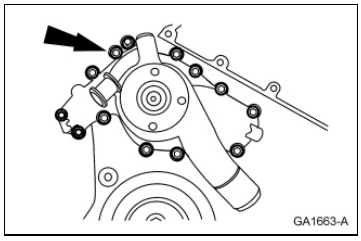
66. Inspect and install new oil filter adapter O-ring seals if necessary.



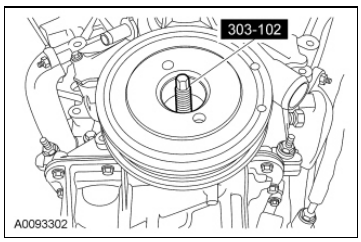
67. Install the oil filter adapter and the bolt.
    - Tighten to 57 Nm (42 lb-ft).



68. Install a new gasket, the coolant pump and the 13 bolts.
    - Tighten to 10 Nm (89 lb-in).



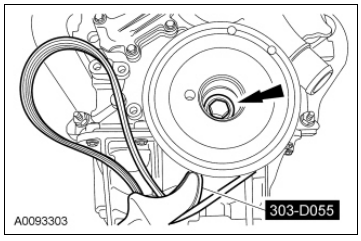
69. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.



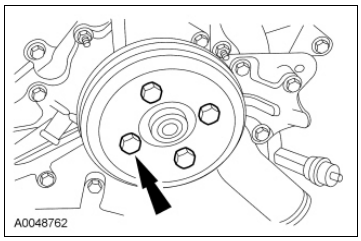
70. **NOTE:** A new bolt must be used each time it is removed.

    Using the Strap Wrench, tighten the bolt in 2 stages.

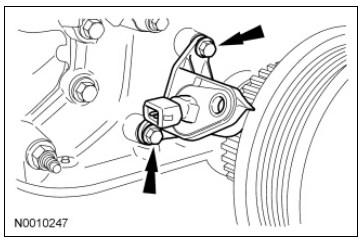
    - Stage 1: Tighten to 55 Nm (41 lb-ft).
    - Stage 2: Rotate an additional 85 degrees.



71. Install the coolant pump pulley and the 4 bolts.
    - Tighten to 25 Nm (18 lb-ft).

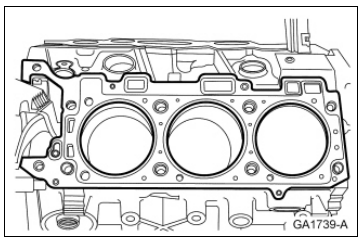


72. Position the Crankshaft Position (CKP) sensor and install the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



73. **NOTE:** LH shown, RH similar.

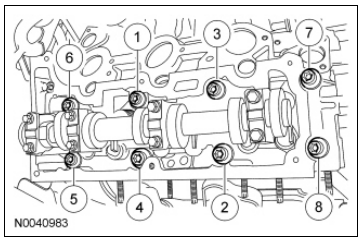
Install the cylinder head gaskets.



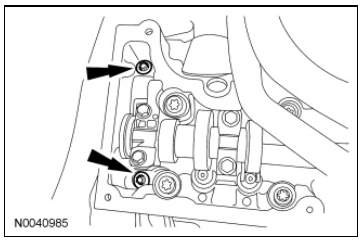
74. **NOTE:** New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

    Install the RH cylinder head. Install 8 new 12-mm bolts and tighten in the sequence shown in 2 stages.

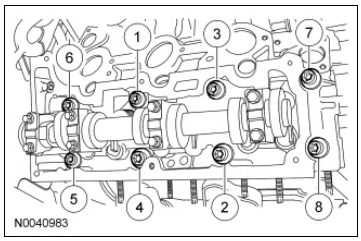
    - Stage 1: Tighten to 12 Nm (106 lb-in).
    - Stage 2: Tighten to 25 Nm (18 lb-ft).



75. Install 2 new 8-mm bolts.
    - Tighten to 32 Nm (24 lb-ft).



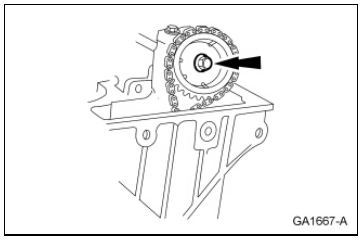
76. Tighten the 8 new 12-mm bolts in the sequence shown in 2 stages.
    - Stage 1: Rotate 90 degrees.
    - Stage 2: Rotate an additional 90 degrees.



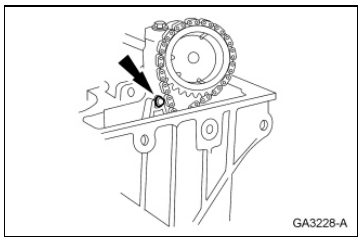
77. ***NOTICE:*** **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

    NOTE: The camshaft sprocket must turn freely on the camshaft. Do not tighten the bolt.

    Loosely install the RH camshaft sprocket bolt.



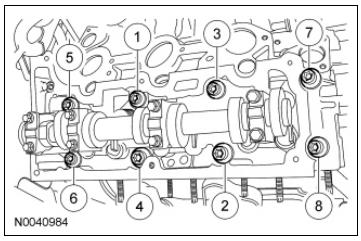
78. Install the RH cassette-to-cylinder head bolt.
    - Tighten to 10 Nm (89 lb-in).



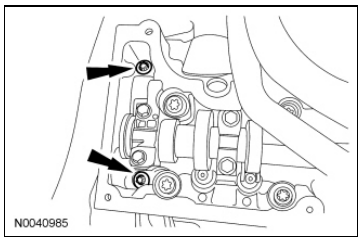
79. **NOTE:** New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

    Install the LH cylinder head and tighten the 8 new 12-mm bolts in the sequence shown in 2 stages.

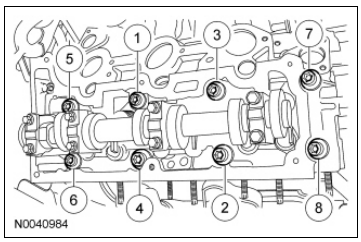
    - Stage 1: Tighten to 12 Nm (106 lb-in).
    - Stage 2: Tighten to 25 Nm (18 lb-ft).



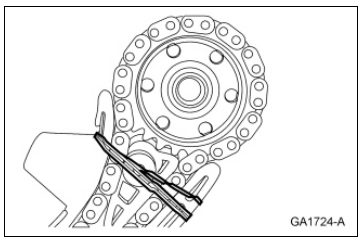
80. Install 2 new 8-mm bolts.
    - Tighten to 32 Nm (24 lb-ft).



81. Tighten the 8 new 12-mm bolts in the sequence shown in 2 stages.
    - Stage 1: Rotate 90 degrees.
    - Stage 2: Rotate an additional 90 degrees.

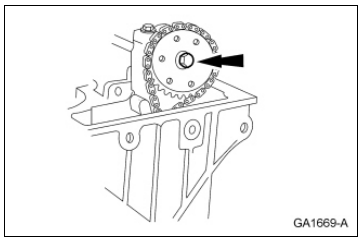


82. Position the LH camshaft sprocket.

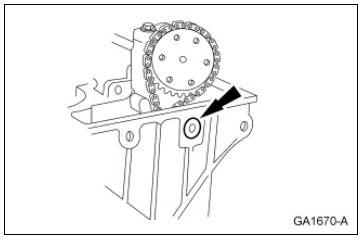


83. **NOTE:** The camshaft sprocket must turn freely on the camshaft. Do not tighten the bolt.

    Loosely install the LH camshaft sprocket bolt.



84. Install the LH cassette-to-cylinder head bolt.
    - Tighten to 12 Nm (106 lb-in).

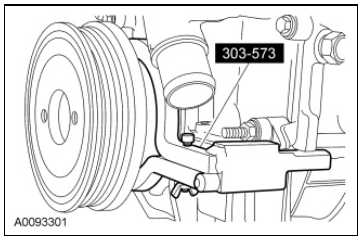


85. Turn the crankshaft one revolution clockwise.

86. ***NOTICE:*** **Do not rotate the engine counterclockwise. Rotating the engine counterclockwise will result in incorrect timing of the engine.**

    NOTE: The Crankshaft TDC Timing Tool must be installed on the damper and should contact the engine block. This positions the engine at Top Dead Center (TDC).

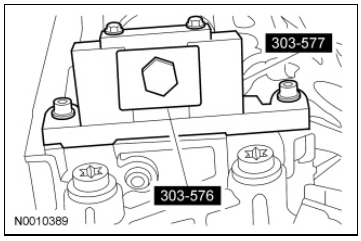
    Install the Crankshaft TDC Timing Tool.



87. **NOTE:** Camshaft timing slots are off-center.

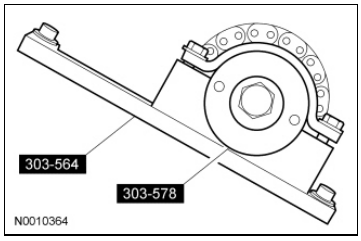
    NOTE: Position the camshaft timing slots below centerline of camshaft.

    Install the Camshaft Holding Tool and the Adapter for 303-577 on the front of the RH cylinder head.

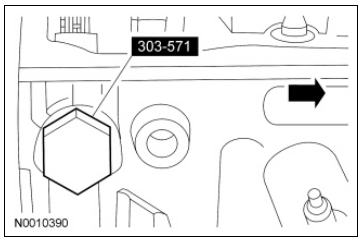


88. **NOTE:** Leave the top 2 Camshaft Sprocket Holding Tool clamp bolts loose.

    Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the rear of the RH cylinder head.



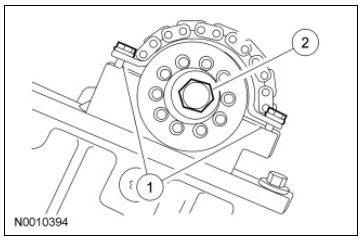
89. Install the Timing Chain Tensioner.



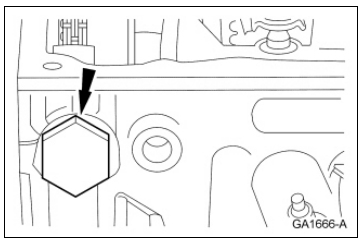
90. ***NOTICE:*** **The RH camshaft sprocket bolt is a LH-threaded bolt. Turning the bolt in the wrong direction can damage the bolt.**

    Tighten the bolts.

    1. Tighten the Camshaft Sprocket Holding Tool top 2 clamp bolts to 10 Nm (89 lb-in).
    2. Tighten the camshaft bolt to 85 Nm (63 lb-ft).

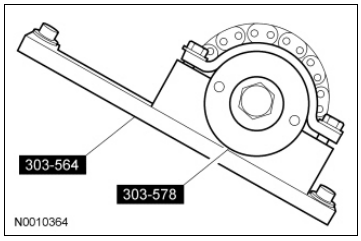


91. Install a new washer and the RH timing chain tensioner.
    - Tighten to 44 Nm (32 lb-ft).



92. **NOTE:** Do not tighten the Camshaft Sprocket Holding Tool top 2 clamp bolts. The camshaft sprocket must rotate freely.

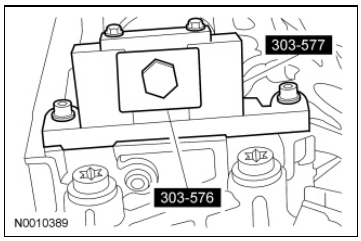
    Install the Camshaft Sprocket Holding Tool and the Adapter for 303-564 on the front of the LH cylinder head.



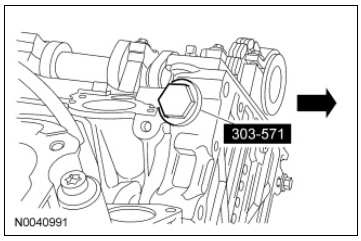
93. **NOTE:** Camshaft timing slots are off-center.

    NOTE: Position the camshaft timing slots below centerline of camshaft.

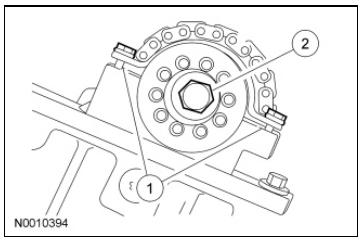
    Install the Camshaft Holding Tool and the Adapter for 303-577 on the front of the LH cylinder head.



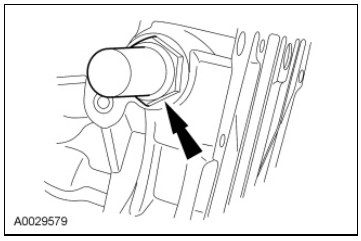
94. Install the Timing Chain Tensioner.



95. Tighten the bolts.
    1. Tighten the Camshaft Sprocket Holding Tool top 2 clamp bolts to 10 Nm (89 lb-in).
    2. Tighten the camshaft bolt to 85 Nm (63 lb-ft).

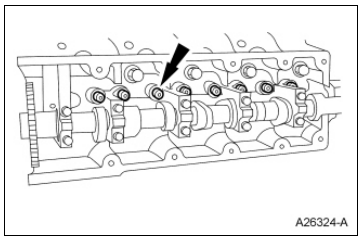


96. Install a new washer and the LH timing chain tensioner.
    - Tighten to 44 Nm (32 lb-ft).

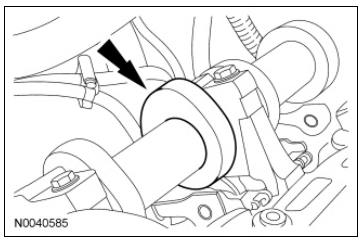


97. **NOTE:** Install the hydraulic lash adjuster in the same positions from which they were removed.

    Install the hydraulic lash adjusters.

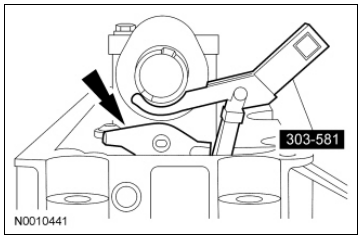


98. Rotate the crankshaft until the cam lobe on the cylinder being serviced is in the up position.



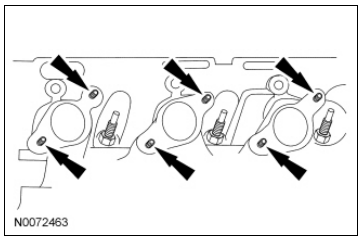
99. **NOTE:** Lubricate the parts with clean engine oil.

    Using the Valve Spring Compressor, install the roller followers in their original positions.



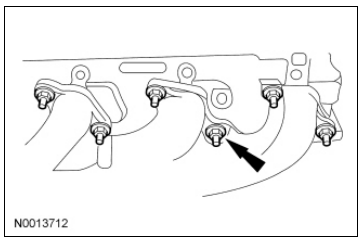
100. Inspect the RH and LH exhaust manifold gasket mating surfaces for flatness. For additional information, refer to Section 303-00 .

101. Install 6 new RH exhaust manifold studs.
     - Tighten to 12 Nm (106 lb-in).

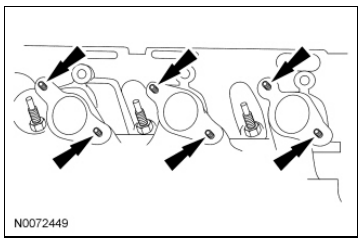


102. Install a new gasket, the RH exhaust manifold and the 6 new nuts.

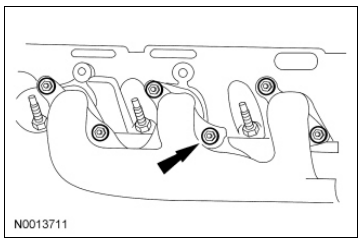
- Tighten to 22 Nm (16 lb-ft).



103. Install 6 new LH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).



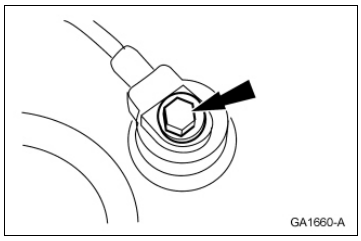
104. Install a new gasket, the LH exhaust manifold and the 6 new nuts.
    - Tighten to 22 Nm (16 lb-ft).



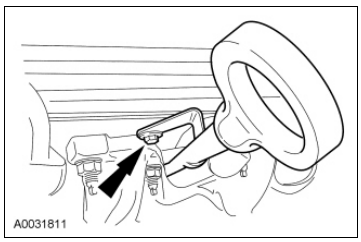
105. **NOTE:** Prior to installation, use metal surface prep to clean mating surfaces. Follow the directions on the packaging.

    Install the Knock Sensor (KS) and the bolt.

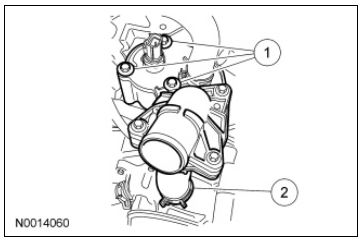
    - Tighten to 20 Nm (177 lb-in).



106. Install the oil level indicator tube and the bolt.
    - Tighten to 10 Nm (89 lb-in).



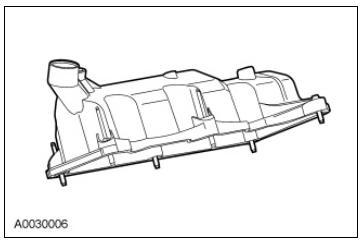
107. Position the thermostat housing and bypass hose on the coolant pump.
    1. Install the 3 bolts.
        - ♦ Tighten to 11 Nm (97 lb-in).
    2. Position the bypass hose clamp.



108. **NOTE:** RH valve cover shown, LH similar.

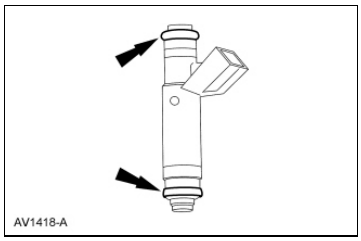
    Install the valve covers and tighten the 12 bolts.

    - Tighten to 10 Nm (89 lb-in).



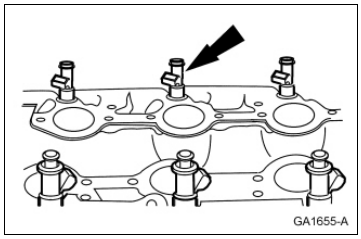
109. ***NOTICE:*** **Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings seals may cause the fuel system to leak. Do not reuse the O-ring seals.**

    Install new O-ring seals on each of the fuel injectors.

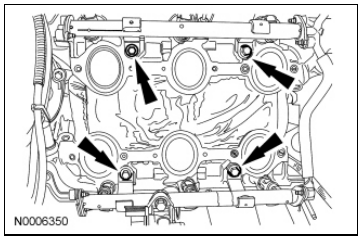


110. **NOTE:** Lubricate the fuel injector O-ring seals with clean engine oil.

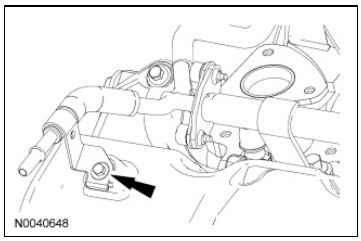
    Install the fuel injectors.



111. Install the fuel rail and the 4 bolts.
    - Tighten to 24 Nm (18 lb-ft).



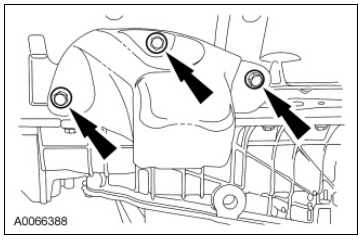
112. Position the fuel supply tube and install the bolt.
    - Tighten to 6 Nm (53 lb-in).



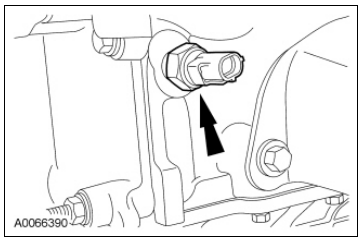
113. **NOTE:** LH shown, RH similar.

    Install the LH and RH insulator brackets and the 6 bolts.

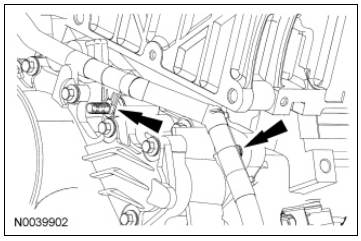
    - Tighten to 80 Nm (59 lb-ft).



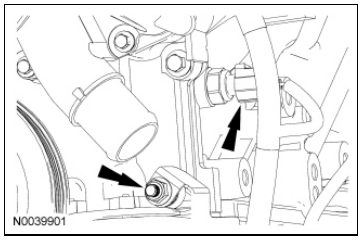
114. Install the oil pressure switch.
    - Tighten to 13 Nm (115 lb-in).



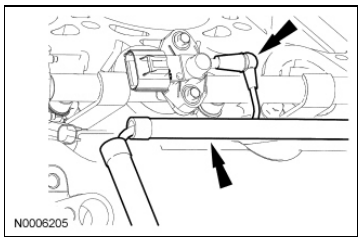
115. Position the battery cable and harness and attach the retainers.



116. Connect the oil pressure switch electrical connector. Position the battery cable and harness bracket and install the nut.
    - Tighten to 20 Nm (177 lb-in).

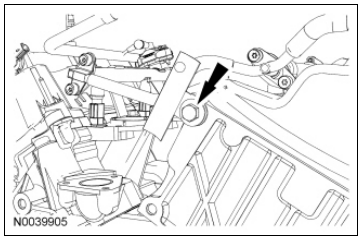


117. Position the vacuum harness on the engine and connect the fuel pressure and temperature sensor vacuum hose fittings.

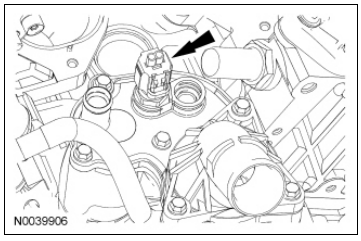


118. Position the engine wiring harness on the engine.

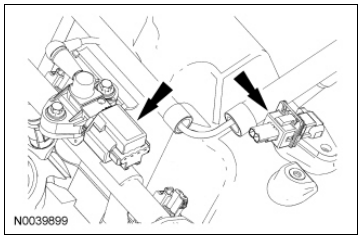
119. Position the engine wiring harness retainer and install the bolt.
    - Tighten to 47 Nm (35 lb-ft).



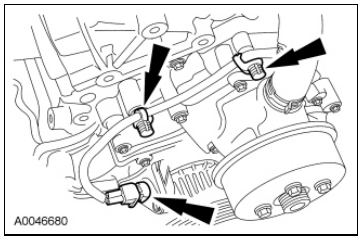
120. Connect the Engine Coolant Temperature (ECT) sensor electrical connector.



121. Connect the fuel rail pressure and temperature sensor and the Camshaft Position (CMP) sensor electrical connector.

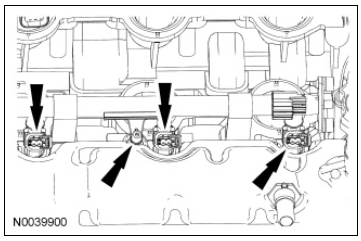


122. Connect the Crankshaft Position (CKP) sensor electrical connectors and new wiring anchors.



123. **NOTE:** RH shown, LH similar.

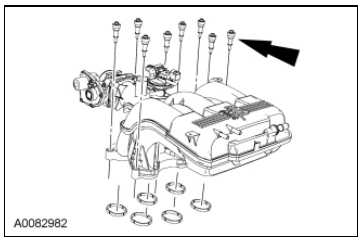
    Connect the 6 fuel injector electrical connectors and attach the wiring harness retainers.



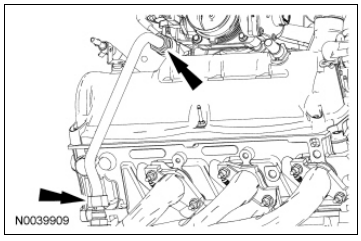
124. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

    Install the gaskets, the intake manifold and the 8 bolts.

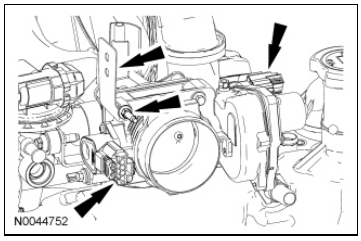
    - Tighten to 11 Nm (97 lb-in).



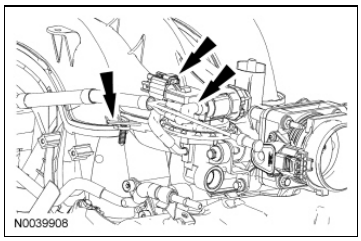
125. Install the exhaust manifold-to-EGR system module tube.
    - Tighten to 34 Nm (25 lb-ft).



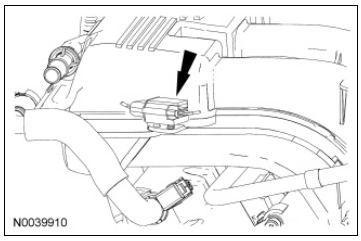
126. Connect the Electronic Throttle Body (ETB) and Throttle Position (TP) sensor electrical connectors. Attach the wiring harness bracket and install the nut.
    - Tighten to 9 Nm (80 lb-in).



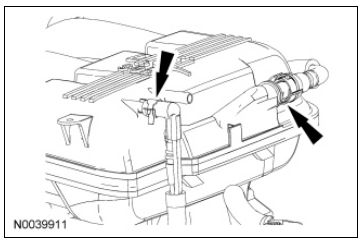
127. Connect the EGR system module vacuum hose and electrical connector. Attach the wiring harness pin-type retainer.



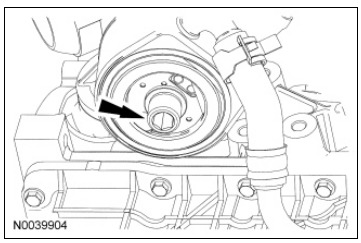
128. Attach the wiring harness pin-type retainer and connect the KS electrical connector.



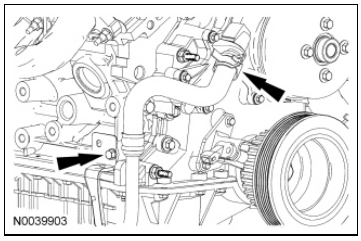
129. Connect the vacuum and PCV hoses to the intake manifold.



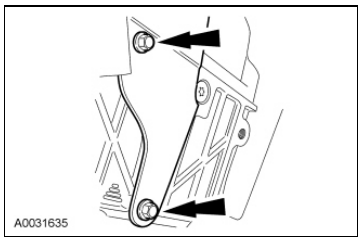
130. Install the oil cooler and hose.
    - Tighten to 57 Nm (42 lb-ft).



131. Connect the oil cooler hose. Position the oil cooler hose bracket and install the bolt.
    - Tighten to 25 Nm (18 lb-ft).

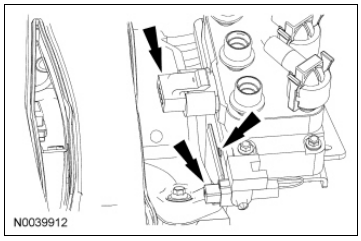


132. Position the ignition coil, bracket and spark plug wires as an assembly and install the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



133. **NOTE:** RH spark plug wires removed for clarity.

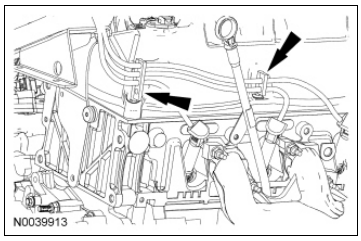
    Attach the wiring harness retainer and connect the coil and radio interference capacitor electrical connectors.



134. ***NOTICE:*** **Make sure to orient the spark plug boots so the spark plug wires do not contact the exhaust manifold or the spark plug wires may be damaged.**

    NOTE: Apply silicone dielectric compound to the inside of the spark plug boots.

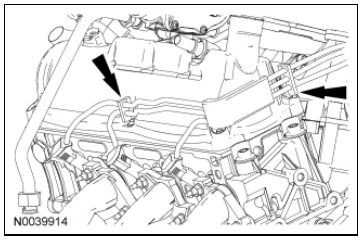
    Attach the LH spark plug wire retainers and connect the LH spark plug wires to the spark plugs.



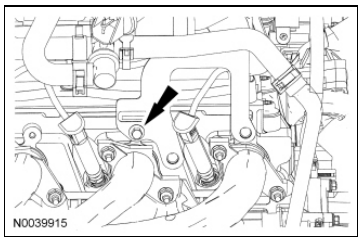
135. ***NOTICE:*** **Make sure to orient the spark plug boots so the spark plug wires do not contact the exhaust manifold or the spark plug wires may be damaged.**

    NOTE: Apply silicone dielectric compound to the inside of the spark plug boots.

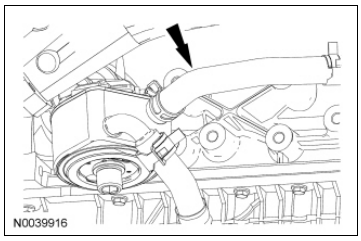
    Attach the RH spark plug wire retainers and connect the RH spark plug wires to the spark plugs.



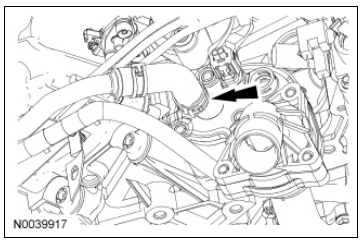
136. Position the heater hose tube bracket and the hoses as an assembly and install the bolt.
    - Tighten to 23 Nm (17 lb-ft).



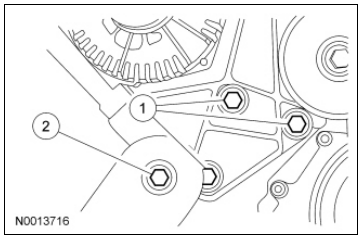
137. Connect the hose to the oil cooler.



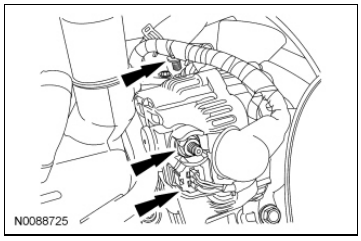
138. Connect the heater hose to the thermostat housing.



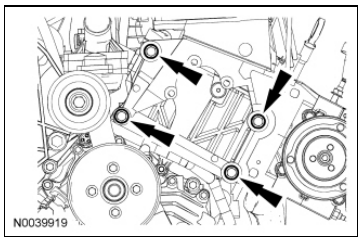
139. Install the generator mounting bracket.
    1. Install the 3 generator mounting bracket bolts.
        - ♦ Tighten to 42 Nm (31 lb-ft).
    2. Install the drive belt tensioner and bolt.
        - ♦ Tighten to 47 Nm (35 lb-ft).



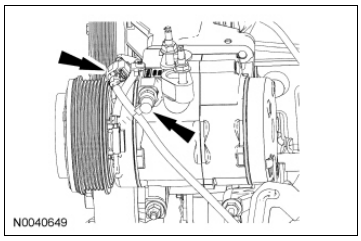
140. Attach the wire harness retainer, connect the generator electrical connector and the B+ cable and install the nut.
    - Tighten to 9 Nm (80 lb-in).



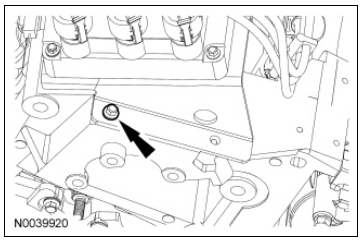
141. Install the A/C compressor and power steering pump bracket and the 4 bolts.
    - Tighten to 42 Nm (31 lb-ft).



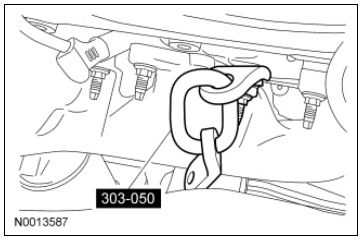
142. Connect the A/C compressor electrical connector and wire harness retainer.



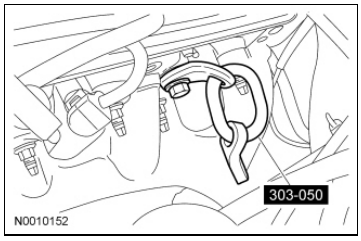
143. Install the ignition coil bracket bolt.
    - Tighten to 10 Nm (89 lb-in).



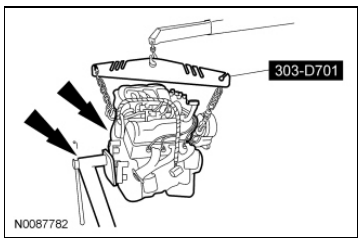
144. Install the right side Engine Lifting Bracket.



145. Install the left side Engine Lifting Bracket.



146. Using the Spreader Bar and a floor crane, remove the engine from the engine stand.

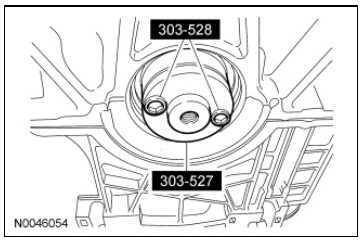


147. **NOTE:** The new replacement crankshaft rear seal comes with a speedy sleeve. The speedy sleeve must be installed with the crankshaft rear seal.

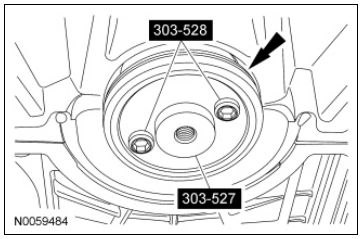
    NOTE: Be sure that the crankshaft rear sealing surface is clean and free of any rust or corrosion. To clean the crankshaft rear sealing surface, use an extra-fine emery cloth or an extra-fine steel wool with metal surface prep.

    Lubricate the crankshaft rear oil seal with engine oil.

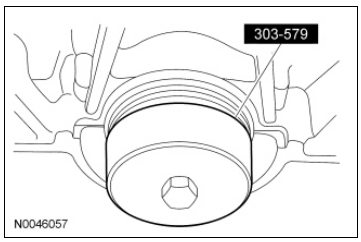
148. Install the Adapter for 303-579 and the Crankshaft Rear Oil Seal Screws.



149. Position the crankshaft rear seal with speedy sleeve on the Adapter for 303-579 and the Crankshaft Rear Oil Seal Screws.



150. Using the Crankshaft Rear Oil Seal Installer, install the crankshaft rear oil seal with speedy sleeve.



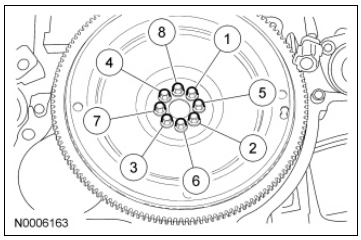
151. Install the spacer plate.

152. Install the flexplate-to-crankshaft spacer.

153. **NOTE:** New flexplate bolts must be installed. They are a torque-to-yield design and cannot be reused.

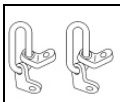
    Install the flexplate.

    - Tighten the 8 new bolts in the sequence shown in 3 stages.
    - Stage 1: Tighten to 13 Nm (115 lb-in).
    - Stage 2: Tighten to 50 Nm (37 lb-ft).
    - Stage 3: Tighten an additional 90 degrees.



Engine

Special Tool(s)

 ST1595-A	Engine Lifting Bracket 303-050 (T70P-6000)
 ST2673-A	Spreader Bar 303-D701 or equivalent

Material

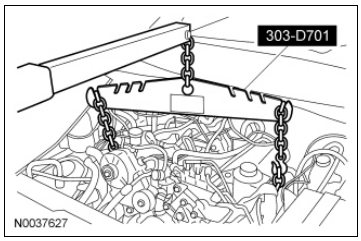
Item	Specification
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Installation

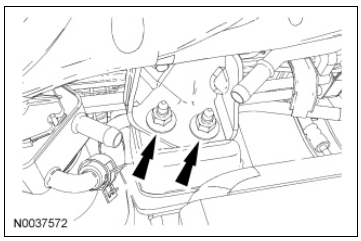
NOTICE: **Rotating the crankshaft pulley bolt counterclockwise could cause a reduction in clamp load on the crankshaft pulley and timing sprocket, which could cause severe engine damage.**

NOTICE: **If used as a leverage device, the fuel rail can be damaged. Care must be taken when working around the fuel rail.**

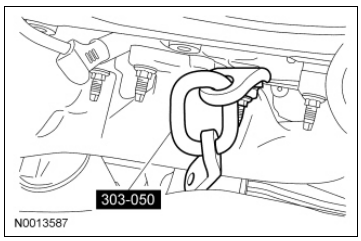
1. Position the engine in the vehicle and remove the floor crane and the Spreader Bar.



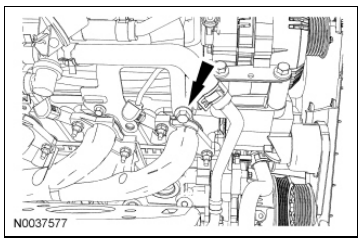
2. Install the 2 RH engine support insulator nuts.
   - Tighten to 90 Nm (66 lb-ft).



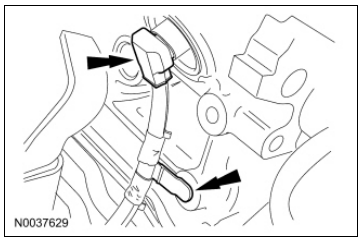
3. Remove the Engine Lifting Bracket from the RH side of the engine.



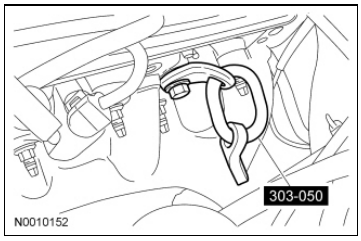
4. Install the heater tube bracket front bolt.
   - Tighten to 34 Nm (25 lb-ft).



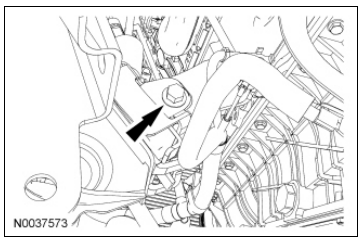
5. If equipped, connect the block heater electrical connector and the wiring harness retainer.



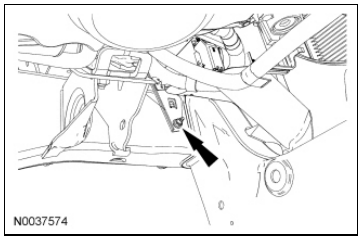
6. Remove the Engine Lifting Bracket from the LH side of the engine.



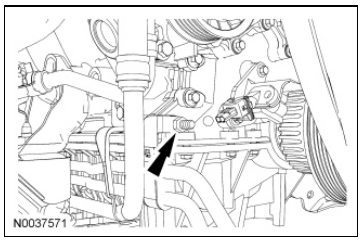
7. Install the LH engine support insulator through bolt.
   - Tighten to 103 Nm (76 lb-ft).



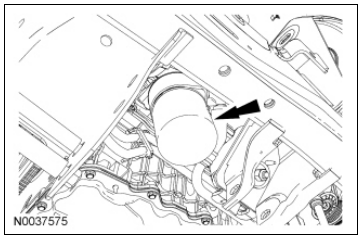
8. Position the battery cable harness bracket and install the nut.
   - Tighten to 15 Nm (133 lb-in).



9. Position the transmission cooler tubes and install the nut.
   - Tighten to 23 Nm (17 lb-ft).

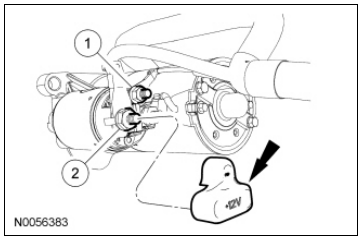


10. Install the oil filter.
    - Tighten to 13 Nm (115 lb-in).

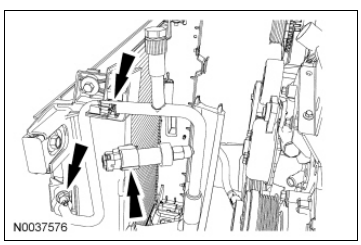


11. Install the transmission. For additional information, refer to Section 307-01A .

12. Attach the starter wiring and install the nuts. Install the terminal cover.
    1. Tighten the S-terminal nut to 6 Nm (53 lb-in).
    2. Tighten the B-terminal nut to 12 Nm (106 lb-in).

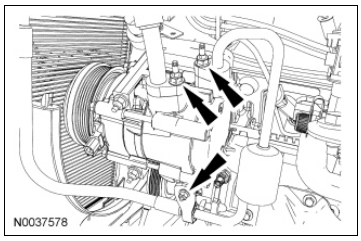


13. Install a new gasket and a new O-ring seal. Position the A/C tube, install the A/C line fitting nut, close the latch and connect the A/C high pressure cutoff switch electrical connector.
    - Tighten to 15 Nm (133 lb-in).

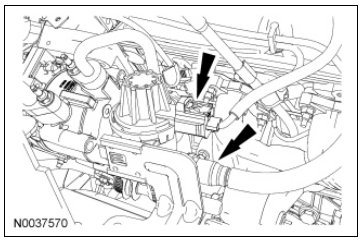


14. Install new gaskets and new O-ring seal. Position the A/C tubes and install the 3 nuts.

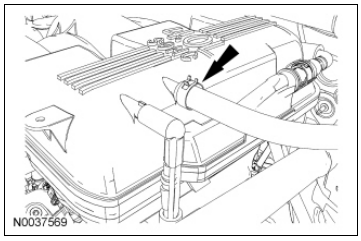
- Tighten the 2 A/C fitting nuts to 15 Nm (133 lb-in).
- Tighten the A/C tube bracket nut to 10 Nm (89 lb-in).



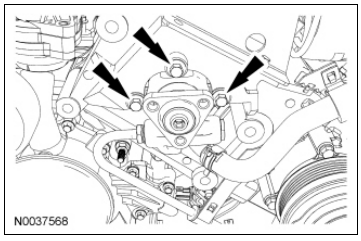
15. Position the Evaporative Emission (EVAP) hose and connect it to the EVAP canister purge valve. Connect the EVAP canister purge valve electrical connector.



16. Connect the brake booster vacuum hose.



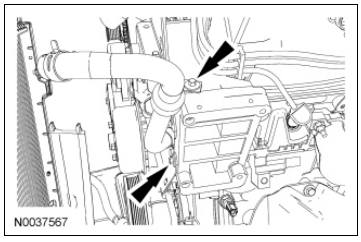
17. Position the power steering pump and install the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).



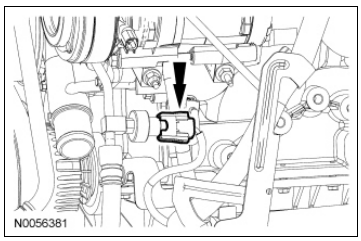
18. **NOTE:** A/C compressor removed from art for clarity.

    Position the Power Steering Pressure (PSP) hose and the power steering reservoir-to-power steering pump hoses and install the 2 bolts.

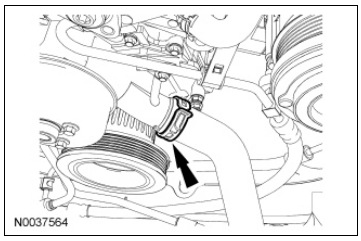
    - Tighten to 11 Nm (97 lb-in).



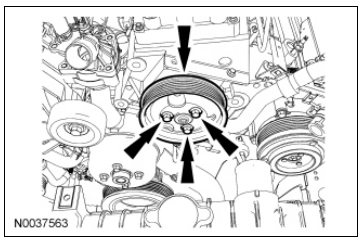
19. Connect the PSP switch electrical connector.



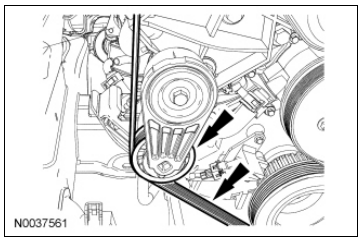
20. Connect the lower radiator hose to the coolant pump.



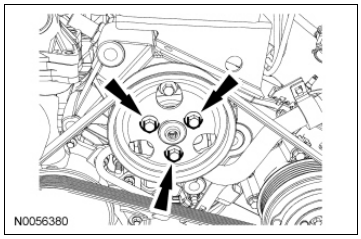
21. Position the power steering pump pulley and install the 3 bolts finger-tight.



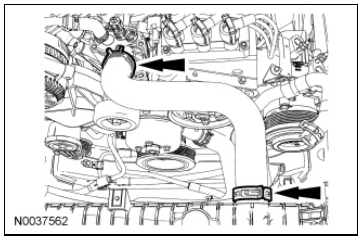
22. Rotate the accessory drive belt counterclockwise and install the accessory drive belt.



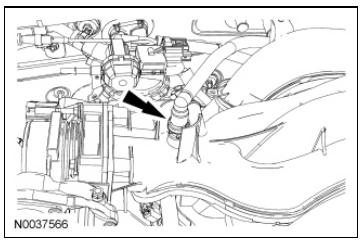
23. Tighten the 3 power steering pump pulley bolts.
    - Tighten to 25 Nm (18 lb-ft).



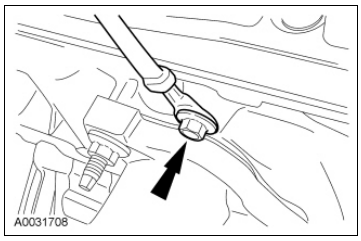
24. Install the upper radiator hose.



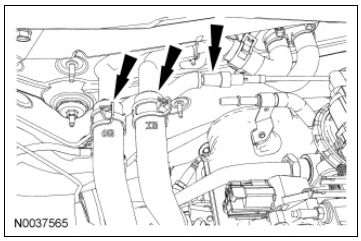
25. Connect the EVAP hose.



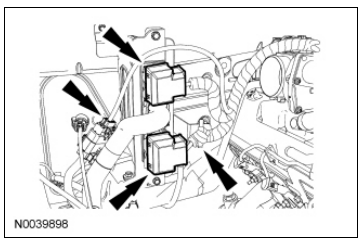
26. Position the ground strap to the RH cylinder head and install the bolt.
    - Tighten to 10 Nm (89 lb-in).



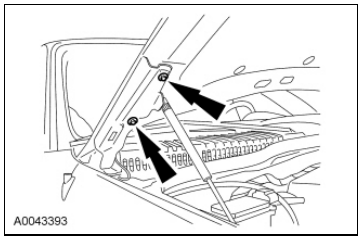
27. Connect the heater hoses and the vacuum hose.
    - Connect the heater control valve vacuum hose.



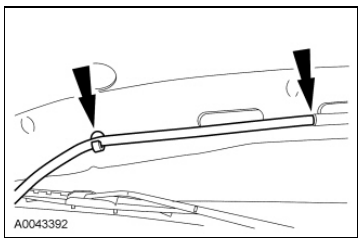
28. Connect the engine wiring harness-to-PCM electrical connectors and the wiring harness electrical connector. Attach the wiring harness retainer.



29. Position the hood and install the 4 bolts.
    - Tighten to 12 Nm (106 lb-in).



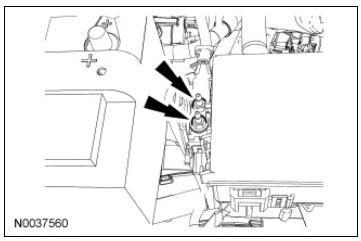
30. Connect the windshield washer hose.



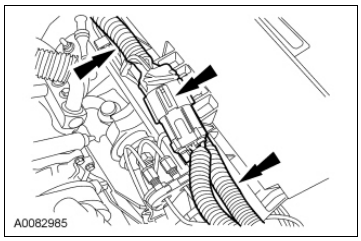
31. Install the Air Cleaner (ACL) and the ACL outlet pipe. For additional information, refer to Section 303-12 .

32. Install the cooling fan. For additional information, refer to Section 303-03 .

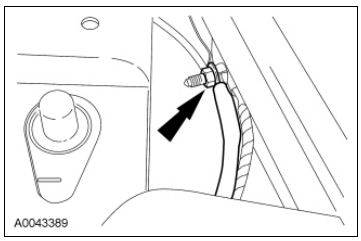
33. Connect the battery cable connectors and install the 2 nuts. Close the cover.
    - Tighten to 12 Nm (106 lb-in).



34. Connect the electrical connector and attach the wiring harness retainers.



35. Position the ground wire and install the nut.
    - Tighten to 9 Nm (80 lb-in).



36. Connect the battery cables. For additional information, refer to Section 414-01 .

37. Connect the fuel supply tube spring lock coupling. For additional information, refer to Section 310-00 .

38. Fill the engine with clean engine oil.

39. Fill the cooling system. For additional information, refer to Section 303-03 .

40. Recharge the A/C system. For additional information, refer to Section 412-00 .

41. Start the engine and check for leaks. Stop the engine and check all fluid levels.

42. Carry out the fluid level check for the transmission. For additional information, refer to Section 307-01A .

Material

Item	Specification	Fill Capacity
Gasket Maker TA-16	WSK-M2G348-A5	-
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada); or equivalent	WSS-M97B51-A1	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	5.7L (6.0 qt)
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Motorcraft® Silicone Gasket Remover ZC-30	-	-

General Specifications

Item	Specification
Engine	
Displacement	4.6L (281 CID)
Number of cylinders	8
Bore	90.2 mm (3.55 in)
Stroke	90.0 mm (3.54 in)
Firing order	1-3-7-2-6-5-4-8
Spark plugs	HJFS-24FP
Minimum oil pressure at idle (engine at normal operating temperature)	172 kPa (25 psi)
Oil pressure minimum at 2,000 rpm (engine at normal operating temperature)	517 kPa (75 psi)
Compression ratio	9.8:1

Engine weight (without accessory drive components or flexplate)	220 kg (485 lb)
Cylinder Head and Valve Train	
Combustion chamber volume	48.1-51.1 cc (2.94-3.12 cu in)
Valve arrangement (front to rear) - LH	I-E-I-I-E-I-I-E-I-I-E-I
Valve arrangement (front to rear) - RH	I-E-I-I-E-I-I-E-I-I-E-I
Valve guide bore diameter	6.015-6.044 mm (0.237-0.238 in)
Valve stem diameter - intake	5.975-5.995 mm (0.235-0.236 in)
Valve stem diameter - exhaust	5.95-5.97 mm (0.234-0.235 in)
Valve stem-to-guide clearance - intake	0.020-0.069 mm (0.001-0.003 in)
Valve stem-to-guide clearance - exhaust	0.045-0.094 mm (0.002-0.004 in)
Valve head diameter - intake	33.62-33.98 mm (1.324-1.338 in)
Valve head diameter - exhaust	37.32-37.68 mm (1.469-1.483 in)
Valve face runout	0.05 mm (0.002 in)
Valve face angle	45.5 degrees
Valve seat width - intake	1.2-1.4 mm (0.047-0.055 in)
Valve seat width - exhaust	1.4-1.6 mm (0.055-0.063 in)
Valve seat angle	44.5-45.0 degrees
Valve spring free length	56.5 mm (2.22 in)
Valve spring compression pressure (maximum lift)	760 N (171 lb) ± 39.0 N (8.8 lb) @ 31.04 mm (1.22 in)
Valve spring installed height	42.04 mm (1.66 in)
Valve spring installed pressure	350 N (79 lb) ± 17.5 N (4 lb) @ 42.04 mm (1.66 in)
Head gasket surface flatness	0.025 mm (0.001 in) in any 25 mm (1 in) x 25 mm (1 in) area; 0.05 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area; 0.1 mm (0.004 in) overall
Hydraulic Lash Adjuster	
Diameter	15.988-16.000 mm (0.6294-0.6299 in)
Clearance-to-bore	0.018-0.069 mm (0.0007-0.0027 in)
Service limit	-
Collapsed lash adjuster gap	0.45-0.85 mm (0.018-0.033 in)
Camshaft	
Theoretical valve lift @ 0 lash - intake	11.166 mm (0.439 in)
Theoretical valve lift @ 0 lash - exhaust	11.066 mm (0.436 in)
Lobe lift - intake	5.520 mm (0.217 in)
Lobe lift - exhaust	5.506 mm (0.217 in)
Allowable lobe lift loss	0.00127 mm (0.00005 in)
Journal diameter	28.607-28.633 mm (1.126-1.127 in)
Camshaft journal bore inside diameter	28.657-28.682 mm (1.128-1.129 in)
Camshaft journal-to-bearing clearance	0.024-0.075 mm (0.001-0.003 in)

Runout	0.03 mm (0.001 in)
End play	0.027-0.190 mm (0.001-0.007 in)
Cylinder Block	
Cylinder bore diameter - grade 1	90.200-90.210 mm (3.5512-3.5516 in)
Cylinder bore diameter - grade 2	90.210-90.220 mm (3.5516-3.5520 in)
Cylinder bore diameter - grade 3	90.220-90.230 mm (3.5520-3.5524 in)
Cylinder bore maximum taper	0.006 mm (0.0002 in)
Cylinder bore maximum out-of-round	0.020 mm (0.0008 in)
Main bearing bore inside diameter	72.400-72.424 mm (2.850-2.851 in)
Head gasket surface flatness	0.03 mm (0.001 in) in any 40 mm (1.5 in) x 40 mm (1.5 in) area; 0.05 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area; 0.15 mm (0.006 in) overall
Crankshaft	
Main bearing journal diameter	67.481-67.505 mm (2.6567-2.6576 in)
Main bearing journal maximum taper	0.004 mm (0.0002 in)
Main bearing journal maximum out-of-round	0.0075 mm (0.0003 in) between cross sections
Main bearing journal-to-cylinder block clearance	0.048-0.024 mm (0.0019-0.0009 in)
Connecting rod journal diameter	53.003-52.983 mm (2.0867-2.0859 in)
Connecting rod journal maximum taper	0.004 mm (0.0002 in)
Connecting rod journal maximum out-of-round	0.0075 mm (0.0003 in) between cross sections
Crankshaft maximum end play	0.075-0.377 mm (0.0030-0.0148 in)
Piston and Connecting Rod	
Piston diameter - grade 1 (at right angle to pin bore) (uncoated)	90.182-90.167 mm (3.5504-3.5499 in)
Piston diameter - grade 2 (at right angle to pin bore) (uncoated)	90.196-90.179 mm (3.551-3.5503 in)
Piston diameter - grade 3 (at right angle to pin bore) (uncoated)	90.208-90.193 mm (3.5515-3.551 in)
Piston-to-cylinder bore clearance (at grade size)	0.017-0.047 mm (0.0007-0.0019 in)
Piston ring end gap - top	0.15-0.30 mm (0.006-0.012 in)
Piston ring end gap - intermediate	0.25-0.50 mm (0.0098-0.0197 in)
Piston ring end gap - oil control	0.15-0.65 mm (0.0059-0.0256 in)
Piston ring groove width - top	1.52-1.54 mm (0.0598-0.0606 in)
Piston ring groove width - intermediate	1.52-1.54 mm (0.0598-0.0606 in)
Piston ring groove width - oil control	3.030-3.056 mm (0.1193-0.1203 in)
Piston ring width - top and intermediate	1.50-1.48 mm (0.0590-0.0582 in)
Piston ring-to-groove clearance - top	0.020-0.060 mm (0.0008-0.0020 in)
Piston ring-to-groove clearance - intermediate	0.020-0.060 mm (0.0008-0.0020 in)
Piston pin bore diameter	22.0125-22.0175 mm (0.8666-0.8668 in)
Piston pin diameter	22.0010-22.0030 mm (0.8662-0.8663 in)
Piston pin length	61.8 mm (2.433 in)

Piston pin-to-piston fit	0.0095-0.023 mm (0.0004-0.0009 in)
Connecting rod-to-pin clearance	0.009-0.023 mm (0.0004-0.0009 in)
Connecting rod pin bore diameter	22.012-22.024 mm (0.8666-0.8671 in)
Connecting rod length (center-to-center)	150.7 mm (5.933 in)
Connecting rod maximum allowed bend	± 0.038 mm (0.0015 in)
Connecting rod maximum allowed twist [a]	± 0.05 mm (0.0020 in)
Connecting rod bearing bore diameter (with assembled liners)	53.049-53.027 mm (2.0885-2.0877 in)
Connecting rod bearing-to-crankshaft clearance	0.024-0.066 mm (0.0009-0.0026 in)
Connecting rod side clearance	0.5-0.15 mm (0.02-0.006 in)

[a] The pin bore and crank bearing bore must be parallel and in the same vertical plane within the specified total difference when measured at the ends of a 203 mm bar, 105.5 mm on each side of rod centerline.

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor stud bolt	25	18	-
A/C compressor nuts	25	18	-
A/C hose bracket-to-A/C compressor nut	20	-	177
Accessory drive belt idler pulley bolts	25	18	-
Accessory drive belt tensioner bolts	25	18	-
Alternator lower mounting nuts	25	18	-
Alternator mounting bracket bolts	10	-	89
Auxiliary line bracket nut	6	-	53
Battery cable bracket-to-engine front cover nut	10	-	89
Battery cable bracket-to-engine support insulator bracket bolt	15	-	133
Battery cable bracket-to-power steering pump nuts	10	-	89
Camshaft bearing cap bolts [a]	-	-	-
Camshaft phaser sprocket assembly bolts [a]	-	-	-
Camshaft Position (CMP) sensor bolt	10	-	89
Connecting rod cap bolts [a]	-	-	-
Coolant crossover bolts	10	-	89
Coolant pump bolts	25	18	-
Coolant pump pulley bolts	25	18	-
Cooling fan wiring harness bracket nut	25	18	-
Crankshaft main bearing cap bolts [a]	-	-	-
Crankshaft main bearing cap side bolts [a]	-	-	-
Crankshaft main bearing cap jack screws [a]	-	-	-
Crankshaft main bearing cap stud bolt [a]	-	-	-
Crankshaft Position (CKP) sensor bolt	10	-	89

Crankshaft pulley bolt [a]	-	-	-
Crankshaft rear seal retainer bolts [a]	-	-	-
Cylinder head bolts [a]	-	-	-
Cylinder Head Temperature (CHT) sensor	10	-	89
Differential housing bolts	66	49	-
Dual converter Y-pipe-to-exhaust manifold nuts	40	30	-
Engine front cover bolts [a]	-	-	-
Engine support insulator bracket bolts	72	53	-
Engine support insulator nuts	90	66	-
Engine support insulator through bolt	103	76	-
Exhaust manifold heat shield bolts	10	-	89
Exhaust manifold nuts [a]	-	-	-
Exhaust manifold studs	12	-	106
Flexplate bolts [a]	-	-	-
Ground strap-to-heater supply tube nut	10	-	89
Ground strap-to-cowl nut	12	-	106
Heated PCV fitting bolts	10	-	89
Heater supply tube stud bolt	10	-	89
Hood hinge bolts	12	-	106
Ignition coil bolts	6	-	53
Intake manifold bolts [a]	-	-	-
Knock Sensor (KS) bolts	20	-	177
Oil drain splash shield	12	-	106
Oil filter adapter bolts	25	18	-
Oil level indicator tube bolt	10	-	89
Oil pan bolts [a]	-	-	-
Oil pan drain plug	23	17	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube spacer	25	18	-
Oil pump screen and pickup tube-to-oil pump bolts	10	-	89
Oil pump screen and pickup tube-to-spacer bolt	25	18	-
Power Steering Pressure (PSP) hose-to-battery cable bracket nut	10	-	89
Power steering pump stud bolts	25	18	-
Radio interference capacitor nuts	25	18	-
Spark plugs	12	-	106
Stabilizer bar bracket bolts	55	41	-
Steering intermediate shaft coupling bolt	48	35	-
Throttle Body (TB) bolts	10	-	89
Timing chain guide bolts	10	-	89
Timing chain hydraulic tensioner bolts	25	18	-
Transmission cooler tube bracket-to-engine front cover nut	12	-	106
Valve cover bolts [a]	-	-	-
Variable Camshaft Timing (VCT) housing bolts	10	-	89
Wiring harness bracket nuts	10	-	89

Wiring harness terminals-to-Power Distribution Box (PDB) nuts	12	-	106

[a] Refer to the procedure in this section.

Engine

NOTE: For information, refer to the exploded views under Engine in the Assembly portion of this section.

The 4.6L (3V) is a V-8 engine with the following features:

- Single overhead camshafts
- Three valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- Aluminum cylinder heads
- Aluminum cylinder block
- Variable Camshaft Timing (VCT)
- Individually chain-driven camshafts with a hydraulic timing chain tensioner on each timing chain
- Distributorless ignition system
- Electronic returnless fuel system

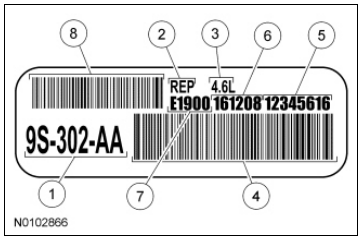
Identification

Always refer to these labels when installation of new parts is necessary or when checking engine calibrations. The engine parts often differ within a CID family. Verification of the identification codes will make sure that the correct parts are obtained. These codes contain all of the pertinent information relating to the dates, optional equipment and revisions. The Ford Catalog AdvantageTM or equivalent contains a complete listing of the codes and their applications.

Engine Code Information Label

The engine code information label is located on the side of the LH valve cover, it contains the following:

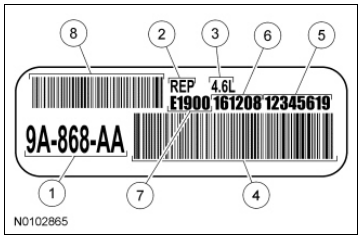
Explorer/Mountaineer



Item	Description
1	Engine part number
2	Romeo engine plant
3	Engine displacement
4	Bar code
5	Running number
6	Engine build date (DDMMYY)
7	Plant shift line

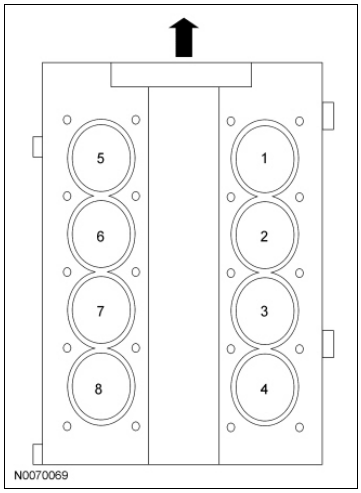
8	Bar code

Explorer Sport Trac



Item	Description
1	Engine part number
2	Romeo engine plant
3	Engine displacement
4	Bar code
5	Running number
6	Engine build date (DDMMYY)
7	Plant shift line
8	Bar code

Engine Cylinder Identification



Induction System

The SFI provides the fuel/air mixture needed for combustion in the cylinders. The 8 solenoid-operated fuel injectors:

- are mounted in the intake manifold.
- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.

- are connected in series with the fuel rail pressure and temperature sensor.
- supply fuel from the fuel tank with a fuel pump mounted in the fuel tank.

A constant fuel pressure is maintained across the fuel injectors by the fuel rail pressure and temperature sensor. The fuel rail pressure and temperature sensor is positioned upstream from the fuel injectors on the fuel rail.

Valve Train

The valve train operates as follows:

- Ball-tip hydraulic lash adjusters provide automatic lash adjustment.
- Roller followers ride on the camshaft lobe, transferring the up-and-down motion of the camshafts to the valves in the cylinder heads.

Positive Crankcase Ventilation System

All engines are equipped with a closed-type positive crankcase ventilation system recycling the crankcase vapors to the upper intake manifold.

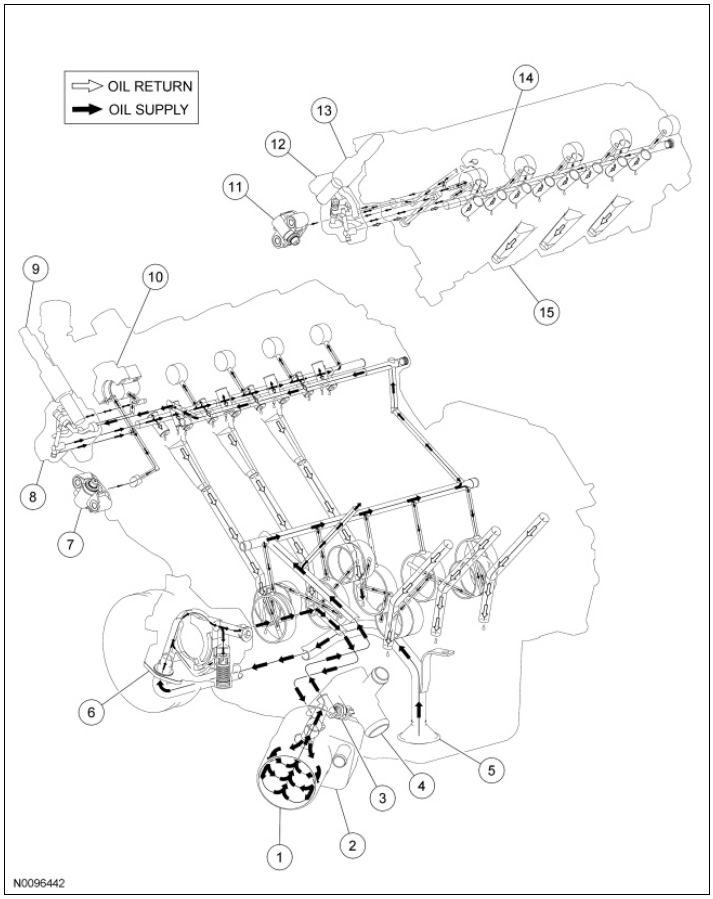
Lubrication System

The engine lubrication system operates as follows:

- Oil is drawn into the oil pump through the oil pump screen cover and tube in the sump of the oil pan.
- Oil is pumped through the oil filter on the left front side of the cylinder block.
- Oil enters the main gallery where it is distributed to the crankshaft main journals and to both cylinder heads.
- From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly.
- The left cylinder head is fed from a drilling into the supply passage feeding the main gallery at the front of the cylinder block. The right cylinder head is fed from a drilling into the rear of the main gallery. Main gallery pressure is reduced as it enters the cylinder head galleries through fixed serviceable orifices, located at the upper part of the feed passages. It is this reduced pressure in the cylinder head galleries which feeds the camshaft journals, the hydraulic lash adjusters and the primary and secondary timing chain tensioners.
- The oil pressure feed for the Variable Camshaft Timing (VCT) solenoids, VCT housings and camshaft phaser and sprockets is not reduced.
- The camshaft lobe and roller followers are lubricated by splash created through valve train operation.

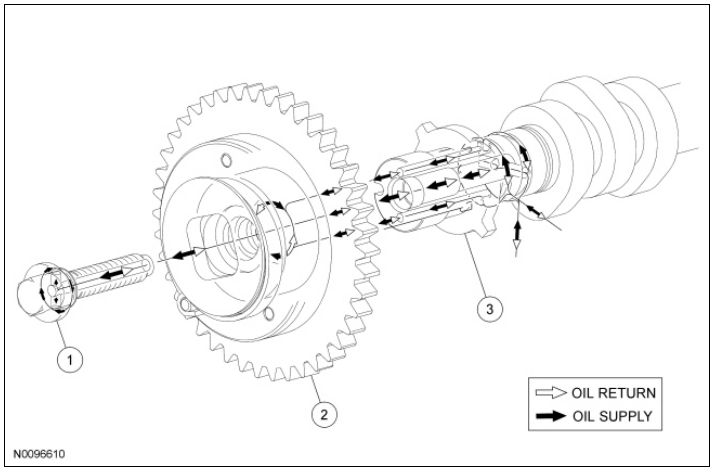
Engine Oil Flow Illustrations

Engine Assembly



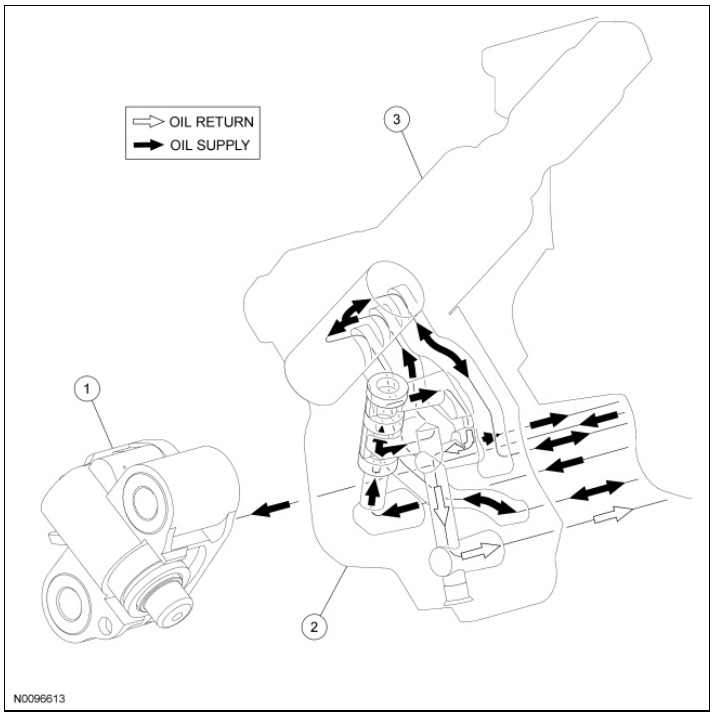
Item	Part Number	Description
1	6714	Oil filter
2	6A642	Oil cooler (if equipped)
3	9278	Engine Oil Pressure (EOP) switch
4	6884	Oil filter adapter
5	6622	Oil pump screen and pickup tube
6	6621	Oil pump
7	6L266A	Timing chain tensioner - RH
8	6C260	Variable Camshaft Timing (VCT) housing - RH
9	6M280	VCT oil control solenoid assembly - RH
10	6B284	Front camshaft bearing cap - RH
11	6L266B	Timing chain tensioner - LH
12	6C261	VCT housing - LH
13	6M280	VCT oil control solenoid assembly - LH
14	6B284	Front camshaft bearing cap - LH
15	6050	Cylinder head - LH

Camshaft Phaser and Sprocket, Camshaft Phaser and Sprocket Bolt and Camshaft



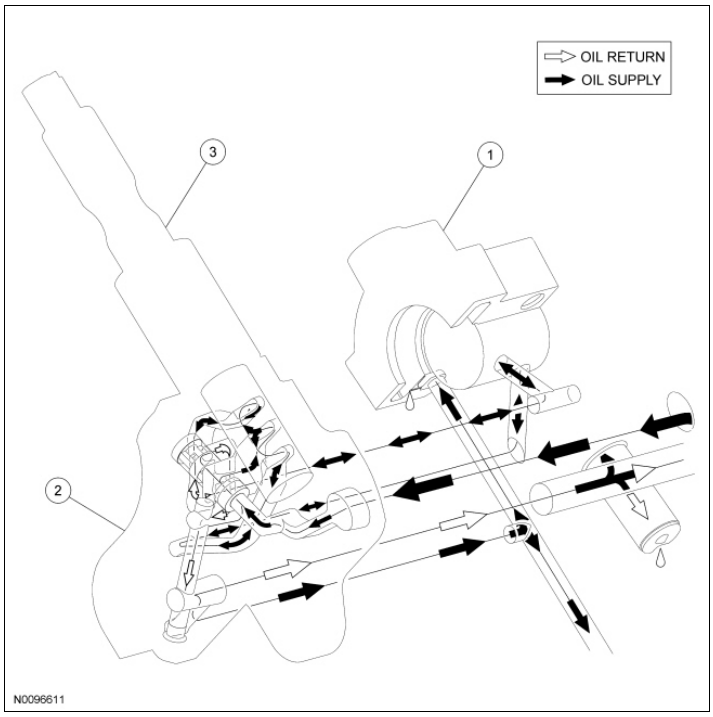
Item	Part Number	Description
1	6279	Camshaft phaser and sprocket bolt
2	6256	Camshaft phaser and sprocket
3	-	Camshaft

LH Variable Camshaft Timing (VCT) Housing, VCT Solenoid and Timing Chain Tensioner



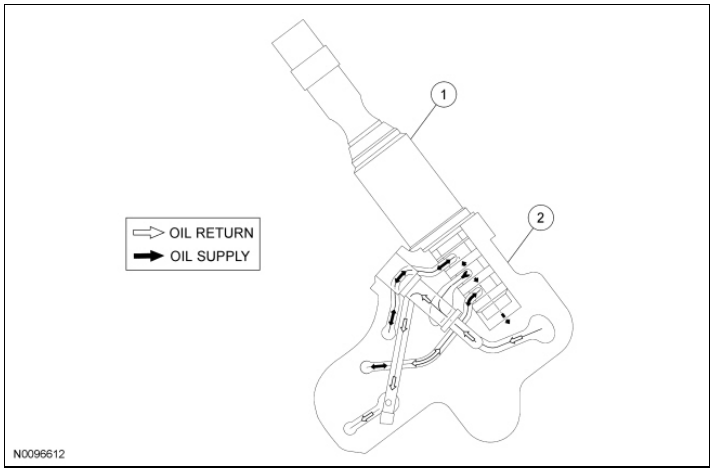
Item	Part Number	Description
1	6L266B	Timing chain tensioner - LH
2	6C261	Variable Camshaft Timing (VCT) housing - LH
3	6M280	VCT oil control solenoid assembly - LH

RH Variable Camshaft Timing (VCT) Housing and VCT Solenoid



Item	Part Number	Description
1	6M280	Front camshaft bearing cap - RH
2	6C261	Variable Camshaft Timing (VCT) housing - RH
3	6C260	VCT oil control solenoid assembly - RH

Variable Camshaft Timing (VCT) Housing



Item	Part Number	Description
1	-	Variable Camshaft Timing (VCT) oil control solenoid assembly
2	-	VCT housing

Oil Pump

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range. The heart of the system is a positive displacement internal gear oil pump using top seal rotors. Generically this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral, internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure, both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high-viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

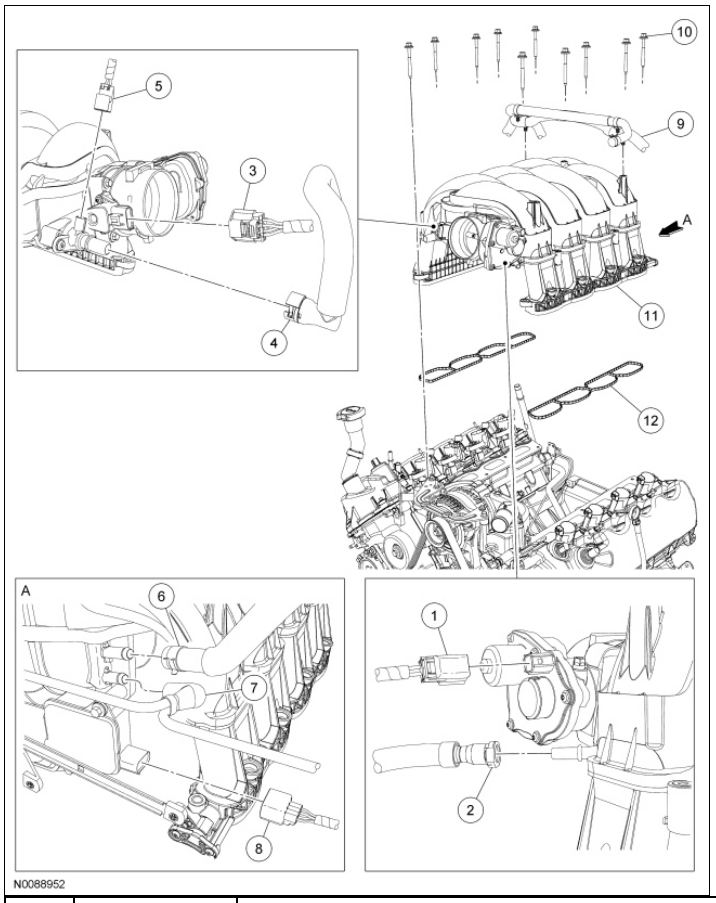
Engine

For basic engine mechanical concerns, refer to Section 303-00 . For driveability concerns, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Intake Manifold

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-



Item	Part Number	Description
1	14A464	Electronic Throttle Body (ETB) electrical connector (part of 12B637)
2	9D289	Evaporative Emission (EVAP) hose
3	14A464	Throttle Position (TP) sensor electrical connector (part of 12B637)
4	6K817	PCV hose
5	14A464	Heated PCV fitting electrical connector (part of 12B637)
6	9C482	Brake booster vacuum hose
7	4E498	Vacuum hose

8	14A464	Charge Motion Control Valve (CMCV) electrical connector (part of 12B637)
9	13A506	Wiring harness retainers (part of 12B637)
10	W709552	Intake manifold bolt (10 required)
11	9425	Intake manifold
12	9439	Intake manifold gasket (2 required)

Removal

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .
3. Remove the fuel rail and injectors. For additional information, refer to Section 303-04B .
4. Disconnect the Electronic Throttle Body (ETB) electrical connector.
5. Disconnect the Evaporative Emission (EVAP) tube from the intake manifold.
6. Disconnect the Throttle Position (TP) sensor electrical connector.
7. Disconnect the PCV hose from the heated PCV fitting on the intake manifold.
8. Disconnect the heated PCV fitting electrical connector.
9. Detach the wiring harness retainers from the intake manifold.
10. Disconnect the Charge Motion Control Valve (CMCV) electrical connector.
11. Remove the 10 bolts and position the intake manifold forward.
12. Disconnect the brake booster vacuum hose from the rear of the intake manifold.
13. Disconnect the vacuum hose from the rear of the intake manifold.
14. Remove the intake manifold and the gaskets.
    - Discard the gaskets.

Installation

1. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

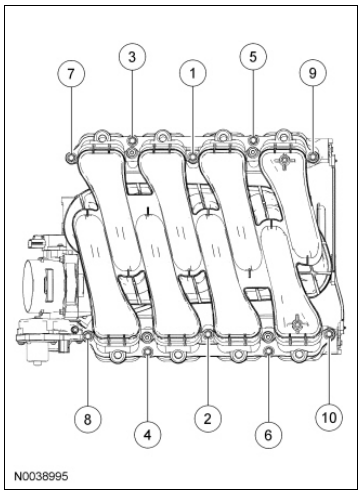
NOTICE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old gaskets.**

NOTE: Clean and inspect the sealing surfaces with metal surface prep. Follow the directions on the packaging.

NOTE: Electrical and vacuum harnesses must not restrict movement of the CMCV control rods at the rear of the intake manifold. Use extreme care during the installation of the intake manifold to prevent any pinching of electrical and vacuum harnesses.

Using new intake manifold gaskets, position the intake manifold.

2. Connect the vacuum hose to the rear of the intake manifold.
3. Connect the brake booster hose to the rear of the intake manifold.
4. Install the 10 intake manifold bolts and tighten the bolts in the sequence shown in 2 stages.
   - Stage 1: Tighten to 2 Nm (18 lb-in).
   - Stage 2: Tighten to 10 Nm (89 lb-in).



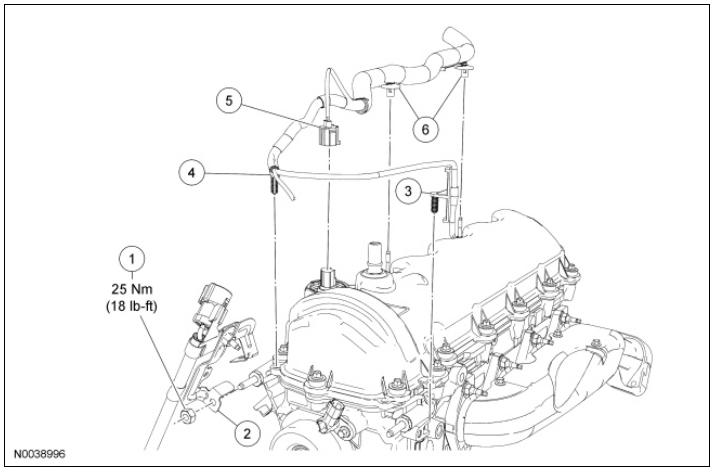
5. Connect the CMCV electrical connector.
6. Attach the wiring harness retainers to the intake manifold.
7. Connect the heated PCV fitting electrical connector.
8. Connect the PCV hose to the heated PCV fitting on the intake manifold.
9. Connect the TP sensor electrical connector.
10. Connect the EVAP hose to the intake manifold.
11. Connect the ETB electrical connector.
12. Install the fuel rail and injectors. For additional information, refer to Section 303-04B .
13. Install the ACL outlet pipe. For additional information, refer to Section 303-12 .

Valve Cover - LH

Material

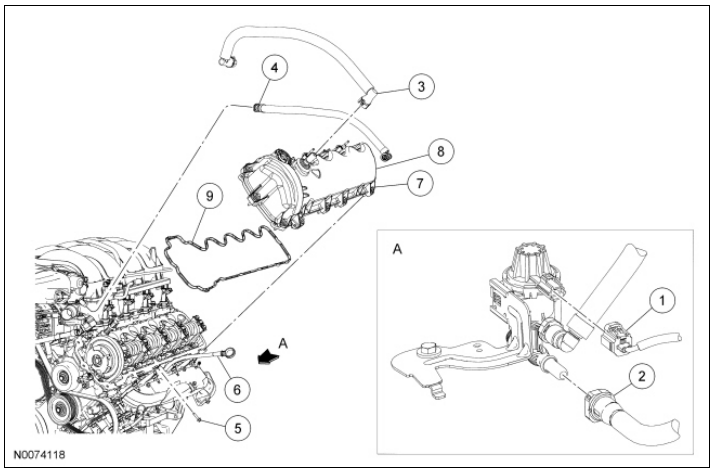
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

Electrical Connectors and Wiring Harnesses



Item	Part Number	Description
1	N804758	Electric cooling fan clutch wiring harness bracket nut
2	14W163	Electric cooling fan clutch wiring harness bracket
3	13A506	Wiring harness retainer (part of 12B637)
4	13A506	Wiring harness retainer (part of 12B637)
5	14A464	LH Variable Camshaft Timing (VCT) solenoid electrical connector (part of 12B637)
6	14A163	Wiring harness retainers (part of 12B637) (2 required)

LH Valve Cover



Item	Part Number	Description
1	14A464	Evaporative Emission (EVAP) canister purge valve electrical connector
2	9D676	EVAP canister-to- EVAP canister purge valve hose
3	6K817	PCV hose
4	9D289	EVAP tube
5	N806155	Oil level indicator tube bracket bolt
6	-	Oil level indicator tube (part of 6754)
7	6C519	LH valve cover bolt (10 required)
8	6A513	LH valve cover
9	6A559	LH valve cover gasket

Removal

1. Remove the LH ignition coils. For additional information, refer to Section 303-07B .
2. Remove the bolt and position the oil level indicator and tube aside.
3. Disconnect the Evaporative Emission (EVAP) tube from the intake manifold.
4. Disconnect the PCV hose from the valve cover.
5. Remove the nut and position the cooling fan wiring harness bracket aside.
6. Disconnect the 2 pin-type retainers from the valve cover.
7. Disconnect the Variable Camshaft Timing (VCT) solenoid electrical connector.
8. Detach the wiring harness retainers from the valve cover studs.
9. Disconnect the EVAP canister purge valve electrical connector.
10. Disconnect the EVAP canister-to- EVAP canister purge valve EVAP hose from the EVAP canister purge valve.
11. Loosen the 10 bolts and remove the LH valve cover and gasket.

- Discard the gasket.

Installation

1. *NOTICE:* **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

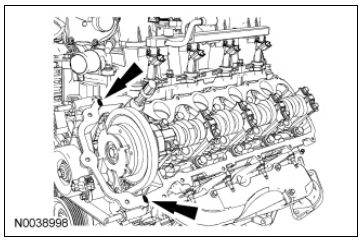
   Clean the gasket mating surfaces.

   - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
   - Clean the valve cover gasket groove in the valve cover with soap and water or a suitable solvent.

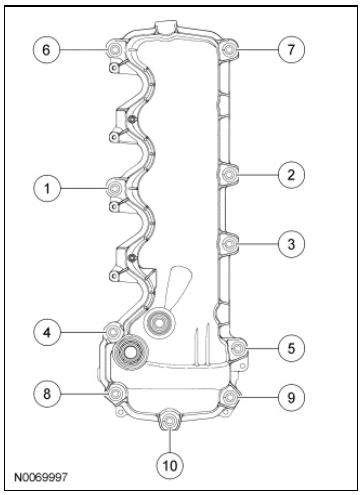
2. Install a new gasket on the LH valve cover.

3. **NOTE:** If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Failure to follow this procedure may cause future oil leakage.

   Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



4. Position the 10 LH valve cover with a new gasket and tighten the 10 bolts in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).



5. Connect the EVAP canister-to- EVAP canister purge valve EVAP hose to the EVAP canister purge valve.

6. Connect the EVAP canister purge valve electrical connector.

7. Attach the wiring harness retainers to the valve cover studs.

8. Connect the VCT solenoid electrical connector.

9. Connect the 2 pin-type retainers to the valve cover.

10. Position the cooling fan wiring harness bracket and install the nut.
    - Tighten to 25 Nm (18 lb-ft).

11. Connect the PCV hose to the valve cover.

12. Connect the EVAP tube to the intake manifold.

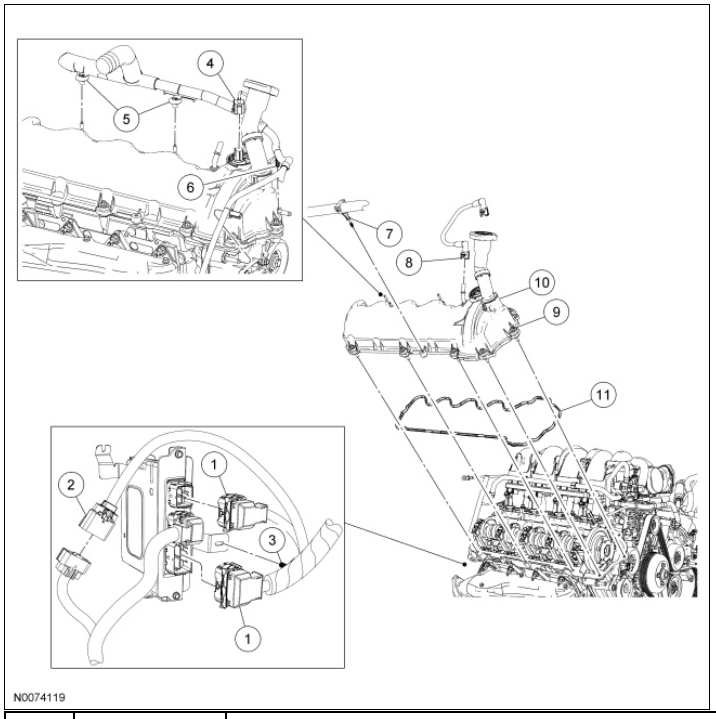
13. Position the oil level indicator tube and install the bolt.
    - Tighten to 10 Nm (89 lb-in).

14. Install the LH ignition coils. For additional information, refer to Section 303-07B .

Valve Cover - RH

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-



Item	Part Number	Description
1	14A464	Engine wiring harness-to-PCM electrical connectors (part of 12B637) (2 required)
2	14A624	Engine wiring harness in-line electrical connector (part of 12B637)
3	13A506	Wiring harness pin-type retainer (part of 12B637)
4	14A464	RH Variable Camshaft Timing (VCT) oil control solenoid electrical connector (part of 12B637)
5	14A163	Wiring harness retainers (part of 12B637) (3 required)
6	13A506	Wiring harness pin-type retainer (part of 12B637)
7	8W287	Heater hose retainer

8	6758	Crankcase breather tube
9	6C519	RH valve cover bolt (9 required)
10	6583	RH valve cover
11	6584	RH valve cover gasket

Removal

1. Remove the Air Cleaner (ACL) and the ACL outlet pipe. For additional information, refer to Section 303-12 .

2. Remove the RH ignition coils. For additional information, refer to Section 303-07B .

3. Disconnect the engine wiring harness from the PCM.
   - Disconnect the 2 PCM electrical connectors.
   - Disconnect the in-line electrical connector.
   - Detach the wiring harness retainer from the PCM bracket and position the wiring harness aside.

4. Disconnect the RH Variable Camshaft Timing (VCT) oil control solenoid electrical connector.

5. Detach the 2 wiring harness retainers from the RH valve cover studs.

6. Detach the wiring harness pin-type retainer from the front of the RH valve cover.

7. Detach the heater hose retainer from the RH valve cover.

8. Disconnect the crankcase breather tube from the RH valve cover.

9. Loosen the 9 RH valve cover bolts and remove the RH valve cover and the RH valve cover gasket.
   - Discard the gasket.

Installation

1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

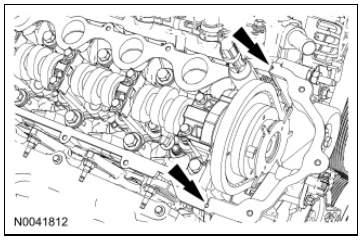
   Clean the gasket mating surfaces.

   - Clean the valve cover mating surface of the RH cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
   - Clean the RH valve cover gasket groove with soap and water or a suitable solvent.

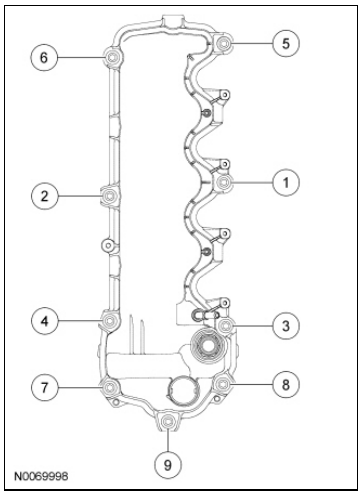
2. Install a new gasket on the RH valve cover.

3. **NOTE:** If the RH valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Failure to follow this procedure may cause future oil leakage.

   Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the RH cylinder head.



4. Position the RH valve cover with a new gasket on the cylinder head and tighten the 9 bolts in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).



5. Connect the crankcase breather tube to the RH valve cover.

6. Attach the heater hose retainer to the RH valve cover.

7. Attach the wiring harness pin-type retainer to the front of the RH valve cover.

8. Attach the wiring harness retainers to the RH valve cover studs.

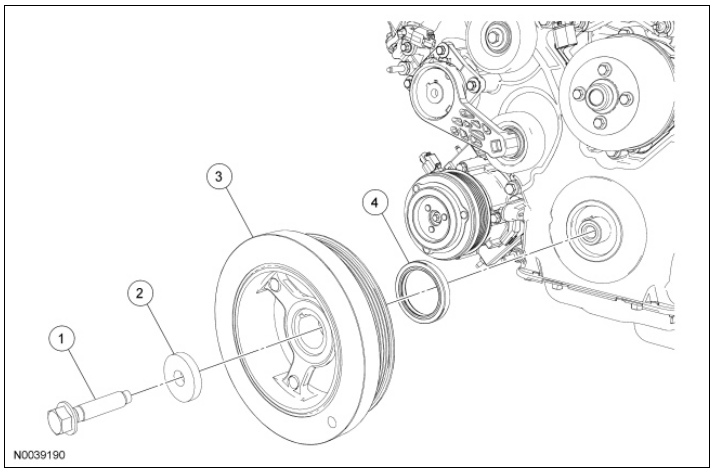
9. Connect the RH VCT oil control solenoid electrical connector.

10. Connect the engine wiring harness to the PCM.
    - Position the wiring harness and attach the wiring harness pin-type retainer to the PCM bracket.
    - Connect the in-line electrical connector.
    - Connect the 2 PCM electrical connectors.

11. Install the RH ignition coils. For additional information, refer to Section 303-07B .

12. Install the ACL and the ACL outlet pipe. For additional information, refer to Section 303-12 .

Lower End Components - Exploded View, Crankshaft Pulley and Crankshaft Front Seal



Item	Part Number	Description
1	W701512	Crankshaft pulley bolt
2	N806165	Crankshaft pulley bolt washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front oil seal

1. For additional information, refer to the procedures in this section.

Crankshaft Pulley

Special Tool(s)

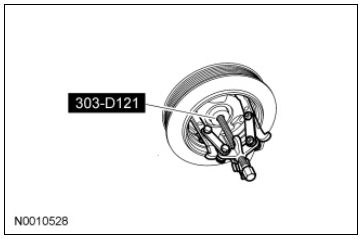
 ST1184-A	3 Jaw Puller 303-D121
 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

Removal

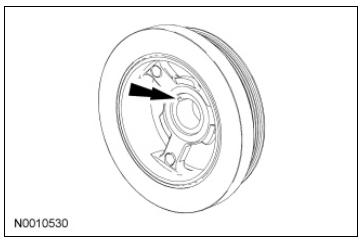
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the cooling fan shroud. For additional information, refer to Section 303-03 .
3. Remove the accessory drive belt. For additional information, refer to Section 303-05 .
4. Remove and discard the crankshaft pulley bolt and washer.
5. Using the 3 Jaw Puller, remove the crankshaft pulley.



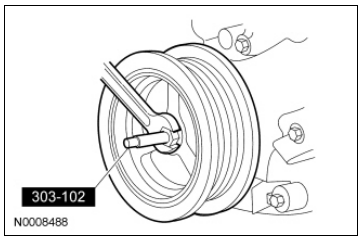
Installation

1. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



2. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.



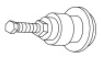
3. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
   - Stage 1: Tighten to 120 Nm (89 lb-ft).
   - Stage 2: Loosen 360 degrees.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.

4. Install the accessory drive belt. For additional information, refer to Section 303-05 .

5. Install the cooling fan shroud. For additional information, refer to Section 303-03 .

Crankshaft Front Seal

Special Tool(s)

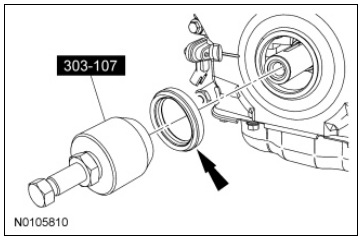
 ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
 ST1288-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

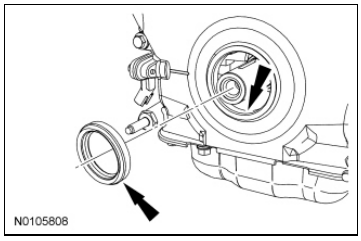
Removal

1. Remove the crankshaft pulley. For additional information, refer to Crankshaft Pulley in this section.
2. Using the Crankshaft Front Seal Remover, remove the crankshaft front seal.

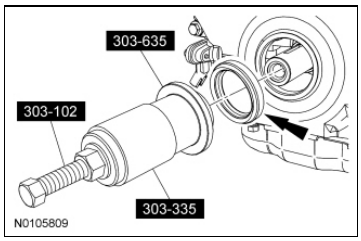


Installation

1. Lubricate the engine front cover and the crankshaft front seal inner lip with clean engine oil.

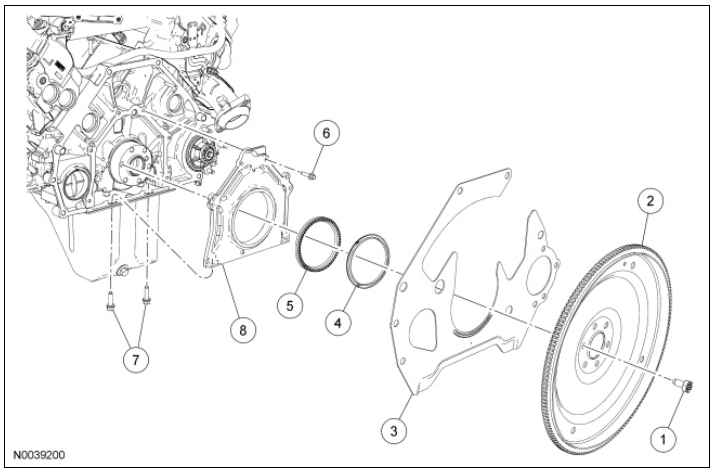


2. Using the Crankshaft Vibration Damper Installer, the Front Cover Seal Installer and the Crankshaft Front Seal Installer, install the crankshaft front seal.



3. Install the crankshaft pulley. For additional information, refer to Crankshaft Pulley in this section.

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View



Item	Part Number	Description
1	N806168	Flexplate bolt (6 required)
2	6375	Flexplate
3	6A373	Engine-to-transmission spacer plate
4	6310	Crankshaft oil slinger
5	6701	Crankshaft rear seal
6	N806155	Crankshaft rear seal retainer plate bolt (6 required)
7	W701605	Oil pan bolts (2 required)
8	6K318	Crankshaft rear seal retainer plate

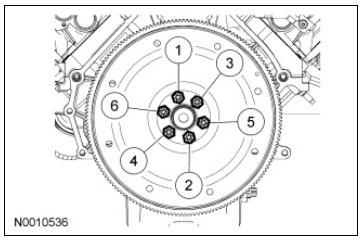
1. For additional information, refer to the procedures in this section.

Flexplate

Removal and Installation

1. Remove the transmission. For additional information, refer to Section 307-01B .

2. Remove the 6 bolts and the flexplate.
   - To install, tighten to 80 Nm (59 lb-ft) in the sequence shown.



3. To install, reverse the removal procedure.

Crankshaft Rear Seal

Special Tool(s)

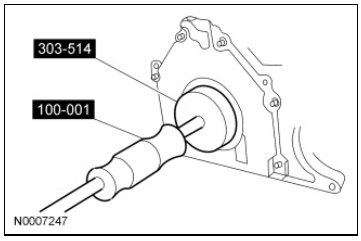
 ST1482-A	Installer, Crankshaft Rear Oil Slinger 303-517 (T95P-6701-CH)
 ST1479-A	Installer, Crankshaft Rear Seal 303-516 (T95P-6701-BH)
 ST1480-A	Installer, Crankshaft Rear Seal 303-518 (T95P-6701-DH)
 ST1481-A	Remover, Crankshaft Rear Oil Slinger 303-514 (T95P-6701-AH)
 ST1382-A	Remover, Crankshaft Rear Seal 303-519 (T95P-6701-EH)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

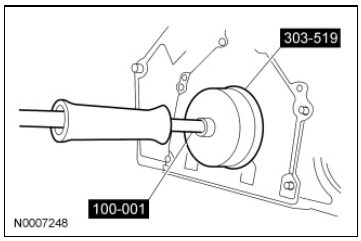
Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Remove the flexplate. For additional information, refer to Flexplate in this section.
2. Remove the engine-to-transmission spacer plate.
3. Using the Slide Hammer and the Crankshaft Rear Oil Slinger Remover, remove the crankshaft oil slinger.
    - Discard the crankshaft oil slinger.



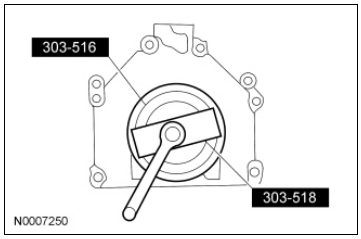
4. Using the Slide Hammer and the Crankshaft Rear Seal Remover, remove the crankshaft rear seal.
   - Discard the crankshaft rear seal.



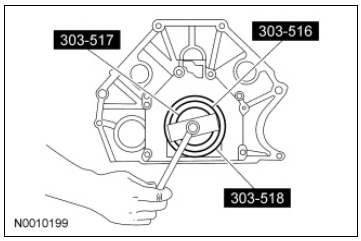
Installation

1. **NOTE:** Lubricate the inner lip of the crankshaft rear seal with clean engine oil.

   Using the 2 Crankshaft Rear Seal Installers, install the crankshaft rear seal.



2. Using the 2 Crankshaft Rear Seal Installers and the Crankshaft Rear Oil Slinger Installer, install the crankshaft rear oil slinger.



3. Install the engine-to-transmission spacer plate.

4. Install the flexplate. For additional information, refer to Flexplate in this section.

Crankshaft Rear Seal with Retainer Plate

Special Tool(s)

 ST1482-A	Installer, Crankshaft Rear Oil Slinger 303-517 (T95P-6701-CH)
 ST1479-A	Installer, Crankshaft Rear Seal 303-516 (T95P-6701-BH)
 ST1480-A	Installer, Crankshaft Rear Seal 303-518 (T95P-6701-DH)
 ST1481-A	Remover, Crankshaft Rear Oil Slinger 303-514 (T95P-6701-AH)
 ST1382-A	Remover, Crankshaft Rear Seal 303-519 (T95P-6701-EH)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Gasket Maker TA-16	WSK-M2G348-A5
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft® Silicone Gasket Remover ZC-30	-

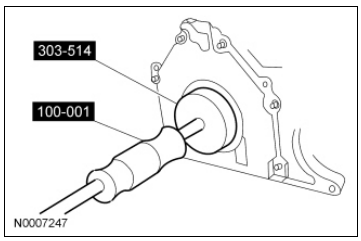
Removal

1. Remove the flexplate. For additional information, refer to Flexplate in this section.

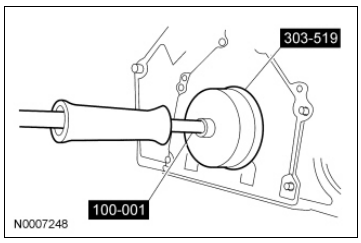
2. Remove the engine-to-transmission spacer plate.

3. Remove the oil pan. For additional information, refer to Oil Pan in this section.

4. Using the Slide Hammer and the Crankshaft Rear Oil Slinger Remover, remove the crankshaft oil slinger.
    - Discard the crankshaft oil slinger.



5. Using the Slide Hammer and the Crankshaft Rear Seal Remover, remove the crankshaft rear seal.
    - Discard the crankshaft rear seal.



6. Remove the 6 bolts and the crankshaft rear seal retainer plate.

Installation

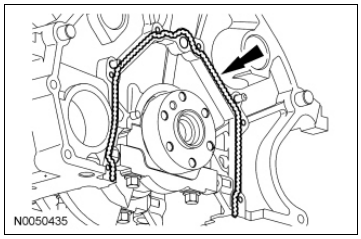
1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

   NOTE: Clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

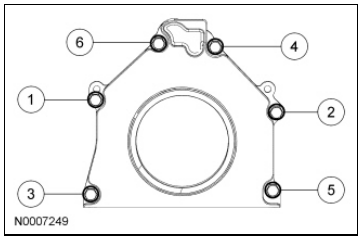
   Clean and inspect the mating surfaces.

2. **NOTE:** The crankshaft rear seal retaining plate does not have a sealant groove. Gasket maker must be applied to the crankshaft rear seal retainer plate mating surface on the engine block.

   Apply a bead of gasket maker to the crankshaft rear seal retainer plate mating surface on the engine block.

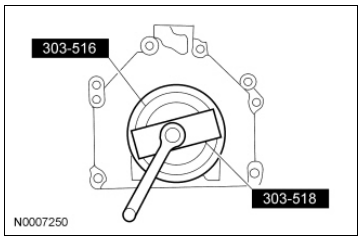


3. Install the crankshaft rear seal retainer plate and the 6 bolts in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).

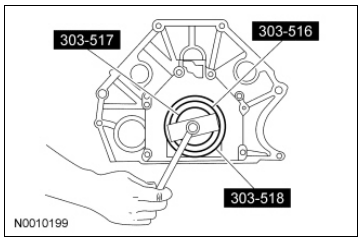


4. **NOTE:** Lubricate the inner lip of the crankshaft rear seal with clean engine oil.

   Using the 2 Crankshaft Rear Seal Installers, install the crankshaft rear seal.



5. Using the 2 Crankshaft Rear Seal Installers and the Crankshaft Rear Oil Slinger Installer, install the crankshaft rear oil slinger.



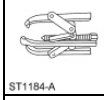
6. Install the oil pan. For additional information, refer to Oil Pan in this section.

7. Install the engine-to-transmission spacer plate.

8. Install the flexplate. For additional information, refer to Flexplate in this section.

Engine Front Cover

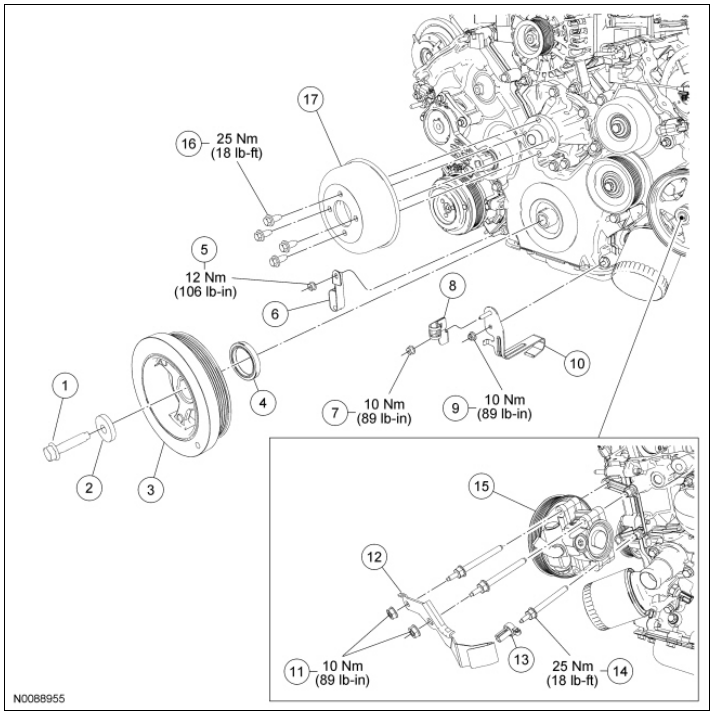
Special Tool(s)

 ST1184-A	3 Jaw Puller 303-D121
 ST1328-A	Installer, Crankshaft Front Seal 303-335 (T88T-6701-A)
 ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1288-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)

Material

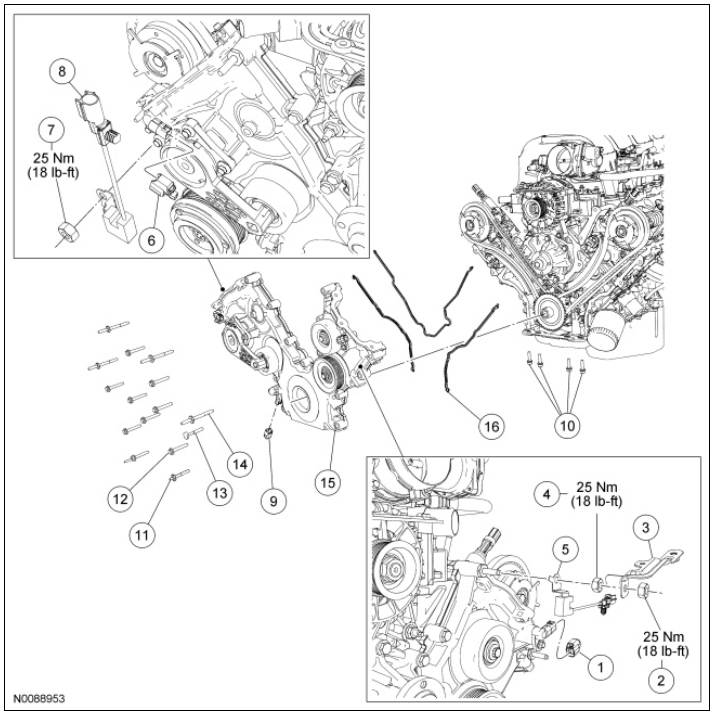
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

Accessory Drive Components and Wiring Harness Brackets



Item	Part Number	Description
1	W701512	Crankshaft pulley bolt
2	N806165	Crankshaft pulley washer
3	8316	Crankshaft pulley
4	6700	Crankshaft front seal
5	7R081	Transmission cooler tube bracket nut
6	BK0001728	Transmission cooler tube bracket (part of 7H420)
7	N805320	Power Steering Pressure (PSP) hose bracket nut
8	81396	PSP hose bracket (part of 3A719)
9	W520101	Battery cable bracket nut
10	10A779	Battery cable bracket (part of 14A280)
11	N805403	Battery cable bracket nuts (2 required)
12	10W652	Battery cable bracket (part of 14A280)
13	14A163	Wiring harness retainer (part of 12B637)
14	W707225	Power steering pump bolt (3 required)
15	3A696	Power steering pump
16	N806282	Coolant pump pulley bolt (4 required)
17	8A528	Coolant pump pulley

Engine Front Cover



Item	Part Number	Description
1	14A464	LH Camshaft Position (CMP) sensor electrical connector (part of 12B637)
2	N804758	Cooling fan wiring harness bracket nut
3	14W163	Cooling fan wiring harness bracket
4	N804758	LH radio interference capacitor nut
5	18801	LH radio interference capacitor
6	14A464	RH CMP sensor electrical connector (part of 12B637)
7	N804758	RH radio interference capacitor nut
8	18801	RH radio interference capacitor
9	14A464	Crankshaft Position (CKP) sensor electrical connector (part of 12B637)
10	W701605	Oil pan-to-engine front cover bolts (4 required)
11	W706508	Engine front cover stud bolt
12	N806177	Engine front cover bolt (8 required)
13	N808294	Engine front cover bolt
14	N806300	Engine front cover stud bolt (5 required)
15	6D080	Engine front cover
16	6D081	Engine front cover gasket (3 required)

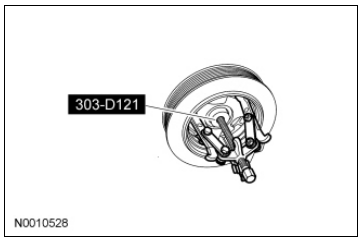
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

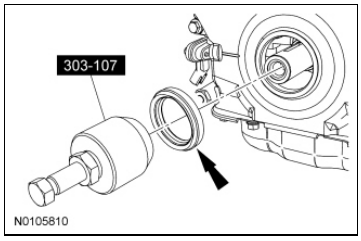
2. Remove the drain plug and drain the engine oil.
   - To install, tighten to 23 Nm (17 lb-ft).

3. Remove the cooling fan shroud. For additional information, refer to Section 303-03 .

4. Remove the RH side idler pulley. For additional information, refer to Section 303-05 .
5. Remove the RH valve cover. For additional information, refer to Valve Cover - RH in this section.
6. Remove the LH valve cover. For additional information, refer to Valve Cover - LH in this section.
7. Remove the nut and position the RH radio interference capacitor aside.
8. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.
9. Remove the nut and the cooling fan wiring harness bracket.
10. Remove the nut and position the LH radio interference capacitor aside.
11. Disconnect the LH CMP sensor electrical connector.
12. Remove the 4 bolts and the coolant pump pulley.
13. Remove the 2 nuts and detach the battery cable bracket from the power steering pump stud bolts.
14. Detach the wiring harness retainer from the power steering pump stud bolt.
15. Remove the 3 stud bolts and position the power steering pump aside.
    - Support the power steering pump with a length of mechanic's wire.
16. Remove the nut and detach the Power Steering Pressure (PSP) hose bracket from the battery cable bracket.
17. Remove the nut and detach the battery cable bracket from the engine front cover.
18. Remove the nut and detach the transmission cooler tube bracket from the engine front cover.
19. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
20. Remove the crankshaft pulley bolt and washer.
    - Discard the crankshaft pulley bolt.
21. Using the 3 Jaw Puller, remove the crankshaft pulley.



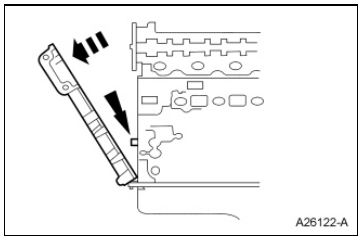
22. Using the Crankshaft Front Seal Remover, remove the crankshaft front seal.
    - Discard the crankshaft front seal.



23. Remove the 4 oil pan-to-engine front cover bolts.

24. Remove the 15 engine front cover bolts and stud bolts.

25. Remove the engine front cover from the engine front cover-to-cylinder block dowel.
    - Remove and discard the engine front cover gaskets.



Installation

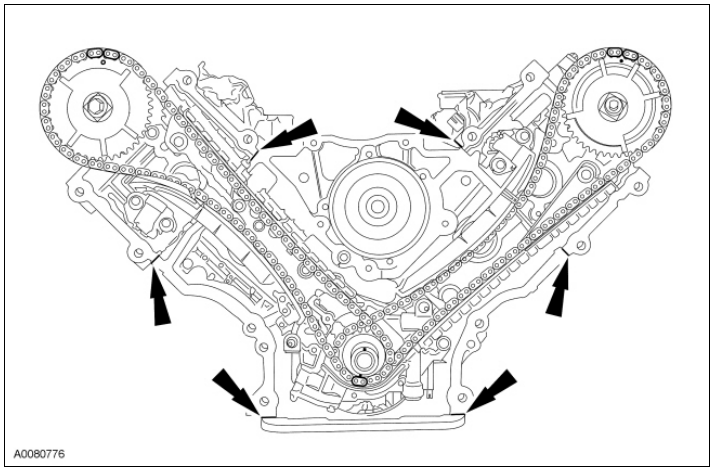
1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

   Clean the mating surfaces with silicone gasket remover, metal surface prep and a plastic scraping tool. Follow the directions on the packaging.

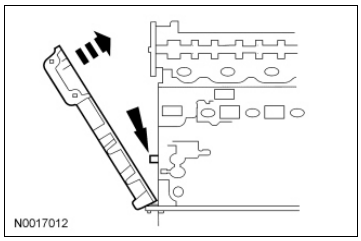
2. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

   NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

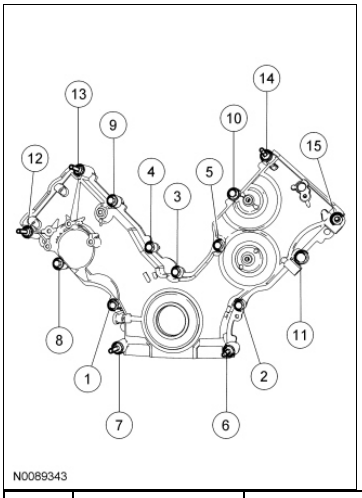
   Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block mating surface and the oil pan-to-cylinder block mating surface at the locations shown.



3. Install new engine front cover gaskets on the engine front cover. Position the engine front cover onto the dowels. Install the 15 fasteners finger-tight.



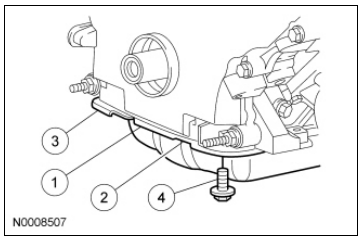
4. Tighten the 15 engine front cover fasteners in the sequence shown to 25 Nm (18 lb-ft).



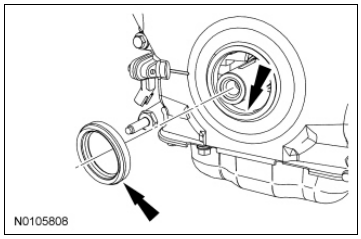
Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53

10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1

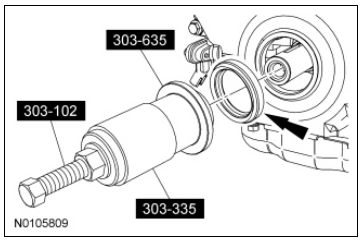
5. Loosely install the 4 oil pan-to-engine front cover bolts, then tighten the bolts in 2 stages in the sequence shown.
    - Stage 1: Tighten to 20 Nm (177 lb-in).
    - Stage 2: Tighten an additional 60 degrees.



6. Lubricate the engine front cover and a new crankshaft front seal inner lip with clean engine oil.

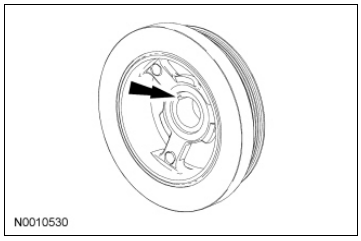


7. Using the 2 Crankshaft Front Seal Installers and the Crankshaft Vibration Damper Installer, install the crankshaft front seal.

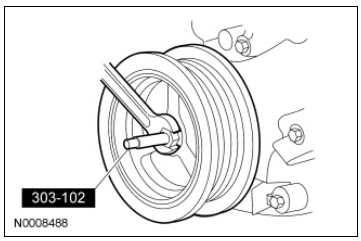


8. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

   Apply silicone gasket sealant to the Woodruff key slot in the crankshaft pulley.



9. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.



10. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen 360 degrees.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

11. Connect the CKP sensor electrical connector.

12. Attach the transmission cooler tube bracket to the engine front cover and install the nut.
    - Tighten to 12 Nm (106 lb-in).

13. Attach the battery cable bracket to the front cover and install the nut.
    - Tighten to 10 Nm (89 lb-in).

14. Attach the PSP hose bracket to the battery cable bracket and install the nut.
    - Tighten to 10 Nm (89 lb-in).

15. Position the power steering pump and install the stud bolts.
    - Tighten to 25 Nm (18 lb-ft).

16. Attach the wiring harness retainer to the power steering pump stud bolt.

17. Position the battery cable bracket on the power steering pump stud bolts and install the nuts.
    - Tighten to 10 Nm (89 lb-in).

18. Position the coolant pump pulley and install the bolts.
    - Tighten the bolts to 25 Nm (18 lb-ft).

19. Connect the LH CMP sensor electrical connector.

20. Position the LH radio interference capacitor and install the nut.
    - Tighten to 25 Nm (18 lb-ft).

21. Position the cooling fan wiring harness bracket and install the nut.

22. Connect the RH CMP sensor electrical connector.

23. Position the RH radio interference capacitor and install the nut.
    - Tighten to 25 Nm (18 lb-ft).

24. Install the LH valve cover. For additional information, refer to Valve Cover - LH in this section.

25. Install the RH valve cover. For additional information, refer to Valve Cover - RH in this section.

26. Install the RH side idler pulley. For additional information, refer to Section 303-05 .

27. Install the cooling fan shroud. For additional information, refer to Section 303-03 .

28. Fill the engine with clean engine oil.

Timing Drive Components

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039
 ST2807-A	Locking Tool, Cam Phaser 303-1046

General Equipment

Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA

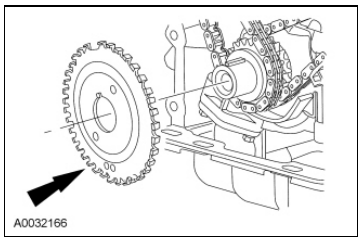
Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

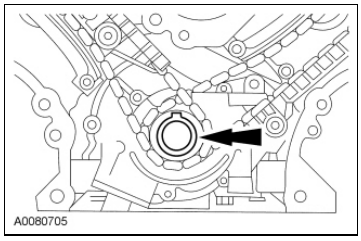
Removal

1. Remove the engine front cover. For additional information, refer to Engine Front Cover in this section.

2. Remove the crankshaft sensor ring from the crankshaft.

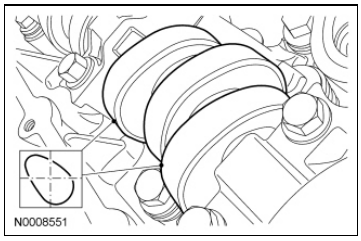

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3. Position the crankshaft keyway at the 12 o'clock position.



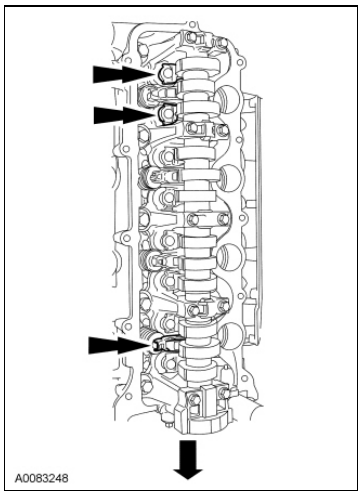
4. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

   The No. 1 cylinder must be coming up on the exhaust stroke with the crankshaft keyway at the 12 o'clock position. Verify by noting the position of the 2 intake lobes and the exhaust lobe on the No. 1 cylinder.



5. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

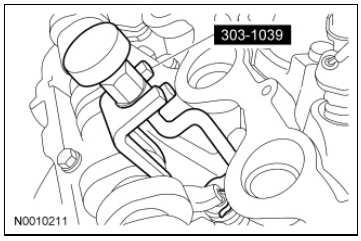
   Remove only the 3 roller followers shown in the illustration from the RH cylinder head.



6. **NOTE:** Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

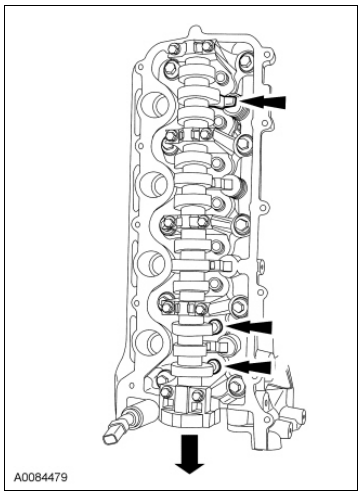
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, remove the 3 roller followers designated in the previous step from the RH cylinder head.



7. *NOTICE:* **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

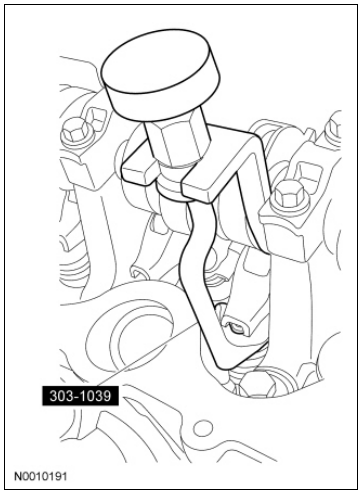
   Remove only the 3 roller followers shown in the illustration from the LH cylinder head.



8. **NOTE:** Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

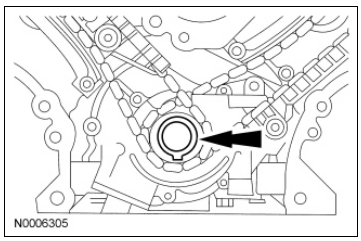
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, remove the 3 roller followers designated in the previous step from the LH cylinder head.

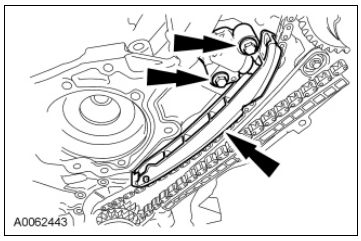


9. *NOTICE:* **The crankshaft cannot be moved past the 6 o'clock position once set or engine damage may occur.**

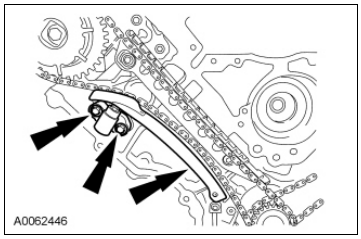
Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



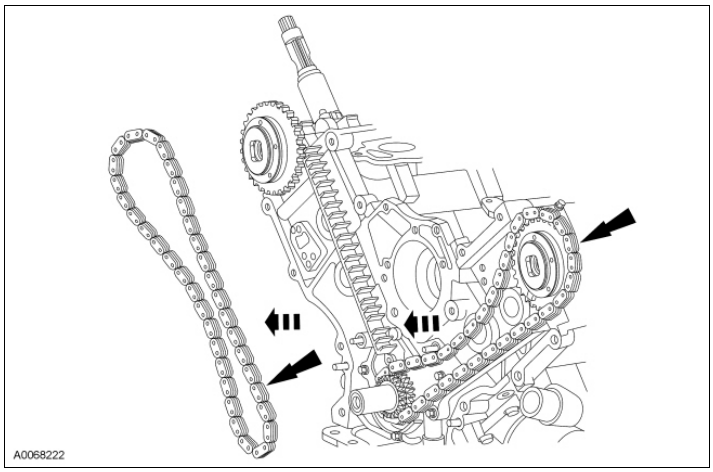
10. Remove the bolts, the LH timing chain tensioner and tensioner arm.



11. Remove the bolts, the RH timing chain tensioner and tensioner arm.



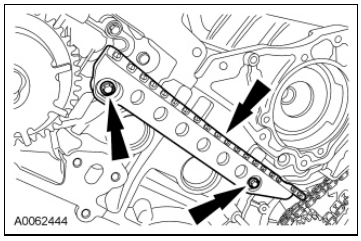
12. Remove the RH and LH timing chains and the crankshaft sprocket.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain and crankshaft sprocket.



13. **NOTE:** RH shown, LH similar.

    Remove the LH and RH timing chain guides.

    - Remove the bolts.
    - Remove both timing chain guides.

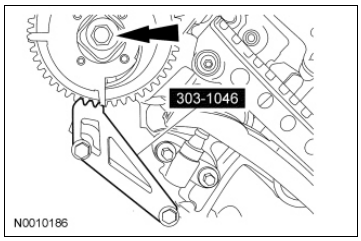


14. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

    Using the Cam Phaser Locking Tool, remove the bolt and the RH camshaft phaser sprocket assembly.

    - Discard the camshaft phaser sprocket bolt.

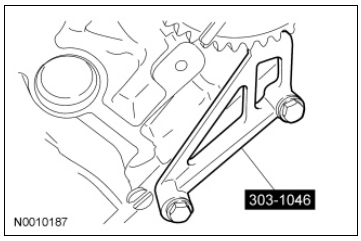


15. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

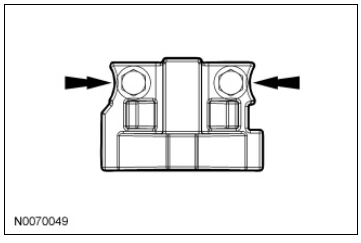
    Using the Cam Phaser Locking Tool, remove the bolt and the LH camshaft phaser sprocket assembly.

    - Discard the camshaft phaser sprocket bolt.



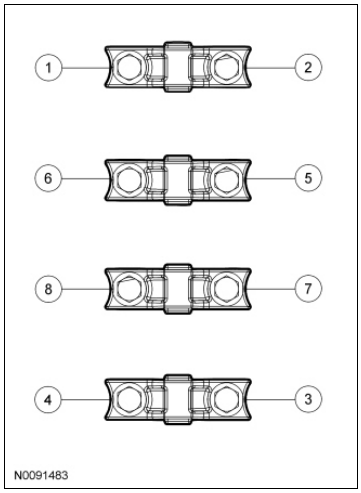
16. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the RH cylinder head camshaft front bearing cap.

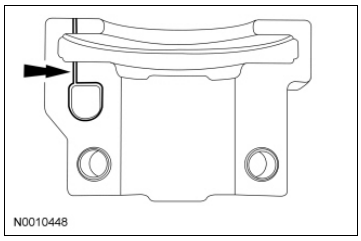


17. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the remaining bolts in the sequence shown and remove the RH cylinder head camshaft bearing caps.



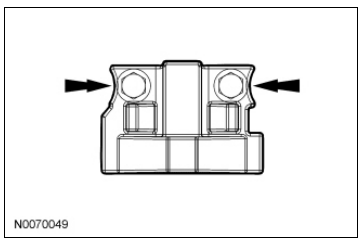
18. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



19. Remove the RH camshaft.

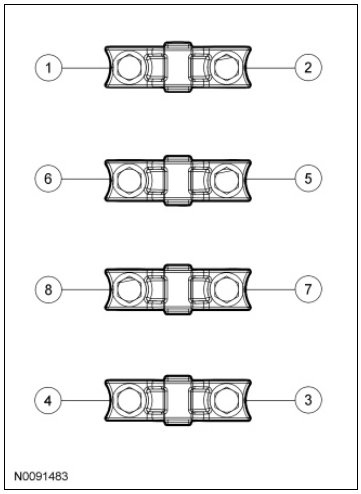
20. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the LH cylinder head camshaft front bearing cap.

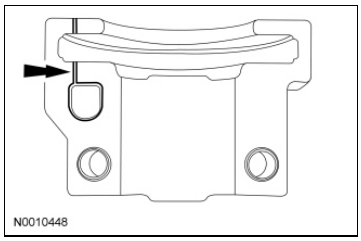


21. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the remaining bolts in the sequence shown and remove the LH cylinder head camshaft bearing caps.



22. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



23. Remove the LH camshaft.

24. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

    Remove all of the remaining roller followers from the cylinder heads.

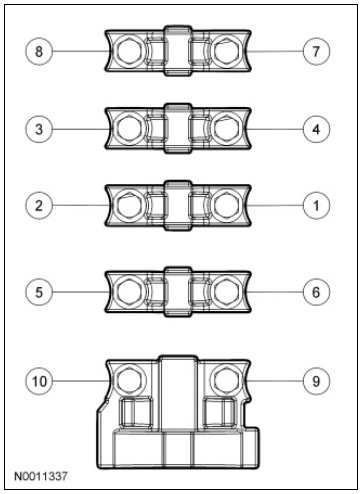
Installation

1. Install the LH and RH camshafts.
    - Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

2. **NOTE:** LH shown, RH similar.

    Install the LH and RH camshaft bearing caps in their original locations.

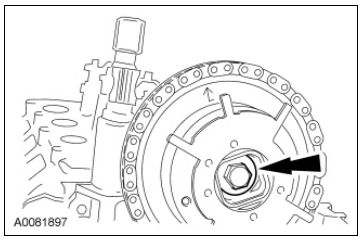
    - Lubricate the camshaft bearing caps with clean engine oil.
    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the bolts loosely.
    - Tighten to 10 Nm (89 lb-in) in the sequence shown.



3. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   NOTE: LH shown, RH similar.

   Install the camshaft phaser sprockets and new camshaft phaser bolts finger-tight.



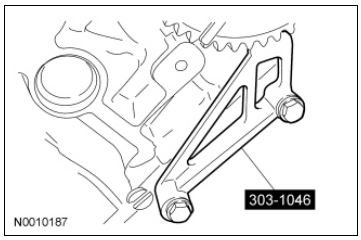
4. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

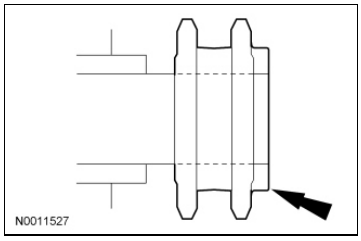
   NOTE: LH shown, RH similar.

   Using the Cam Phaser Locking Tool, tighten the LH and RH camshaft phaser sprocket bolts in 2 stages.

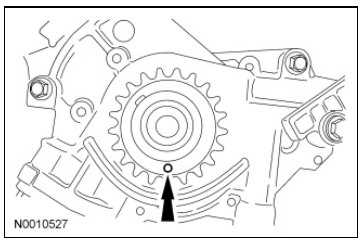
   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.



5. Install the crankshaft sprocket, making sure the flange faces forward.



6. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.



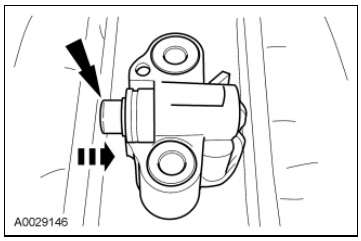
7. ***NOTICE:*** **If one or both of the tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, separation from the tensioner body or permanent compression of the seal bead is observed, install a new tensioner or engine damage may occur.**

   Inspect the RH and LH timing chain tensioners.

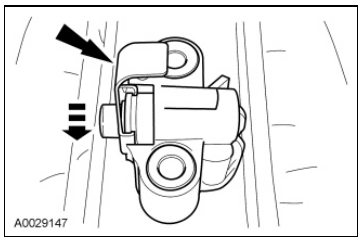
   - Install new tensioners as necessary.

8. ***NOTICE:*** **Timing chain procedures must be followed exactly or damage to valves and pistons will result.**

   Compress the tensioner plunger, using a vise.

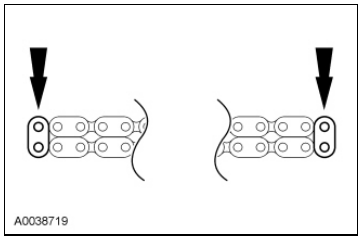


9. Install a retaining clip on the tensioner to hold the plunger in during installation.

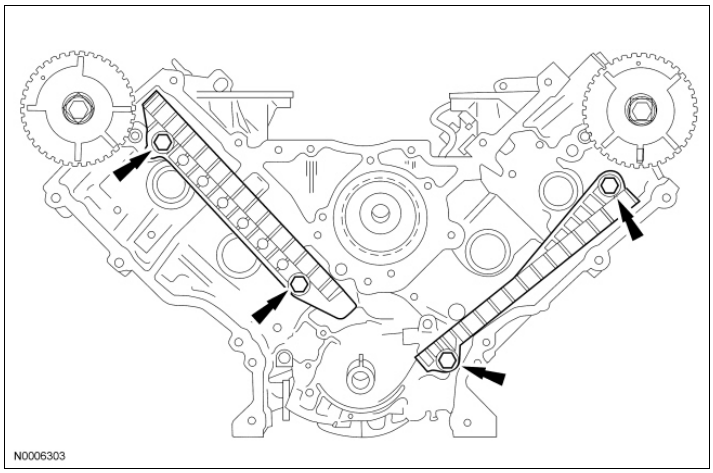


10. Remove the tensioner from the vise.

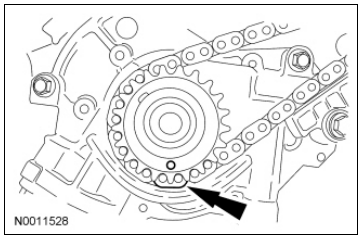
11. If the colored links are not visible, mark one link on one end and one link on the other end and use as timing marks.



12. Install the 4 bolts and the LH and RH timing chain guides.
    - Tighten to 10 Nm (89 lb-in).

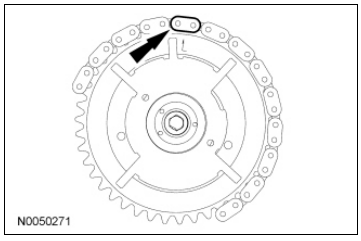


13. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single colored (marked) link on the chain.



14. **NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.

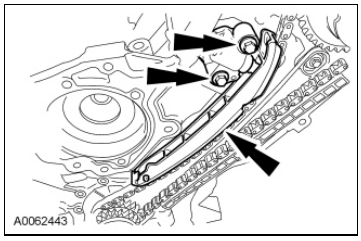
    Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the colored (marked) chain link.



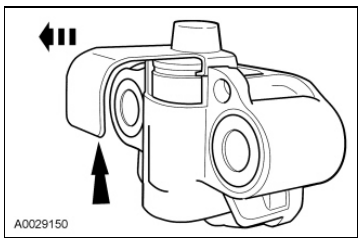
15. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

    Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and bolts.

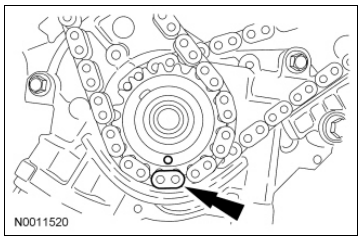
    - Tighten to 25 Nm (18 lb-ft).



16. Remove the retaining clip from the LH timing chain tensioner.



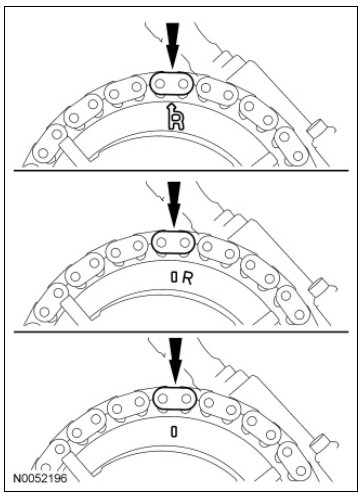
17. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single colored (marked) chain link.



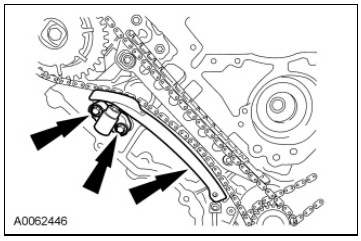
18. **NOTE:** The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

    NOTE: The lower half of the timing chain must be positioned above the tensioner arm dowel.

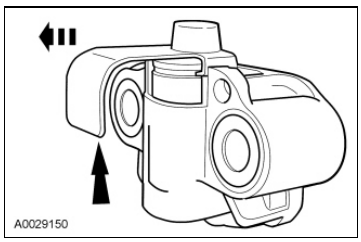
    Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the colored (marked) chain link.



19. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and bolts.
    - Tighten to 25 Nm (18 lb-ft).

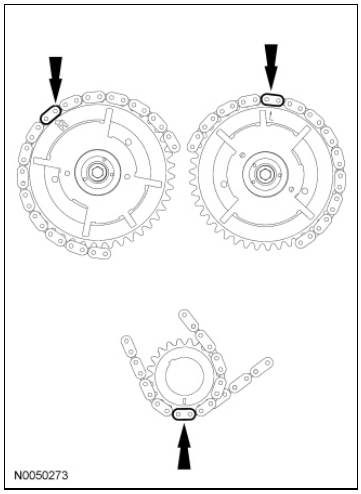


20. Remove the retaining clip from the RH timing chain tensioner.

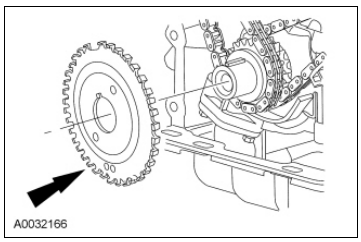


21. **NOTE:** The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

    As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.



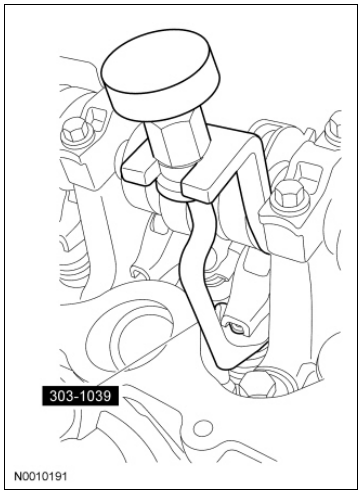
22. Install the crankshaft sensor ring on the crankshaft.



23. **NOTE:** It is necessary to rotate the engine to position the camshaft lobes at base circle to install the roller followers.

    Using the Valve Spring Compressor, install all of the camshaft roller followers.

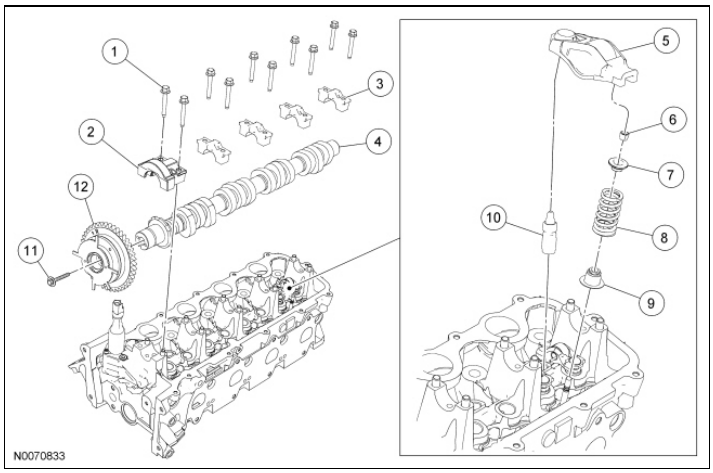
    - Lubricate the roller followers with clean engine oil prior to installation.



24. Install the engine front cover. For additional information, refer to Engine Front Cover in this section.

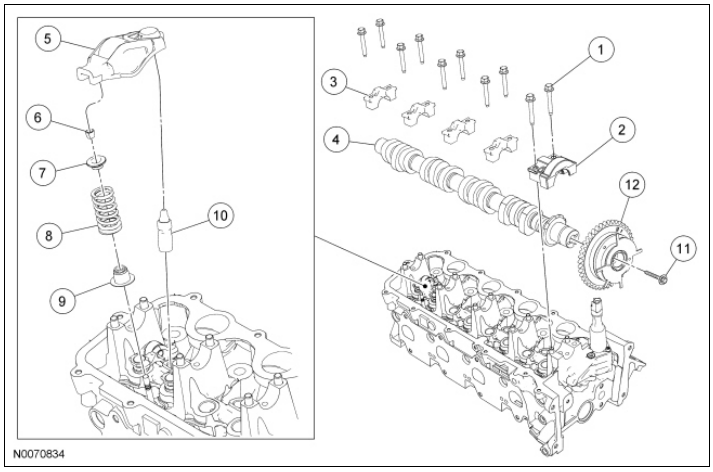
Valve Train Components - Exploded View

LH Side



Item	Part Number	Description
1	N807834	Camshaft bearing cap bolt (10 required)
2	6B284	Camshaft front bearing cap
3	6B280	Camshaft bearing cap (4 required)
4	6C255	Camshaft
5	6529	Camshaft roller follower (12 required)
6	6518	Valve spring retainer key (24 required)
7	6514	Valve spring retainer (12 required)
8	6513	Valve spring (12 required)
9	6A517	Valve seal (12 required)
10	6C501	Hydraulic lash adjuster (12 required)
11	6279	Camshaft phaser and sprocket bolt
12	6C524	Camshaft phaser and sprocket

RH Side



Item	Part Number	Description
1	N807834	Camshaft bearing cap bolt (10 required)
2	6B284	Camshaft front bearing cap
3	6B280	Camshaft bearing cap (4 required)
4	6251	Camshaft
5	6529	Camshaft roller follower (12 required)
6	6518	Valve spring retainer key (24 required)
7	6514	Valve spring retainer (12 required)
8	6513	Valve spring (12 required)
9	6A517	Valve seal (12 required)
10	6C501	Hydraulic lash adjuster (12 required)
11	6279	Camshaft phaser and sprocket bolt
12	6C524	Camshaft phaser and sprocket

1. For additional information, refer to the procedures in this section.

Camshaft - LH

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039
 ST2969-A	Locking Tool, Timing Chain 303-1175

Material

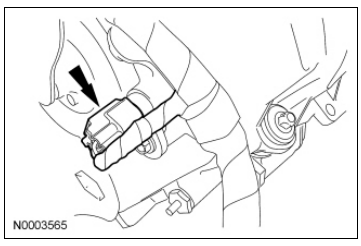
Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

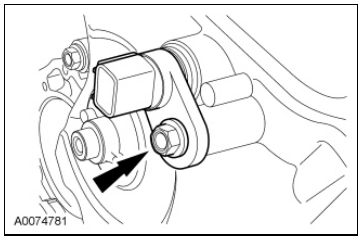
NOTICE: **The camshaft procedure must be followed exactly or damage to the valves and pistons will result.**

1. Remove the LH valve cover. For additional information, refer to Valve Cover - LH in this section.
2. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

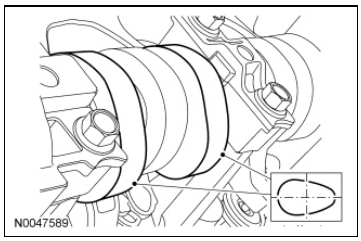
   Loosen and back off the LH camshaft phaser and sprocket bolt one full turn.
3. Disconnect the LH Camshaft Position (CMP) sensor electrical connector.


N0003565

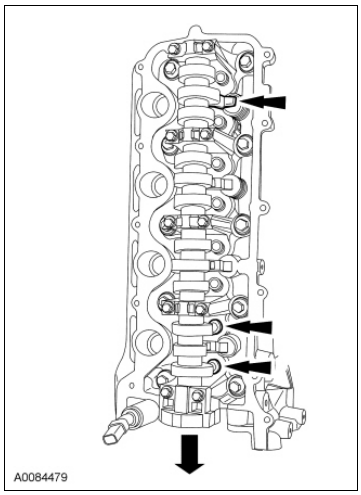
4. Remove the LH CMP sensor and the bolt.



5. Rotate the crankshaft clockwise until the No. 5 cylinder camshaft exhaust lobe opens the valve and the 2 intake lobes are in the 3 o'clock position as shown.



6. Remove only the 3 camshaft roller followers shown in the illustration.

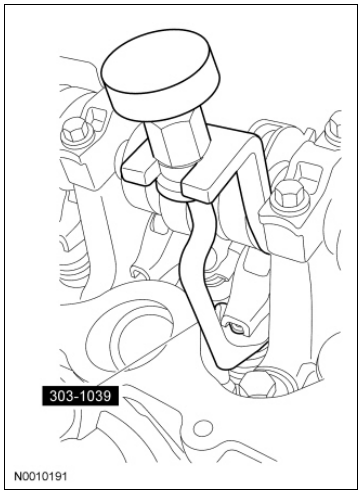


7. ***NOTICE:*** **The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

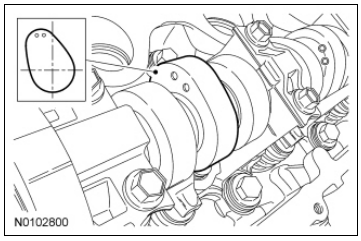
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, remove only the 3 designated camshaft roller followers from the previous step.



8. ***NOTICE:*** **The crankshaft cannot be moved once set or engine damage may occur.**

   Rotate the crankshaft a half turn clockwise, as viewed from the front, positioning the No. 5 cylinder camshaft exhaust lobe at the 11 o'clock position as shown.

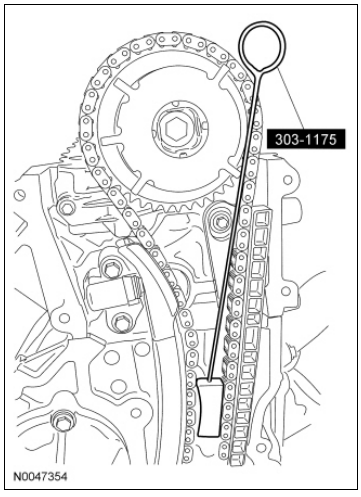


9. ***NOTICE:*** **Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.**

   NOTE: The Timing Chain Locking Tool must be installed square to the timing chain and the engine block.

   NOTE: Engine front cover removed from art for clarity.

   Install the Timing Chain Locking Tool in the LH timing chain as shown.



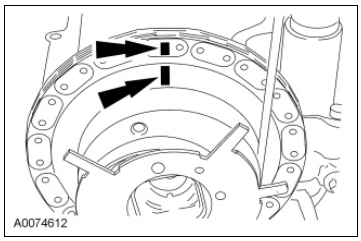
10. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be**

removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.

NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

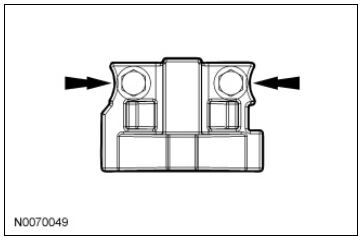
NOTE: RH shown, LH similar.

Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.



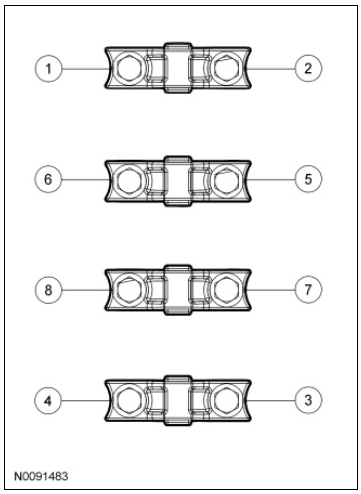
11. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the LH cylinder head camshaft front bearing cap.



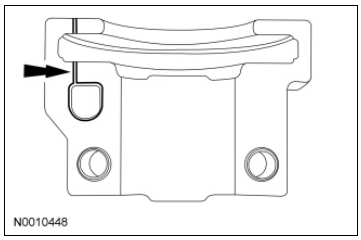
12. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the remaining bolts in the sequence shown and remove the LH cylinder head camshaft bearing caps.



13. Clean and inspect the LH camshaft bearing caps.

- The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



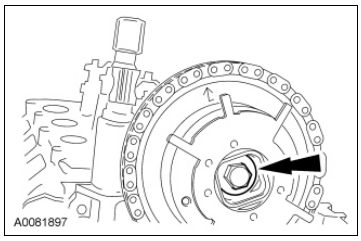
14. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.**

    NOTICE: **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.**

    Remove the bolt and the camshaft phaser and sprocket assembly from the camshaft.

    - Discard the bolt and washer.



15. Remove the camshaft.

16. Remove and inspect the camshaft phaser and sprocket for damage. For additional information, refer to Section 303-00 .

Installation

1. **NOTE:** Do not allow the camshaft roller followers to move out of position when installing the camshaft.

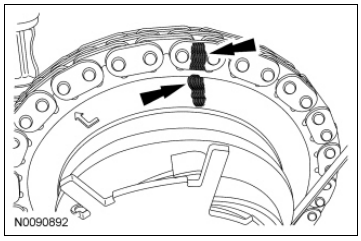
   Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

2. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.**

   NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

NOTE: If replacement of the camshaft phaser and sprocket is necessary, transfer the scribe mark to the new camshaft phaser and sprocket.

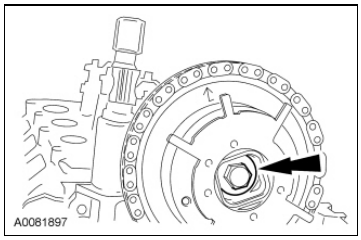
Position the camshaft phaser and sprocket into the timing chain with the timing chain scribe marks in alignment.



3. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

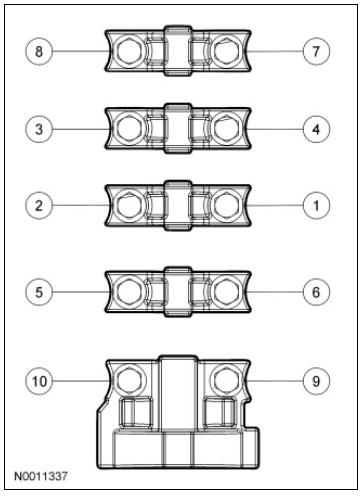
   NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   Install the camshaft phaser and sprocket assembly onto the camshaft and install a new camshaft phaser and sprocket bolt finger-tight.



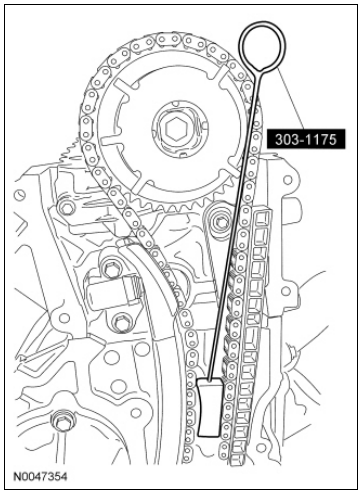
4. Install the camshaft bearing caps in their original locations.
   - Lubricate the camshaft bearing caps with clean engine oil.
   - Position the front camshaft bearing cap.
   - Position the remaining camshaft bearing caps.
   - Install the bolts loosely.

5. Tighten the bolts in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).

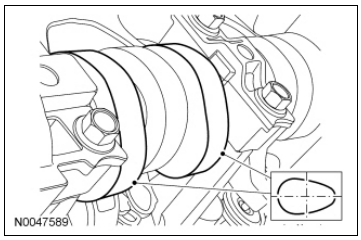


6. **NOTE:** Engine front cover removed from art for clarity.

   Remove the Timing Chain Locking Tool.



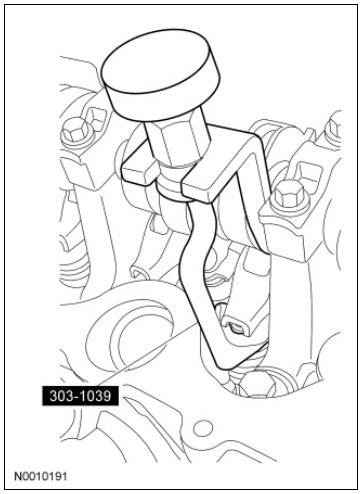
7. Rotate the crankshaft a half turn counterclockwise until the No. 5 cylinder camshaft exhaust lobe opens the valve and the 2 intake lobes are in the 3 o'clock position as shown.



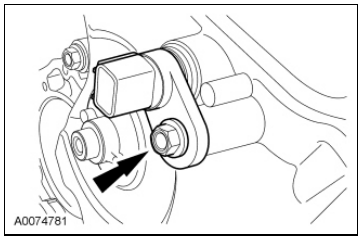
8. **NOTE:** Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

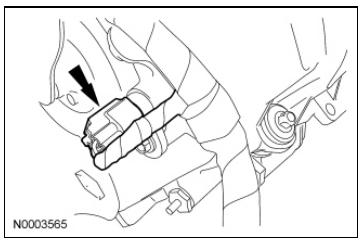
   Using the Valve Spring Compressor, install the 3 originally removed camshaft roller followers.



9. Install the CMP sensor and the bolt.
   - Tighten to 10 Nm (89 lb-in).



10. Connect the CMP electrical connector.

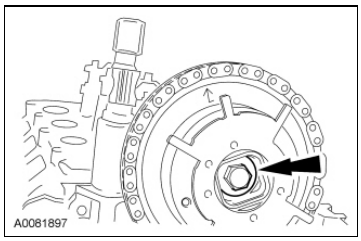


11. ***NOTICE:*** **Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

    NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    Tighten the camshaft phaser and sprocket bolt in 2 stages:

    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



12. Install the LH valve cover. For additional information, refer to Valve Cover - LH in this section.

Camshaft - RH

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039
 ST2969-A	Locking Tool, Timing Chain 303-1175

Material

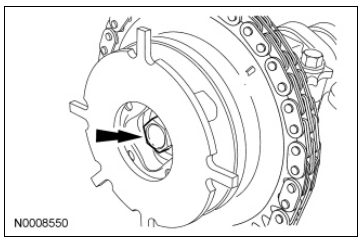
Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

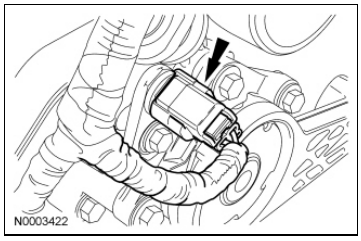
NOTICE: **The camshaft procedure must be followed exactly or damage to the valves and pistons will result.**

1. Remove the RH valve cover. For additional information, refer to Valve Cover - RH in this section.
2. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

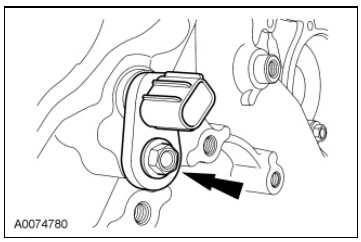
   Loosen and backoff the RH camshaft phaser and sprocket bolt one full turn.


N0008550

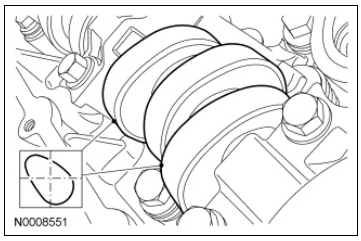
3. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.



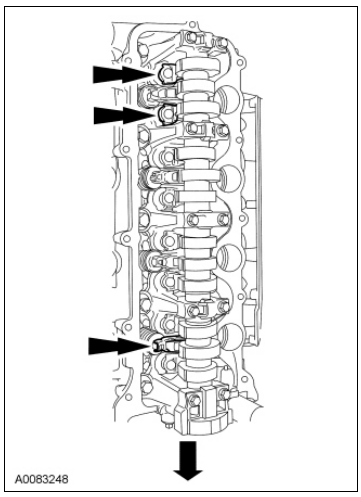
4. Remove the bolt and the RH CMP sensor.



5. Rotate the crankshaft clockwise until the No. 1 cylinder camshaft exhaust lobe is coming up on the exhaust stroke and the 2 intake lobes are positioned between 10 and 11 o'clock as shown.



6. Remove only the 3 camshaft roller followers shown in the illustration.

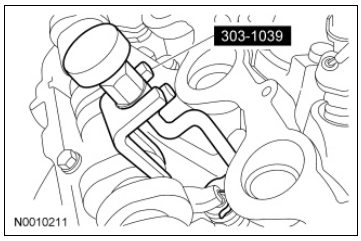


7. *NOTICE:* **The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

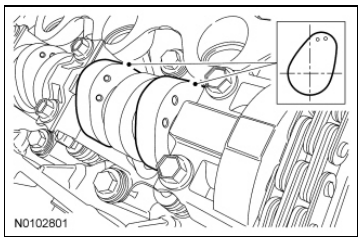
   NOTE: It may be necessary to push the valve down while compressing the spring.

Using the Valve Spring Compressor, remove only the 3 designated camshaft roller followers from the previous step.



8. ***NOTICE:*** **The crankshaft cannot be moved once set or engine damage may occur.**

   Rotate the crankshaft a half turn clockwise, as viewed from the front, positioning the No. 1 cylinder camshaft intake lobes at the 1 o'clock position as shown.

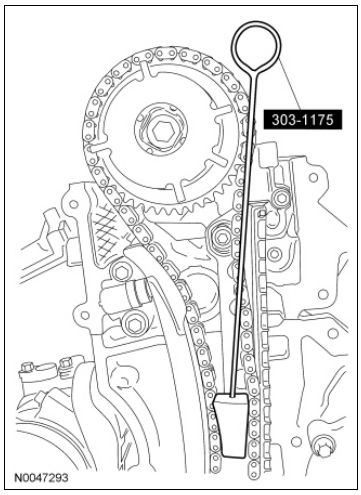


9. ***NOTICE:*** **Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.**

   NOTE: The Timing Chain Locking Tool must be installed square to the timing chain and the engine block.

   NOTE: Engine front cover removed for clarity.

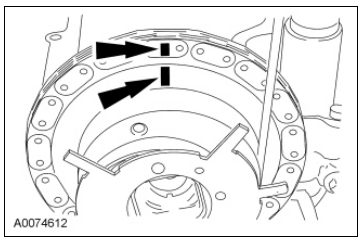
   Install the Timing Chain Locking Tool in the RH timing chain as shown.



10. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

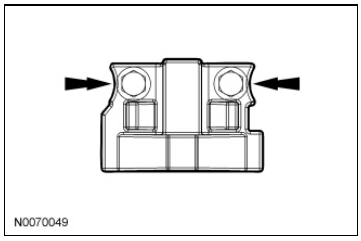
    NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.



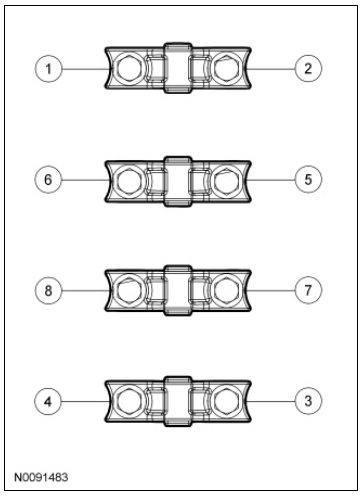
11. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the RH cylinder head camshaft front bearing cap.

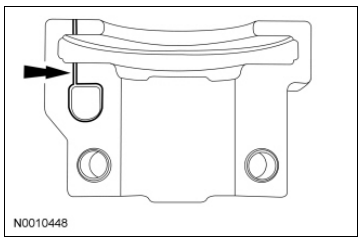


12. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the remaining bolts in the sequence shown and remove the RH cylinder head camshaft bearing caps.



13. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



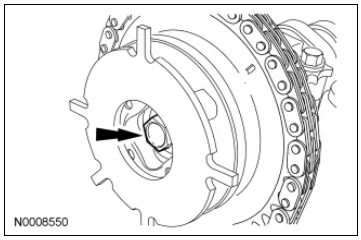
14. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.**

    NOTICE: **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

    Remove the bolt and the camshaft phaser and sprocket assembly from the camshaft.

    - Discard the bolt and washer.



15. Remove the camshaft.

16. Remove and inspect the camshaft phaser and sprocket for damage. For additional information, refer to Section 303-00 .

Installation

1. **NOTE:** Do not allow the camshaft roller followers to move out of position when installing the camshaft.

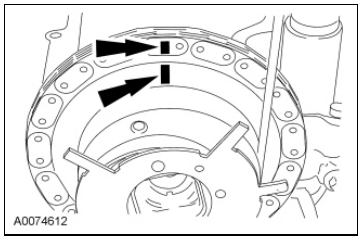
   Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

2. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

   NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

   NOTE: If replacement of the camshaft phaser and sprocket is necessary, transfer the scribe mark to the new camshaft phaser and sprocket.

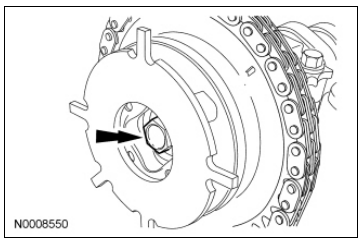
   Position the camshaft phaser and sprocket into the timing chain with the timing chain scribe marks in alignment.



3. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

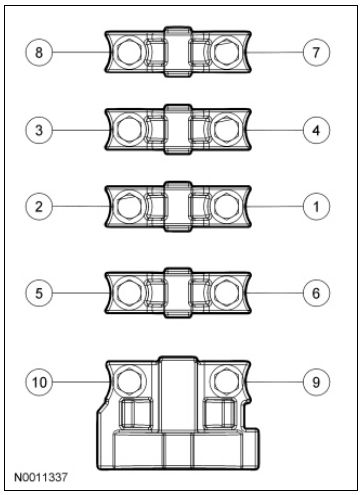
   NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   Install the camshaft phaser and sprocket assembly onto the camshaft and install a new camshaft phaser and sprocket bolt finger-tight.



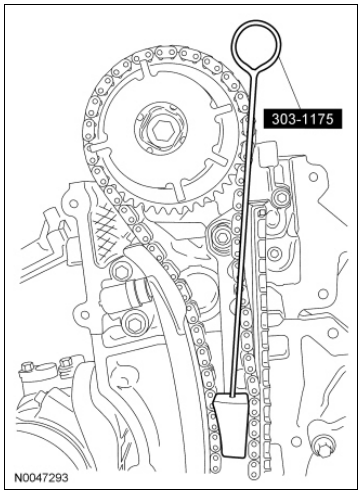
4. Install the camshaft bearing caps in their original locations.
   - Lubricate the camshaft bearing caps with clean engine oil.
   - Position the front camshaft bearing cap.
   - Position the remaining camshaft bearing caps.
   - Install the bolts loosely.

5. Tighten the bolts in the sequence shown.
   - Tighten to 10 Nm (89 lb-in).

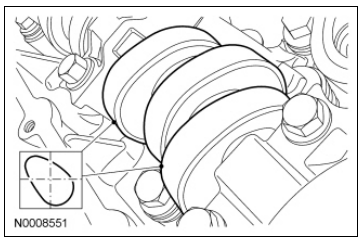


6. **NOTE:** Engine front cover removed for clarity.

   Remove the Timing Chain Locking Tool.



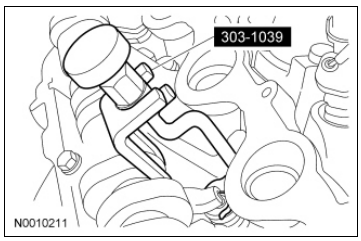
7. Rotate the crankshaft a half turn counterclockwise until the No. 1 cylinder camshaft intake lobes are positioned between 10 and 11 o'clock as shown.



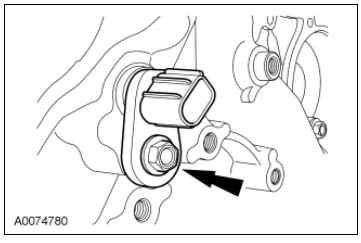
8. **NOTE:** Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

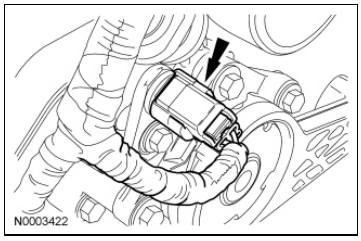
   Using the Valve Spring Compressor, install the 3 originally removed camshaft roller followers.



9. Install the CMP sensor and the bolt.
   - Tighten to 10 Nm (89 lb-in).



10. Connect the CMP electrical connector.

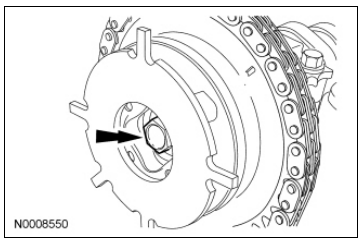


11. ***NOTICE:*** **Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

    NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    Tighten the new camshaft phaser and sprocket bolt in 2 stages:

    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



12. Install the RH valve cover. For additional information, refer to Valve Cover - RH in this section.

Camshaft Phaser and Sprocket - LH

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039
 ST2969-A	Locking Tool, Timing Chain 303-1175

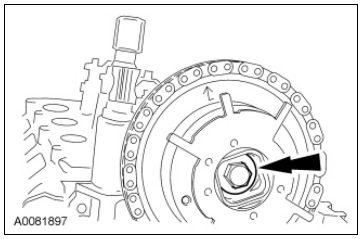
Removal

NOTICE: **This procedure must be followed exactly or damage to the valves and pistons will result.**

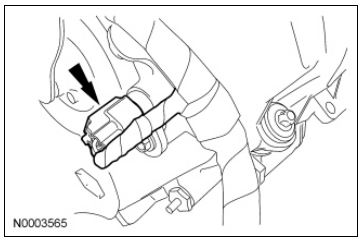
1. Remove the LH valve cover. For additional information, refer to Valve Cover - LH in this section.
2. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   NOTICE: **Only use hand tools to remove the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

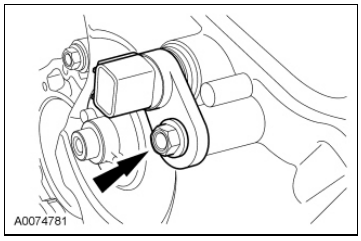
   Loosen and back off the LH camshaft phaser and sprocket bolt one full turn.


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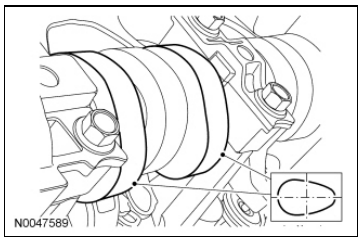
3. Disconnect the LH Camshaft Position (CMP) sensor electrical connector.


N0003565

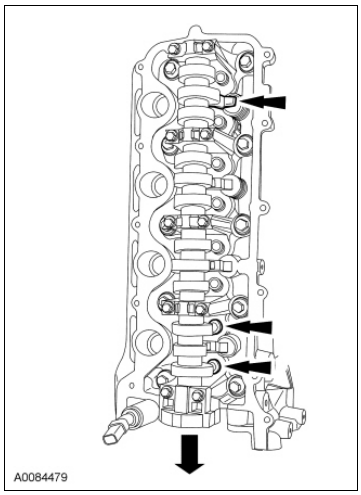
4. Remove the bolt and the LH CMP sensor.



5. Rotate the crankshaft clockwise until the No. 5 cylinder camshaft exhaust lobe opens the valve and the 2 intake lobes are in the 3 o'clock position as shown.



6. Remove only the 3 camshaft roller followers shown in the illustration.

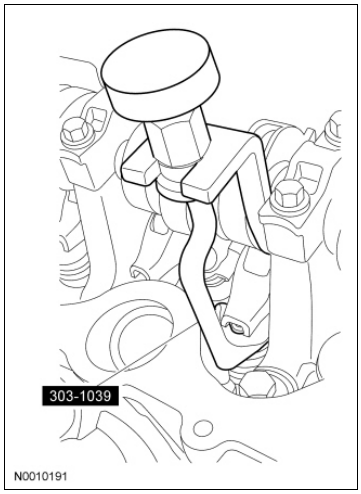


7. *NOTICE:* **The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

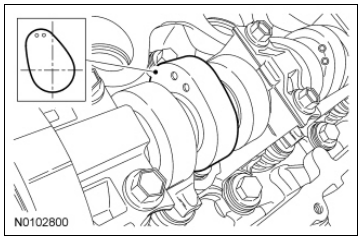
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, remove only the 3 designated camshaft roller followers from the previous step.



8. ***NOTICE:*** **The crankshaft cannot be moved once set or engine damage may occur.**

   Rotate the crankshaft a half turn clockwise, as viewed from the front, positioning the No. 5 cylinder camshaft exhaust lobe at the 11 o'clock position as shown.

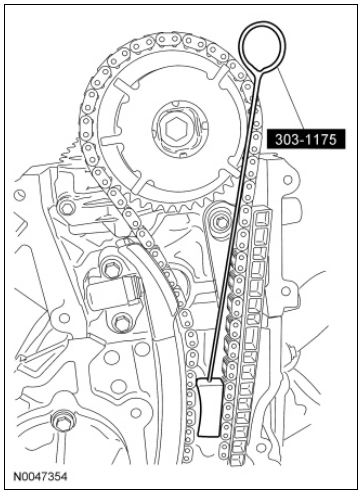


9. ***NOTICE:*** **The engine is not freewheeling. The camshaft procedure must be followed exactly or damage to valves and pistons will result.**

   NOTE: The Timing Chain Locking Tool must be installed square to the timing chain and the engine block.

   NOTE: Engine front cover removed from art for clarity.

   Install the Timing Chain Locking Tool in the LH timing chain as shown.



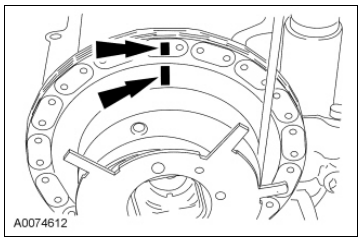
10. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be**

removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.

NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

NOTE: RH shown, LH similar.

Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.



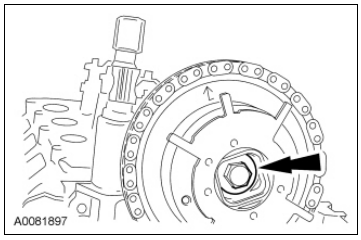
11. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.**

    NOTICE: **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.**

    Remove the bolt and remove the camshaft phaser and sprocket assembly from camshaft and then from the timing chain.

    - Discard the bolt and washer.



12. **NOTE:** If replacement of the camshaft phaser and sprocket is necessary, transfer the scribe mark to the new camshaft phaser and sprocket.

    Inspect the camshaft phaser and sprocket for damage. For additional information, refer to Section 303-00 .

Installation

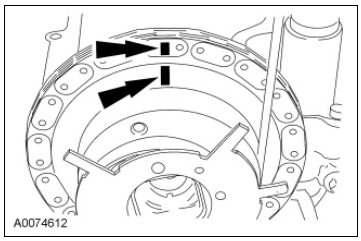
1. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive**

Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.

NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

NOTE: RH shown, LH similar.

Position the camshaft phaser and sprocket into the timing chain with the timing chain scribe marks in alignment.

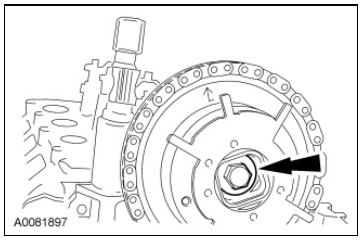


2. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section. Failure to follow this instruction can result in damage to the valves and pistons.**

   NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

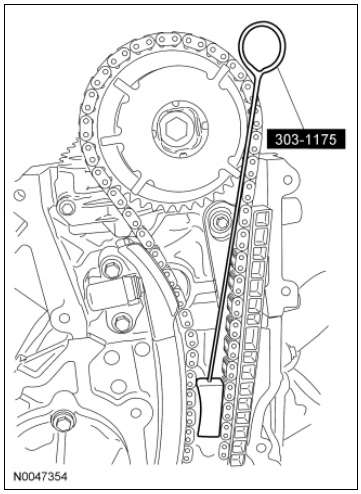
   NOTICE: **Only use hand tools to install the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.**

   Position the camshaft phaser and sprocket onto the camshaft. Install a new camshaft phaser and sprocket bolt finger-tight.

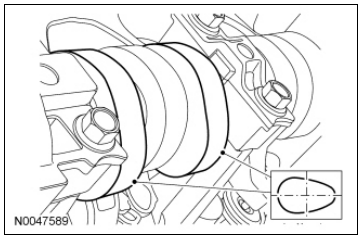


3. **NOTE:** Engine front cover removed from art for clarity.

   Remove the Timing Chain Locking Tool.



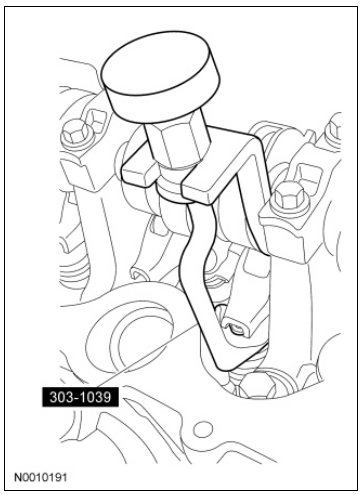
4. Rotate the crankshaft a half turn counterclockwise until the No. 5 cylinder camshaft exhaust lobe opens the valve and the 2 intake lobes are in the 3 o'clock position as shown.



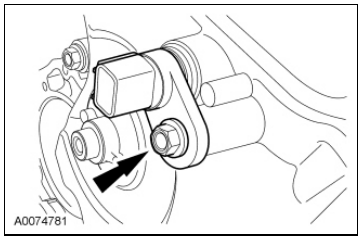
5. **NOTE:** Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

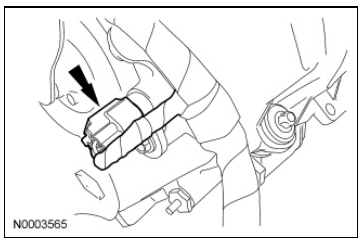
   Using the Valve Spring Compressor, install the 3 originally removed camshaft roller followers.



6. Install the CMP sensor and the bolt.
   - Tighten to 10 Nm (89 lb-in).



7. Connect the CMP electrical connector.

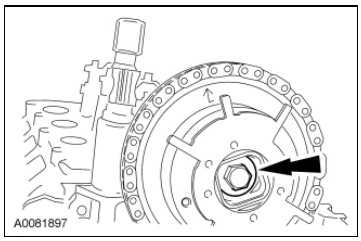


8. ***NOTICE:*** **Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

   NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   Tighten the camshaft phaser and sprocket bolt in 2 stages:

   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.



9. Install the LH valve cover. For additional information, refer to Valve Cover - LH in this section.

Camshaft Phaser and Sprocket - RH

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039
 ST2969-A	Locking Tool, Timing Chain 303-1175

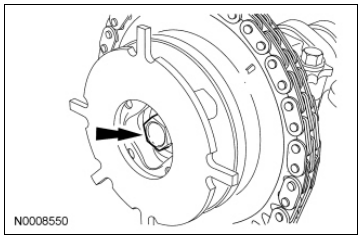
Removal

NOTICE: **This procedure must be followed exactly or damage to the valves and pistons will result.**

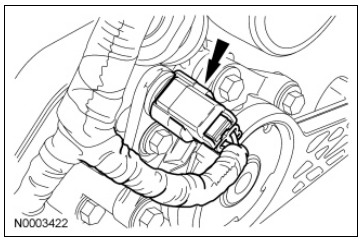
1. Remove the RH valve cover. For additional information, refer to Valve Cover - RH in this section.
2. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   NOTICE: **Only use hand tools to remove the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

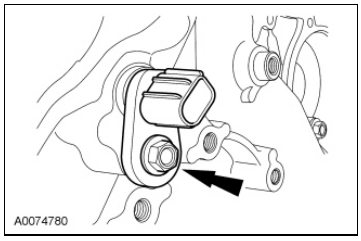
   Loosen and backoff the RH camshaft phaser and sprocket bolt one full turn.


N0008550

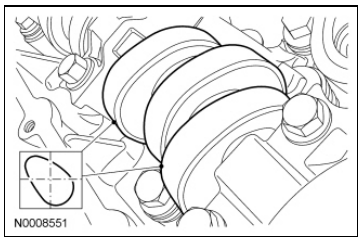
3. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.


N0003422

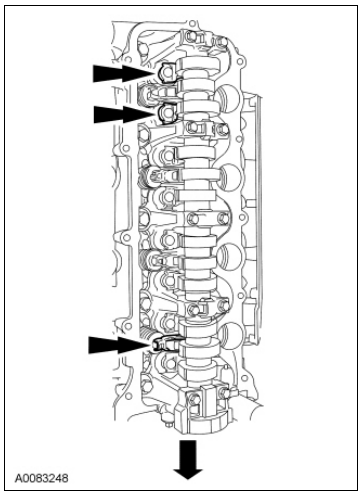
4. Remove the bolt and the RH CMP sensor.



5. Rotate the crankshaft clockwise until the No. 1 cylinder camshaft exhaust lobe is coming up on the exhaust stroke and the 2 intake lobes are positioned between 10 and 11 o'clock as shown.



6. Remove only the 3 camshaft roller followers shown in the illustration.

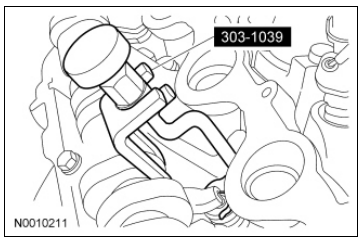


7. *NOTICE:* **The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

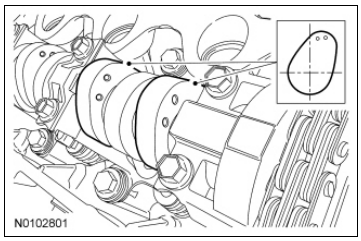
   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, remove only the 3 designated camshaft roller followers from the previous step.



8. ***NOTICE:*** **The crankshaft cannot be moved once set or engine damage may occur.**

   Rotate the crankshaft a half turn clockwise, as viewed from the front, positioning the No. 1 cylinder intake lobes at the 1 o'clock position as shown.

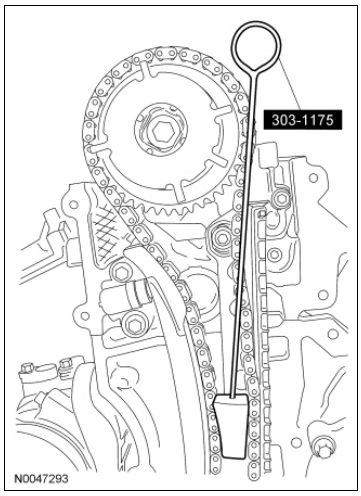


9. ***NOTICE:*** **Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.**

   NOTE: The Timing Chain Locking Tool must be installed square to the timing chain and the engine block.

   NOTE: Engine front cover removed for clarity.

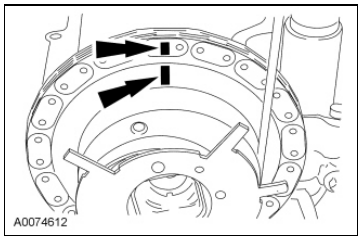
   Install the Timing Chain Locking Tool in the RH timing chain as shown.



10. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

    NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

    Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.



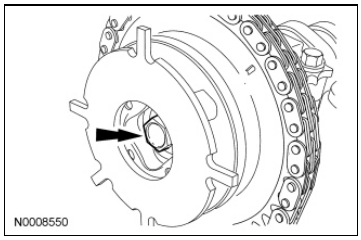
11. ***NOTICE:*** **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.**

    NOTICE: **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

    Remove the bolt and remove the camshaft phaser and sprocket assembly from camshaft and then from the timing chain.

    - Discard the bolt and washer.



12. **NOTE:** If replacement of the camshaft phaser and sprocket is necessary, transfer the scribe mark to the new camshaft phaser and sprocket.

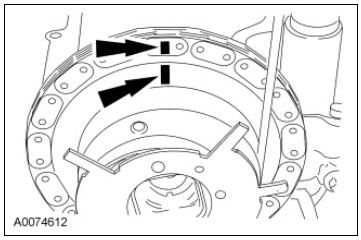
    Inspect the camshaft phaser and sprocket for damage. For additional information, refer to Section 303-00 .

Installation

1. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

   NOTICE: **The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.**

   Position the camshaft phaser and sprocket into the timing chain with the timing chain scribe marks in alignment.

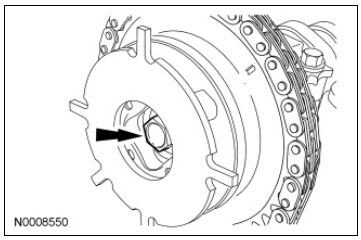


2. ***NOTICE:*** **Do not remove the Timing Chain Locking Tool at any time during assembly. If the Timing Chain Locking Tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components in this section.**

NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

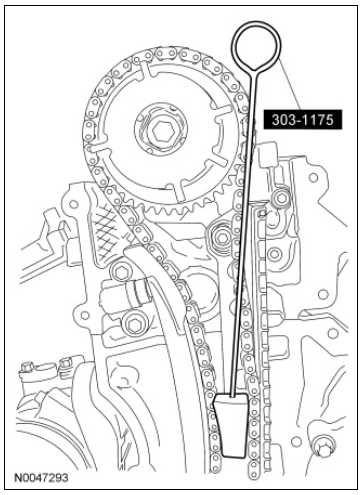
NOTICE: **Only use hand tools to install the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.**

Position the camshaft phaser and sprocket assembly onto the camshaft. Install a new camshaft phaser and sprocket bolt finger-tight.

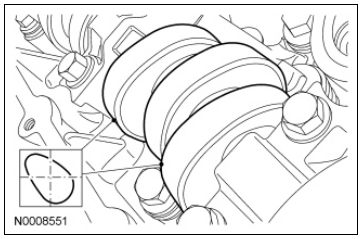


3. **NOTE:** Engine front cover removed for clarity.

   Remove the Timing Chain Locking Tool.



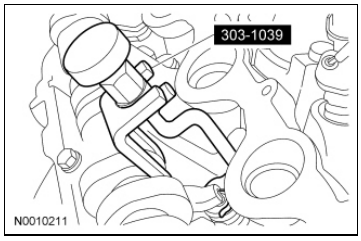
4. Rotate the crankshaft a half turn counterclockwise until the No. 1 cylinder camshaft intake lobes are positioned between 10 and 11 o'clock as shown.



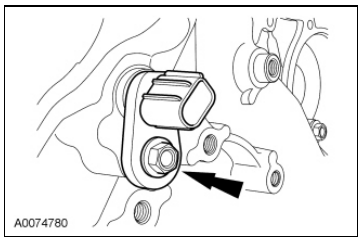
5. **NOTE:** Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

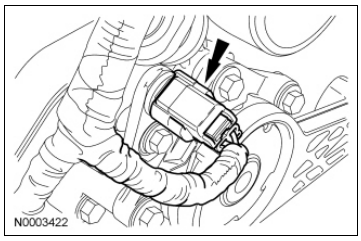
   Using the Valve Spring Compressor, install the 3 originally removed camshaft roller followers.



6. Install the CMP sensor and the bolt.
   - Tighten to 10 Nm (89 lb-in).



7. Connect the CMP electrical connector.

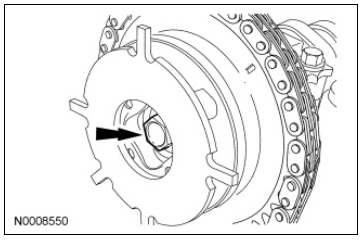


8. ***NOTICE:*** **Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.**

   NOTICE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

   Tighten the new camshaft phaser and sprocket bolt in 2 stages:

   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.



9. Install the RH valve cover. For additional information, refer to Valve Cover - RH in this section.

Variable Camshaft Timing (VCT) Housing

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-

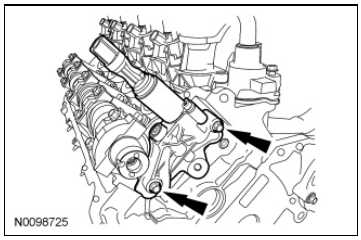
Removal

All Variable Camshaft Timing (VCT) housings

1. Remove the timing drive components. For additional information, refer to Timing Drive Components in this section.

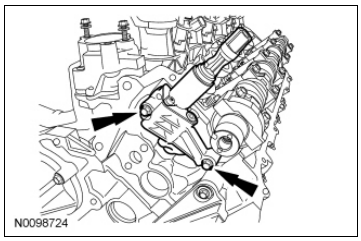
RH VCT housing

2. Remove the 2 bolts and the RH Variable Camshaft Timing (VCT) housing.



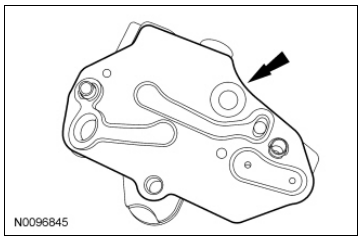
LH VCT housing

3. Remove the 2 bolts and the LH VCT housing.



All VCT housings

4. Remove and discard the VCT housing gasket.



5. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

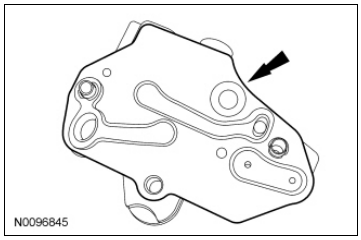
   Clean and inspect the cylinder head sealing surfaces with metal surface prep. Follow the directions on the packaging.

6. Clean and inspect the VCT housing. For additional information, refer to Section 303-00 .

Installation

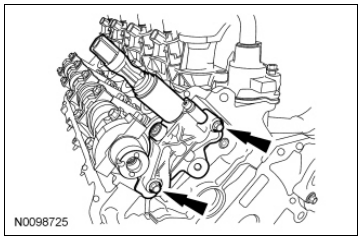
All VCT housing

1. Install a new gasket onto the VCT housing.



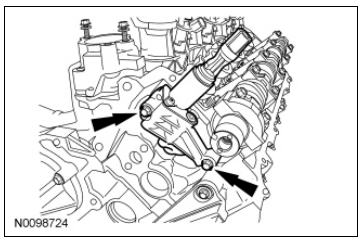
RH VCT housing

2. Position the RH VCT housing and install the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).



LH VCT housing

3. Position the LH VCT housing and install the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

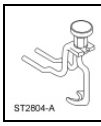


All VCT housings

4. Install the timing drive components. For additional information, refer to Timing Drive Components in this section.

Camshaft Roller Follower

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Depending on the roller follower being serviced, remove the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH in this section.

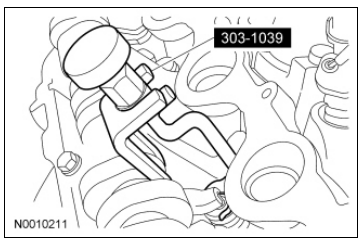
2. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

3. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, compress the valve spring and remove the camshaft roller follower.



4. Repeat the previous 2 steps for each roller follower being serviced.

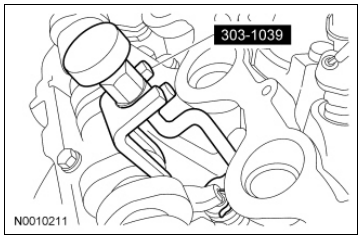
5. Inspect the roller follower. For additional information, refer to Section 303-00 .

Installation

1. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Lubricate the roller follower with clean engine oil.

   Using the Valve Spring Compressor, compress the valve spring and install the camshaft roller follower.

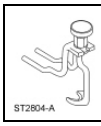


2. Repeat the previous step for each roller follower being serviced.

3. Depending on the valve being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH in this section.

Valve Springs

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Depending on the valve spring being serviced, remove the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH in this section.

2. Remove the spark plug. For additional information, refer to Section 303-07B .

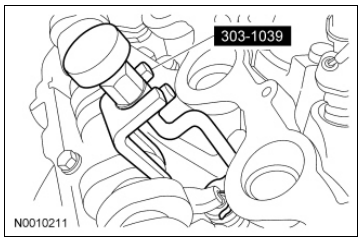
3. Rotate the crankshaft until the piston for the valve spring being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

4. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, compress the valve spring and remove the camshaft roller follower.

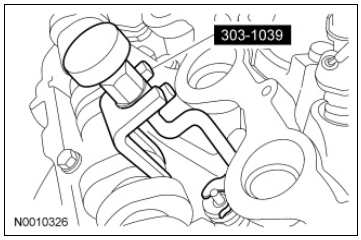


5. Use compressed air in the cylinder to hold both valves in position.
    - Apply a minimum of 965 kPa (140 psi) of compressed air into the cylinder.

6. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal. If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head in this section.

   Using the Valve Spring Compressor, compress the valve spring and remove the valve spring retainer keys.



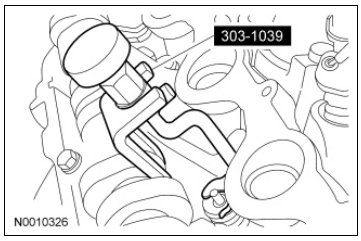
7. Remove the valve spring retainer and the valve spring.

8. Inspect the valve spring. For additional information, refer to Section 303-00 .

Installation

1. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   Using the Valve Spring Compressor, install the valve spring, the valve spring retainer and the valve spring retainer keys.



2. Relieve the air pressure from the cylinder.

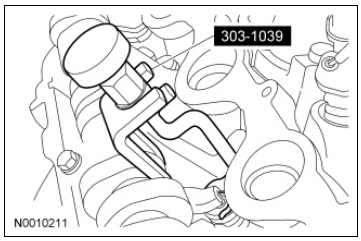
3. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

NOTE: Lubricate the camshaft roller followers with clean engine oil prior to installation.

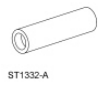
Using the Valve Spring Compressor, compress the valve spring and install the camshaft roller follower.



4. Install the spark plug. For additional information, refer to Section 303-07B .
5. Depending on the valve spring being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH in this section.

Valve Seals

Special Tool(s)

 ST2804-A	Compressor, Valve Spring 303-1039
 ST1332-A	Installer, Valve Stem Oil Seal 303-383 (T91P-6571-A)

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Depending on the valve seal being serviced, remove the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH in this section.

2. Remove the spark plug. For additional information, refer to Section 303-07B .

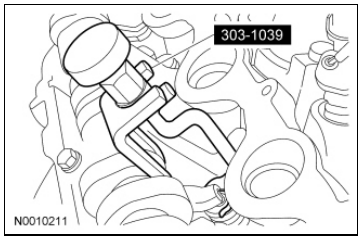
3. Rotate the crankshaft until the piston for the valve seal being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

4. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

   Using the Valve Spring Compressor, compress the valve spring and remove the camshaft roller follower.

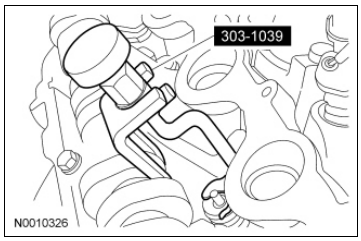


5. Use compressed air in the cylinder to hold both valves in position.
    - Apply a minimum of 965 kPa (140 psi) of compressed air into the cylinder.

6. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal. If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head in this section.

   Using the Valve Spring Compressor, compress the valve spring and remove the valve spring retainer keys.



7. Remove the valve spring retainer, the valve spring and the valve seal.
    - Discard the valve seal.

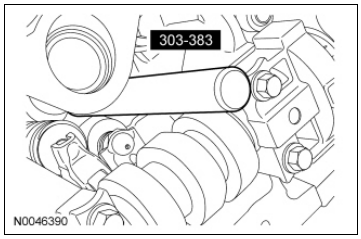
8. Inspect the components. For additional information, refer to Section 303-00 .

Installation

1. **NOTE:** Lubricate the valve seal and valve stem with clean engine oil prior to installation.

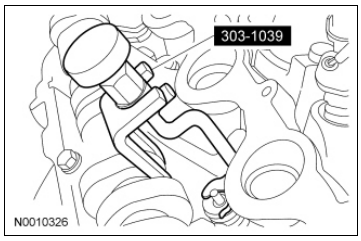
   Position a new valve seal onto the valve stem.

2. Using the Valve Stem Oil Seal Installer, install the new valve seal.



3. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

Using the Valve Spring Compressor, install the valve spring, the valve spring retainer and the valve spring retainer keys.



4. Relieve the air pressure from the cylinder.

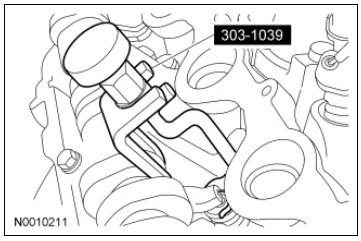
5. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head in this section.

   NOTE: It may be necessary to push the valve down while compressing the spring.

   NOTE: Lubricate the camshaft roller followers with clean engine oil prior to installation.

   Using the Valve Spring Compressor, compress the valve spring and install the camshaft roller follower.



6. Install the spark plug. For additional information, refer to Section 303-07B .

7. Depending on the valve seal being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH in this section.

Hydraulic Lash Adjuster

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal and Installation

1. Remove the camshafts. For additional information, refer to Valve Train Components - Exploded View , Camshaft - LH and Camshaft - RH in this section.

2. Remove the remaining roller followers from the cylinder head being serviced.

3. ***NOTICE:*** **If the components are to be reinstalled, they must be installed in their original positions. Mark the components for installation into their original locations. Failure to follow these instructions may result in engine damage.**

   Remove the hydraulic lash adjusters that are being serviced.

4. Inspect the hydraulic lash adjusters. For additional information, refer to Section 303-00 .

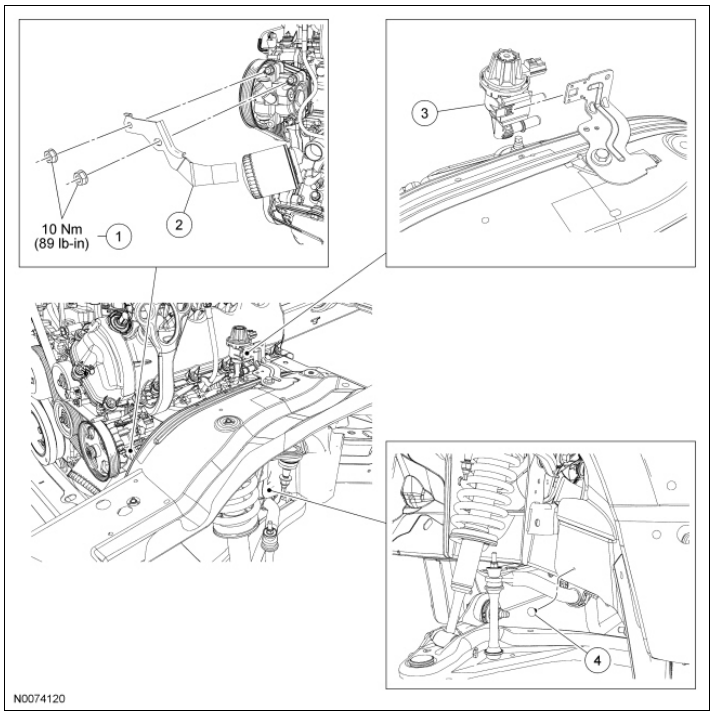
5. **NOTE:** Lubricate each of the hydraulic lash adjusters with clean engine oil prior to installation.

   To install, reverse the removal procedure.

Exhaust Manifold - LH

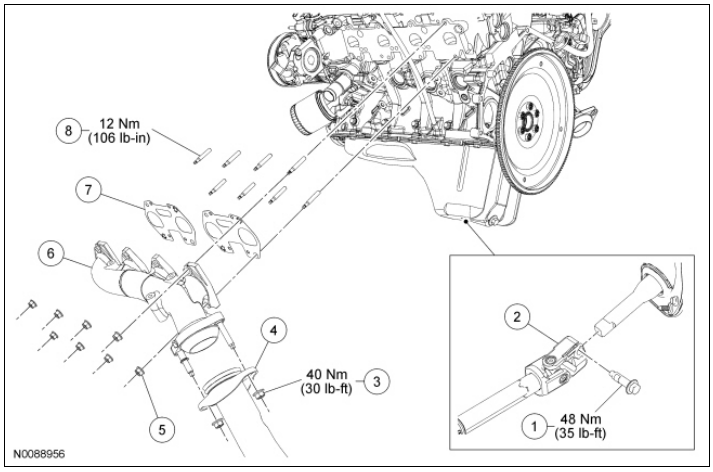
Removal

Wiring Harness Bracket, Evaporative Emission (EVAP) Canister Purge Valve and Splash Shield Pushpin



Item	Part Number	Description
1	N805403	Battery cable bracket nuts (2 required)
2	10W652	Battery cable bracket (part of 14A280)
3	9G641	Evaporative Emission (EVAP) canister purge valve
4	388577	Splash shield pushpin

LH Exhaust Manifold



Item	Part Number	Description
1	W710570	Intermediate steering shaft pinch bolt
2	3C662	Intermediate steering shaft
3	W705443	Dual converter Y-pipe flange nut (4 required)
4	5F250	Dual converter Y-pipe
5	W701706	LH exhaust manifold nut (8 required)
6	9431	LH exhaust manifold
7	9Y431	LH exhaust manifold gasket (2 required)
8	W707747	LH exhaust manifold stud (8 required)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Detach the Evaporative Emission (EVAP) canister purge valve from the bracket and position the valve aside.

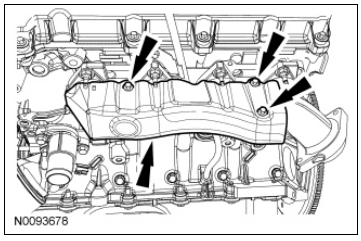
3. ***NOTICE:*** **Do not allow the lower steering column shaft to rotate while it is disconnected from the gear or the clockspring may be damaged. If there is evidence that the lower steering column shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   Remove the intermediate steering shaft pinch bolt and disconnect the intermediate steering shaft from the lower steering column shaft.

4. Remove the 4 nuts and disconnect the dual converter Y-pipe from the exhaust manifolds.

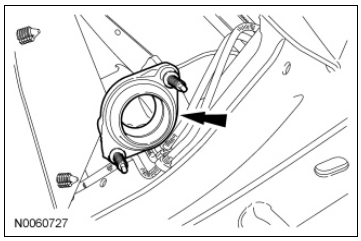
5. Remove the 2 nuts and position the battery cable bracket aside.

6. Remove the 3 bolts and the LH exhaust manifold heat shield.



7. Remove and discard the pushpin.

8. Remove the 8 nuts, the LH exhaust manifold and the 2 gaskets.
    - Deflect the inner fender splash shield and remove the manifold between the splash shield and the frame rail.
    - Discard the nuts and the gaskets.



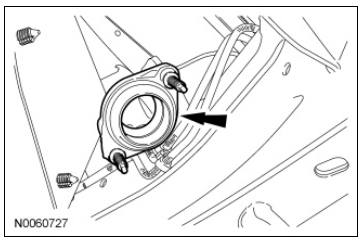
9. Remove and discard the 8 LH exhaust manifold studs.

Installation

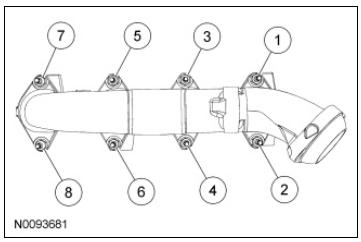
1. Clean and inspect the LH exhaust manifold. For additional information, refer to Section 303-00 .

2. Install 8 new LH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

3. Position the 2 new gaskets, the LH exhaust manifold and install 8 new nuts finger-tight.
    - Deflect the inner fender splash shield and insert the exhaust manifold between the splash shield and the frame rail.

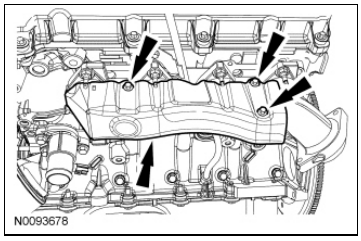


4. Tighten the exhaust manifold nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



5. Position the inner fender splash shield and install a new pushpin.

6. Install the heat shield and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



7. Position the battery cable bracket to the power steering pump and install the 2 nuts.
   - Tighten to 10 Nm (89 lb-in).

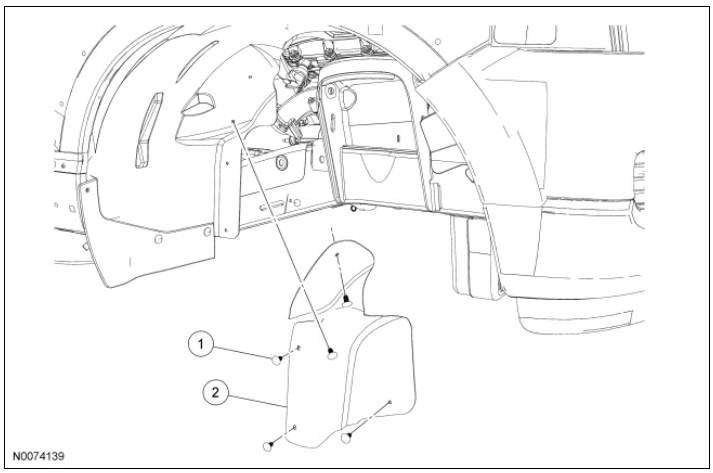
8. Connect the dual converter Y-pipe to the exhaust manifolds and install the 4 nuts.
   - Tighten to 40 Nm (30 lb-ft).

9. Connect the intermediate steering shaft to the lower steering column shaft and install the pinch bolt.
   - Tighten to 48 Nm (35 lb-ft).

10. Attach the EVAP canister purge valve to the bracket.

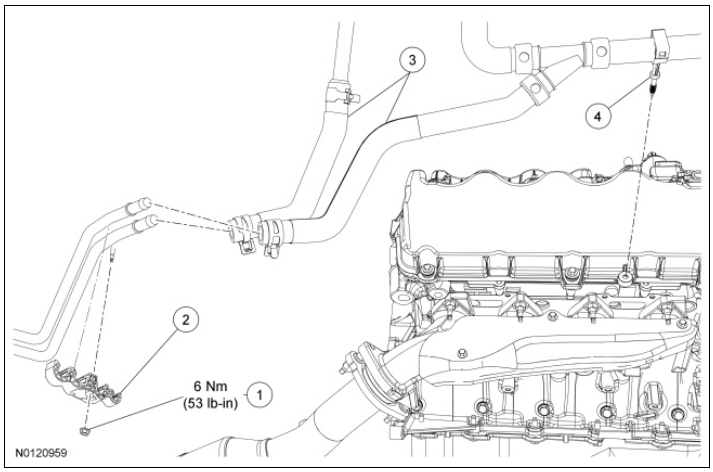
Exhaust Manifold - RH

RH Splash Shield



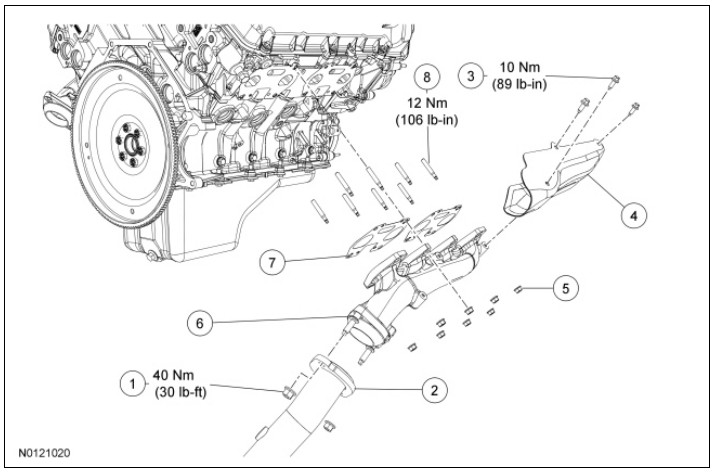
Item	Part Number	Description
1	388577	RH splash shield pushpin (5 required)
2	16034	RH splash shield

Vehicles with auxiliary climate control



Item	Part Number	Description
1	W520512	Auxiliary line bracket nut
2	18N332	Auxiliary line bracket
3	18K470	Heater core hose assembly
4	-	Heater core hose assembly retainer

RH Exhaust Manifold



Item	Part Number	Description
1	W705443	Dual converter Y-pipe flange nut (4 required)
2	5F250	Dual converter Y-pipe
3	W707130	RH exhaust manifold heat shield bolts (3 required)
4	9A462	RH exhaust manifold heat shield
5	W701706	RH exhaust manifold nut (8 required)
6	9430	RH exhaust manifold
7	9Y431	RH exhaust manifold gasket (2 required)
8	W707747	RH exhaust manifold stud (8 required)

Removal

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Vehicles with auxiliary climate control

2. Drain the cooling system. For additional information, refer to Section 303-03 .
3. Detach the heater core hose assembly retainer from the RH valve cover.
4. Remove the RH front fender splash shield. For additional information, refer to Section 501-02 .
5. Disconnect the 2 heater hoses and position aside.
6. Remove the auxiliary line bracket nut.
7. Remove the auxiliary line bracket.

All vehicles

8. Remove the 4 nuts and disconnect the dual converter Y-pipe from the exhaust manifolds.
9. Remove the 3 bolts and the RH exhaust manifold heat shield.

10. Remove the 5 pushpins and the RH splash shield.

11. Remove the 8 nuts, the RH exhaust manifold and the 2 gaskets.
    - Discard the nuts and the gaskets.

12. Remove and discard the 8 RH exhaust manifold studs.

Installation

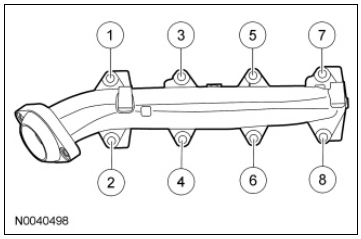
All vehicles

1. Inspect the exhaust manifold gasket mating surfaces for flatness. For additional information, refer to Section 303-00 .

2. Install 8 new RH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

3. Position the 2 new gaskets, the RH exhaust manifold and install 8 new nuts finger-tight.

4. Tighten the nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



5. Position the RH splash shield and install the 5 pushpins.

6. Position the heat shield and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

7. Connect the dual converter Y-pipe to the exhaust manifolds and install the 4 nuts.
    - Tighten to 40 Nm (30 lb-ft).

Vehicles with auxiliary climate control

8. Install the auxiliary line bracket.

9. Install the auxiliary line bracket nut.
    - Tighten to 6 Nm (53 lb-in).

10. Position and connect the 2 heater hoses.

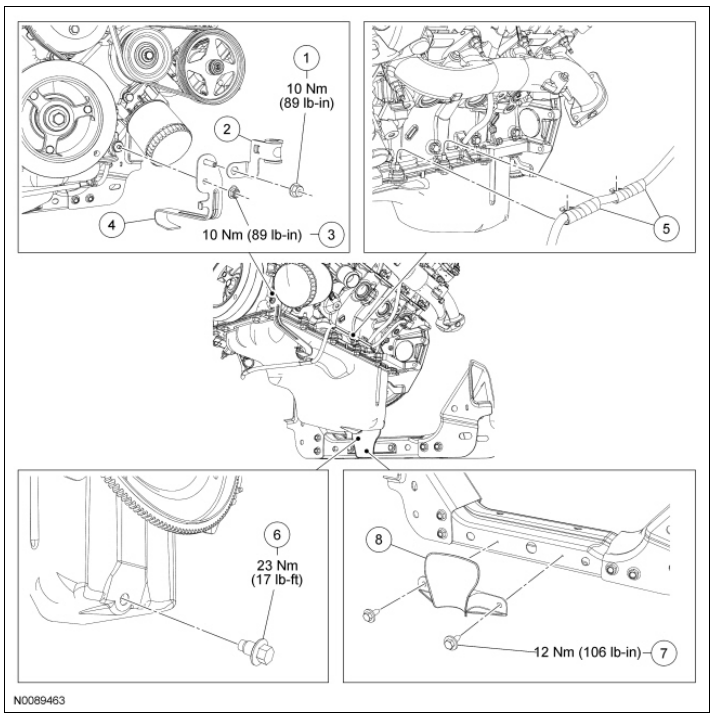
11. Install the RH front fender splash shield. For additional information, refer to Section 501-02 .

12. Attach the heater core hose assembly retainer to the RH valve cover.

13. Fill the cooling system. For additional information, refer to Section 303-03 .

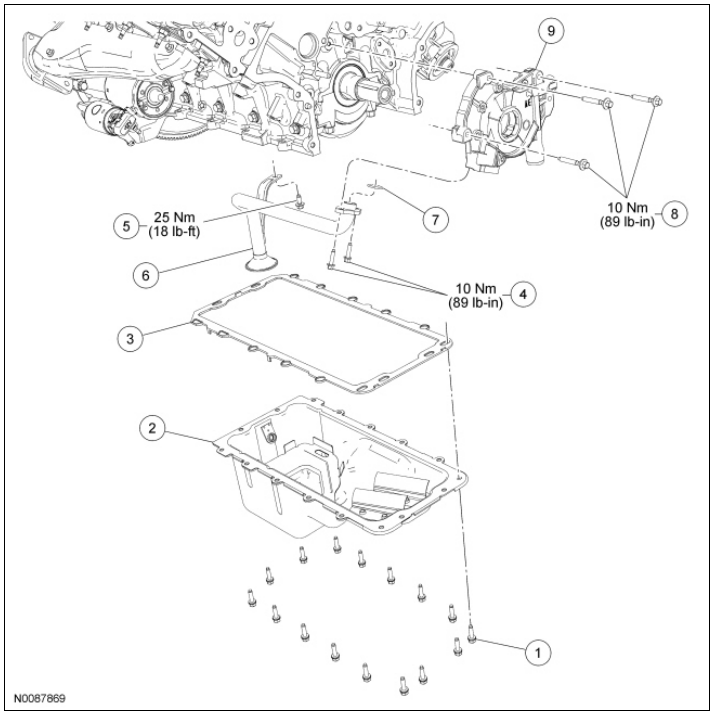
Engine Lubrication Components - Exploded View

Brackets, Oil Drain Plug and Oil Splash Shield



Item	Part Number	Description
1	W805320	Power Steering Pressure (PSP) hose bracket nut
2	81396	PSP hose bracket (part of 3A719)
3	W520101	Battery cable bracket-to-engine front cover nut
4	10A779	Battery cable bracket (part of 14A280)
5	13506	Engine block heater wiring harness retainers (2 required)
6	6730	Oil pan drain plug
7	W710617	Oil splash shield bolt (2 required)
8	5D121	Oil splash shield

Engine Lubrication Components



Item	Part Number	Description
1	W701605	Oil pan bolt (16 required)
2	6675	Oil pan
3	6710	Oil pan gasket
4	N806155	Oil pump screen and pickup tube-to-oil pump bolts (2 required)
5	N605904	Oil pump screen and pickup tube support bracket bolt
6	6622	Oil pump screen and pickup tube
7	6625	Oil pump screen and pickup tube O-ring seal
8	N806183	Oil pump bolts (3 required)
9	6621	Oil pump

1. For additional information, refer to the procedures in this section.

Oil Pan

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the front drive axle, if equipped. For additional information, refer to Section 205-03 .
3. Remove the stabilizer bar. For additional information, refer to Section 204-01A .
4. Remove the drain plug and drain the engine oil. Install the drain plug when finished.
   - Tighten to 23 Nm (17 lb-ft).
5. Remove the nut and position the Power Steering Pressure (PSP) hose bracket aside.
6. Remove the nut and position the battery cable bracket aside.
7. Remove the 2 bolts and the oil drain splash shield.
8. If equipped with a block heater, detach the block heater wiring harness retainers from the LH side oil pan bolts.
9. Remove the 16 bolts, the oil pan and the gasket.
   - Discard the gasket.

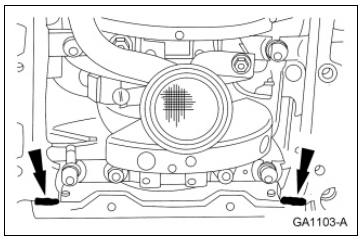
Installation

1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces. Failure to follow these directions can cause future oil leaks.**

   Clean and inspect the sealing surfaces with silicone gasket remover, metal surface prep and a plastic scraper. Follow the directions on the packaging.

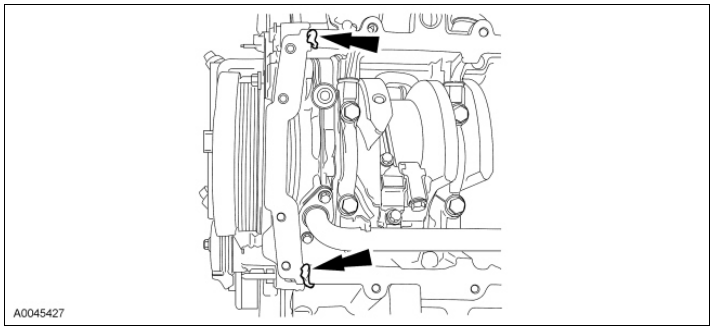
2. **NOTE:** If the oil pan and gasket are not secured within 4 minutes of sealer application, the sealant must be removed and the sealing surfaces cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

   Apply silicone gasket and sealant in 2 places as shown.



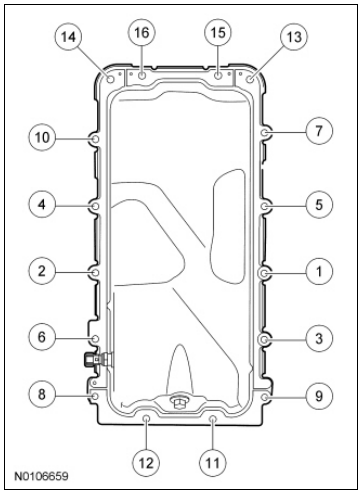
3. **NOTE:** If the oil pan and gasket are not secured within 4 minutes of sealer application, the sealant must be removed and the sealing surfaces cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

   Apply silicone gasket and sealant in 2 places as shown.



4. Position a new oil pan gasket and the oil pan and install the 16 bolts finger-tight.

5. Tighten the bolts in 3 stages in the sequence shown.
   - Stage 1: Tighten to 2 Nm (18 lb-in).
   - Stage 2: Tighten to 20 Nm (177 lb-in).
   - Stage 3: Tighten an additional 60 degrees.



6. If equipped with a block heater, attach the block heater wiring harness retainers to the LH oil pan bolts.

7. Position the oil drain splash shield and install the 2 bolts.
   - Tighten to 12 Nm (106 lb-in).

8. Attach the battery cable bracket to the engine front cover and install the nut.
   - Tighten to 10 Nm (89 lb-in).

9. Attach the PSP hose bracket and install the nut.
   - Tighten to 10 Nm (89 lb-in).

10. Install the stabilizer bar. For additional information, refer to Section 204-01A .

11. Install the front axle, if equipped. For additional information, refer to Section 205-03 .

12. Fill the engine with clean engine oil.

Oil Pump Screen and Pickup Tube

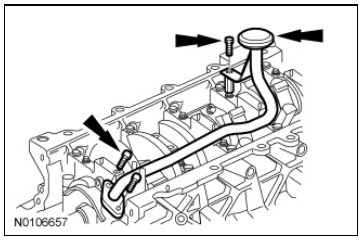
Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Remove the oil pan. For additional information, refer to Engine Lubrication Components - Exploded View and Oil Pan in this section.

2. Remove the bolts and the oil pump screen and pickup tube.



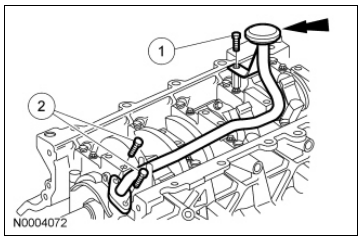
Installation

1. *NOTICE:* **Make sure the O-ring seal is in place and not damaged. A missing or damaged O-ring seal can cause foam in the lubrication system, low oil pressure and severe engine damage.**

   NOTE: Clean and inspect the mating surfaces and install a new O-ring seal. Lubricate the O-ring seal with clean engine oil prior to installation.

   Position the oil pump screen and pickup tube and install the bolts.

   1. Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).
   2. Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).



2. Install the oil pan. For additional information, refer to Engine Lubrication Components - Exploded View and Oil Pan in this section.

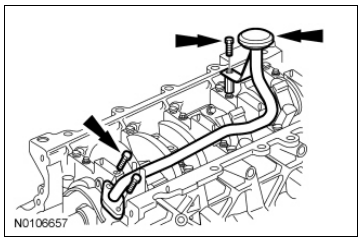
Oil Pump

Material

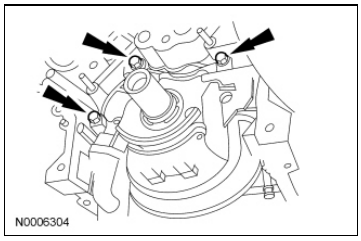
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. Remove the oil pan. For additional information, refer to Engine Lubrication Components - Exploded View and Oil Pan in this section.
2. Remove the timing drive components. For additional information, refer to Timing Drive Components in this section.
3. Remove the bolts and the oil pump screen and pickup tube.



4. Remove the 3 bolts and the oil pump.

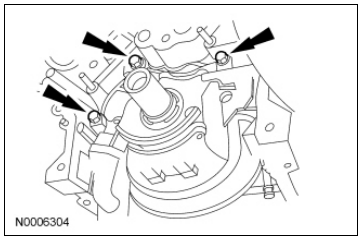


Installation

1. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging. Inspect the mating surfaces.

2. Position the oil pump and install the bolts.
    - Tighten to 10 Nm (89 lb-in).

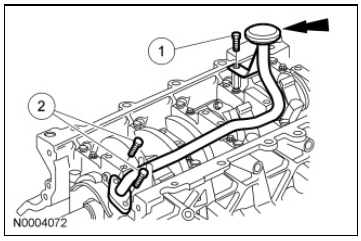


3. ***NOTICE:*** **Make sure the O-ring seal is in place and not damaged. A missing or damaged O-ring seal can cause foam in the lubrication system, low oil pressure and severe engine damage.**

   NOTE: Clean and inspect the mating surfaces and install a new O-ring seal. Lubricate the O-ring seal with clean engine oil prior to installation.

   Position the oil pump screen and pickup tube and install the bolts.

    1. Tighten the oil pump screen and pickup tube-to-spacer bolt to 25 Nm (18 lb-ft).
    2. Tighten the oil pump screen and pickup tube-to-oil pump bolts to 10 Nm (89 lb-in).



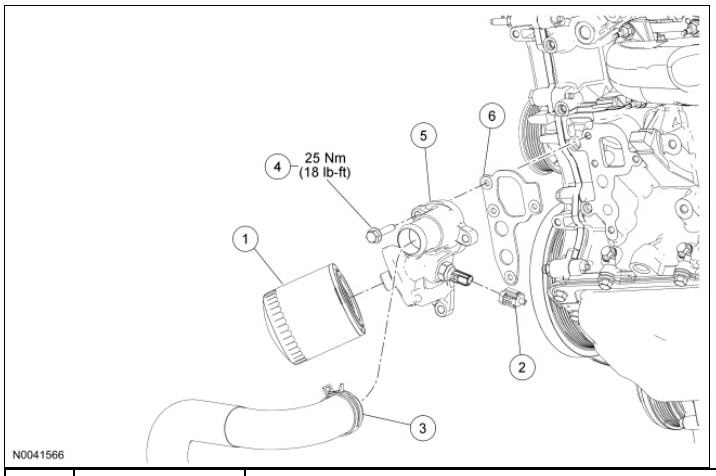
4. Install the timing drive components. For additional information, refer to Timing Drive Components in this section.

5. Install the oil pan. For additional information, refer to Engine Lubrication Components - Exploded View and Oil Pan in this section.

Oil Filter Adapter

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft® Silicone Gasket Remover ZC-30	-



Item	Part Number	Description
1	6714	Oil filter
2	14A464	Engine oil pressure switch electrical connector (part of 12B637)
3	8B273	Lower radiator hose
4	W705128	Oil filter adapter bolt (4 required)
5	6881	Oil filter adapter
6	6A636	Oil filter adapter gasket

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the engine cooling system. For additional information, refer to Section 303-03 .

3. Drain the engine oil.
    - Install the drain plug and tighten to 23 Nm (17 lb-ft).

4. Disconnect the engine oil pressure switch electrical connector.

5. Disconnect the lower radiator hose and position it aside.

6. Remove and discard the engine oil filter.
    - To install, lubricate the oil filter gasket with clean engine oil and tighten until the seal makes contact.
        - ♦ Using an oil filter strap wrench, tighten the filter an additional 270 degrees.

7. Remove the 4 bolts and the oil filter adapter.
    - To install, tighten to 25 Nm (18 lb-ft).

8. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

   Remove and discard the oil filter adapter gasket.

    - Clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
    - Inspect the mating surfaces.

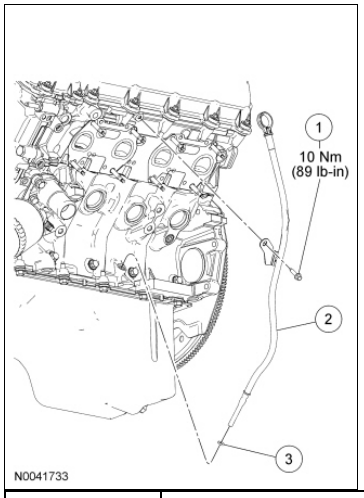
9. To install, reverse the removal procedure.
    - Fill the engine with clean engine oil.

10. Fill and bleed the engine cooling system. For additional information, refer to Section 303-03 .

Oil Level Indicator and Tube

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	N806155	Oil level indicator and tube bolt
2	6754	Oil level indicator and tube
3	-	O-ring seal (part of 6754)

Removal and Installation

1. Remove the LH exhaust manifold. For additional information, refer to Exhaust Manifold - LH in this section.

2. Remove the oil level indicator and tube bolt.
   - To install, tighten to 10 Nm (89 lb-in).

3. Remove the oil level indicator and tube from the cylinder block.

4. Remove and discard the O-ring seal.

5. **NOTE:** Install a new oil level indicator tube O-ring seal and lubricate it with clean engine oil prior to installation.

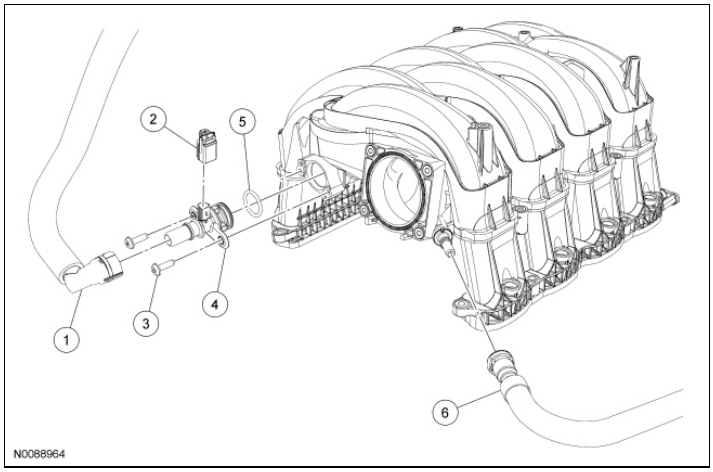
   To install, reverse the removal procedure.

Engine Support Insulators

Special Tool(s)

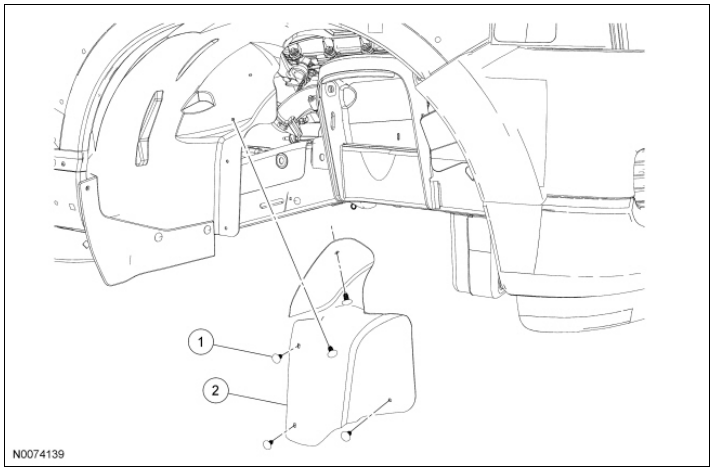
 ST2176-A	3-Bar Engine Support 303-F070
 ST2592-A	Engine Support Bracket 303-639

Intake Manifold Connections



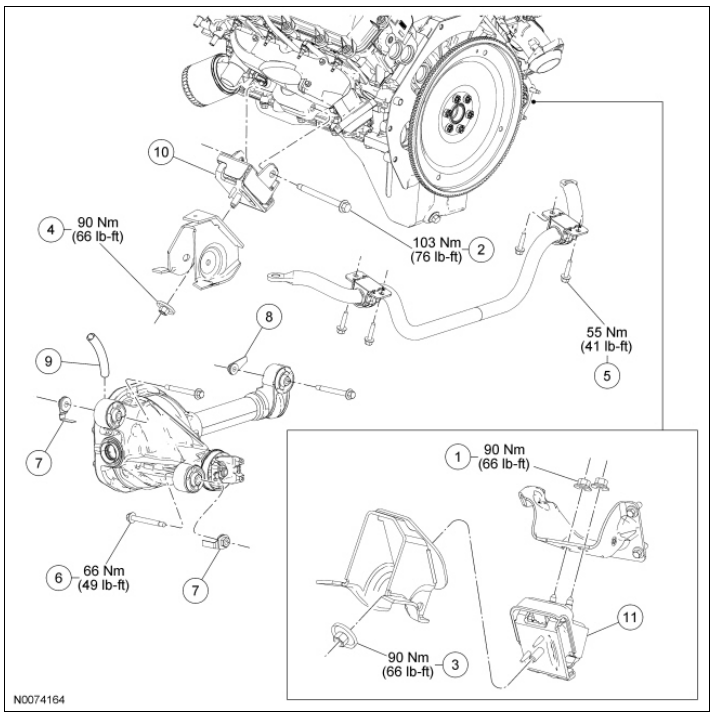
Item	Part Number	Description
1	6K817	PCV valve hose
2	14A464	Heated PCV fitting electrical connector (part of 12B37)
3	W506975	Heated PCV fitting bolt (2 required)
4	9F624	Heated PCV fitting
5	9L479	Heated PCV fitting O-ring seal
6	9D289	Evaporative Emission (EVAP) hose

RH Splash Shield



Item	Part Number	Description
1	388577	RH splash shield pushpin (5 required)
2	16034	RH splash shield

Engine Support Insulators



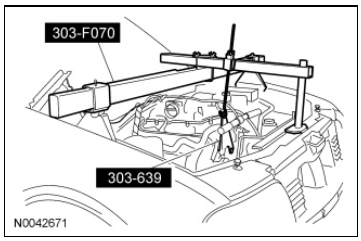
Item	Part Number	Description
1	N807479	RH engine support insulator nut (2 required)
2	W708103	LH engine support insulator through bolt
3	N802330	RH engine support insulator nut
4	N802330	LH engine support insulator nut
5	W707472	Stabilizer bar bracket bolt (4 required)
6	W506549	Differential housing bolt (if equipped) (3 required)
7	W706348	Differential housing flagnuts (2 required)
8	W708348	Differential housing flagnut

9	3B476	Differential housing vent hose
10	6B032	LH engine support insulator
11	6038	RH engine support insulator

Removal and Installation

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the engine cooling fan. For additional information, refer to Section 303-03 .
3. Remove the Electronic Throttle Body (ETB). For additional information, refer to Section 303-04B .
4. Remove the generator. For additional information, refer to Section 414-00 .
5. Disconnect the PCV valve hose from the heated PCV fitting.
6. Disconnect the heated PCV fitting electrical connector.
7. Remove the 2 bolts the heated PCV fitting.
8. Disconnect the Evaporative Emission (EVAP) hose from the intake manifold.
9. Remove the 5 pushpins and the splash shield.
10. Remove the 2 RH engine support insulator upper nuts.
    - To install, tighten to 90 Nm (66 lb-ft).
11. Remove the LH engine support insulator through bolt.
    - To install, tighten to 103 Nm (76 lb-ft).
12. Install the 3-Bar Engine Support and the Engine Support Bracket and raise the engine approximately 70 mm (2.75 in).



RH side

13. Remove the RH engine support insulator lower nut.
    - To install, tighten to 90 Nm (66 lb-ft).
14. Remove the RH engine support insulator.

Four-Wheel Drive (4WD) vehicles

15. Remove the stabilizer bar bracket bolts and allow the stabilizer bar to hang freely.
    - To install, tighten to 55 Nm (41 lb-ft).

16. ⚠ **WARNING: Secure the assembly to the jack. Avoid any obstructions while lowering and raising the jack. Contact with obstructions may cause the assembly to fall off the jack, which may result in serious personal injury.**

    Support the differential housing with a suitable jackstand.

17. Disconnect the vent hose from the differential housing vent tube.

18. ***NOTICE:*** **Any time bolts, washers, spacers or nuts are loosened in the differential support for any reason, install new components to prevent damage.**

    Remove and discard the 3 differential housing bolts and flagnuts.

    - To install, tighten to 66 Nm (49 lb-ft).

19. Lower the differential housing approximately 25 mm (1 in).

LH side

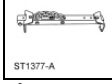
20. Remove the LH engine support insulator nut.
    - To install, tighten to 90 Nm (66 lb-ft).

21. Remove the LH engine support insulator.

22. To install, reverse the removal procedure.
    - If equipped, install new differential housing bolts and flagnuts.

Engine

Special Tool(s)

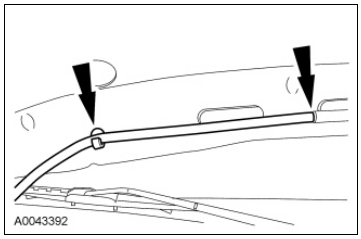
 ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

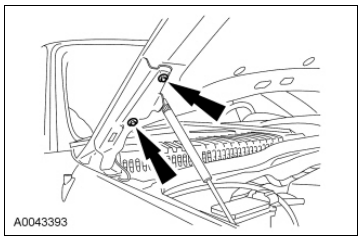
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the windshield washer hose.


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3. **NOTE:** Index-mark the hood hinge location to aid in hood installation.

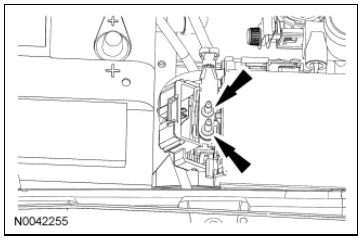
   Remove the 4 bolts and the hood.


A0043393

4. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

   Remove the intake manifold. For additional information, refer to Intake Manifold in this section.

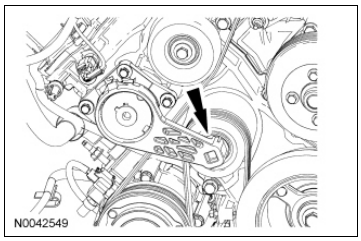
5. Open the cover, remove the 2 nuts and disconnect the wiring harness terminals.



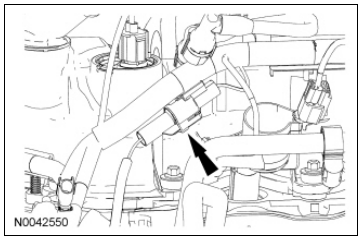
6. Remove the cooling fan. For additional information, refer to Section 303-03 .

7. Drain the cooling system. For additional information, refer to Section 303-03 .

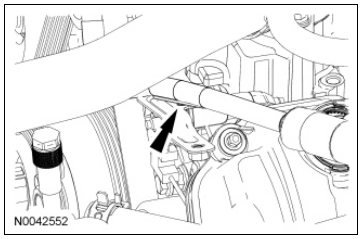
8. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.



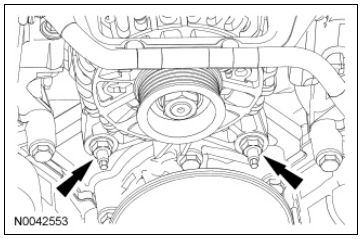
9. Disconnect the electrical connector.



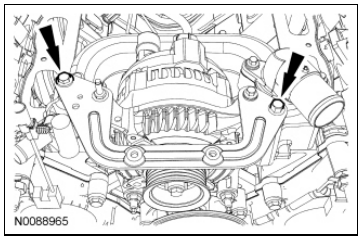
10. Detach the wiring harness retainer from the cooling fan wiring harness bracket.



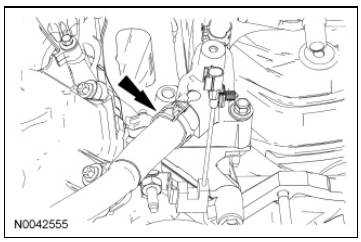
11. Loosen the 2 nuts.



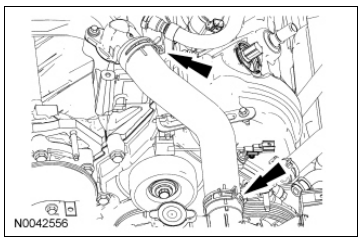
12. Remove the 2 bolts and the alternator, the alternator bracket and the wiring harness as an assembly.



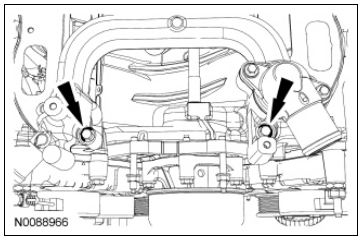
13. Disconnect the heater hose.



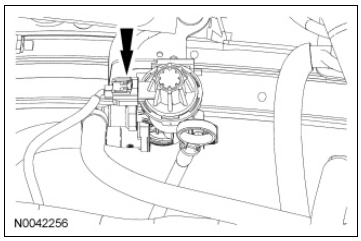
14. Remove the upper radiator hose.



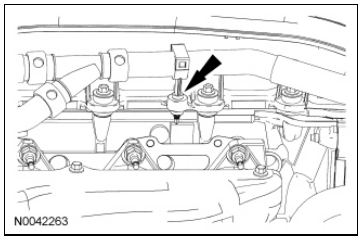
15. Remove the 2 bolts, the coolant crossover manifold and the 2 gaskets.
    - Discard the gaskets.



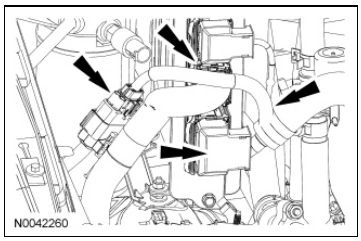
16. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.



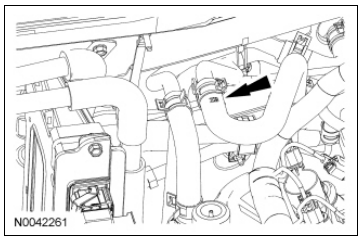
17. Detach the heater hose retainer from the RH valve cover.



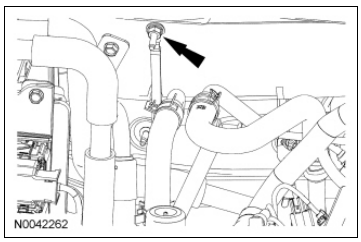
18. Disconnect the in-line electrical connector and the 2 PCM electrical connectors, and detach the wiring harness pin-type retainer.



19. Disconnect the heater hose.

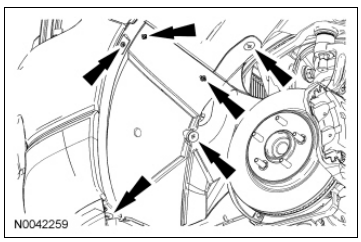


20. Remove the nut and disconnect the ground wire.

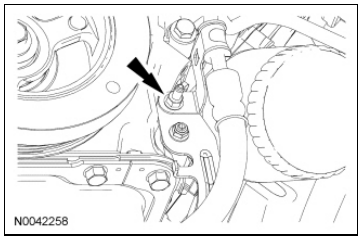


21. Remove the transmission. For additional information, refer to Section 307-01B .

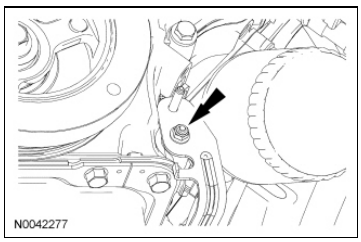
22. Remove the 3 screws, the 3 pushpins and the inner fender splash shield.



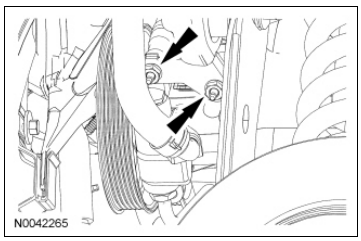
23. Remove the nut and detach the Power Steering Pressure (PSP) hose bracket.



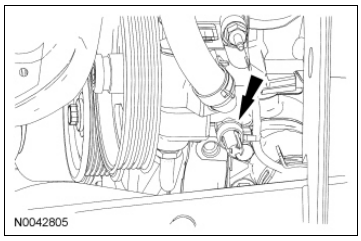
24. Remove the nut and detach the wiring harness bracket.



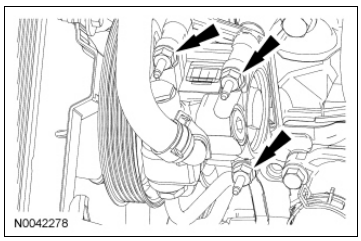
25. Remove the 2 nuts and detach the wiring harness bracket.



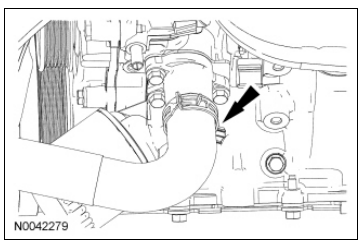
26. Detach the wiring harness retainer from the power steering pump stud bolt.



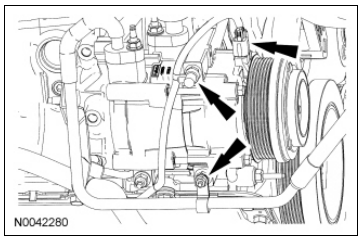
27. Remove the 3 stud bolts and position the power steering pump aside.



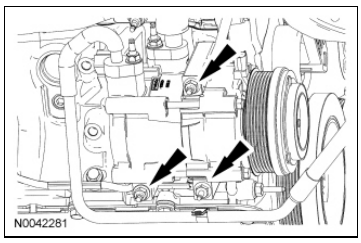
28. Disconnect the lower radiator hose from the oil filter adapter.



29. Disconnect the A/C clutch electrical connector and detach the wiring harness retainer. Remove the nut and detach the A/C hose bracket.

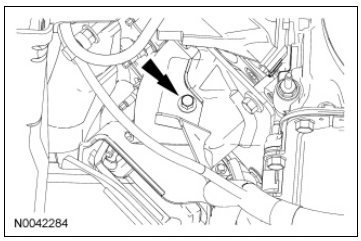


30. Remove the 2 nuts, the stud bolt and position the A/C compressor aside.

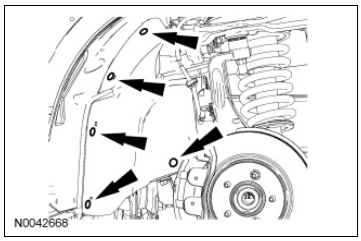


31. Remove the oil drain plug and drain the engine oil. Install the drain plug when finished.
    - Tighten to 23 Nm (17 lb-ft).

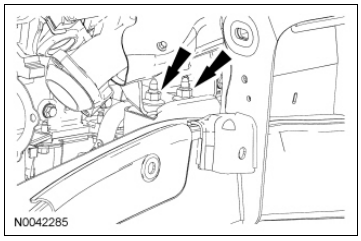
32. Remove the bolt and detach the wiring harness bracket from the RH engine support insulator bracket.



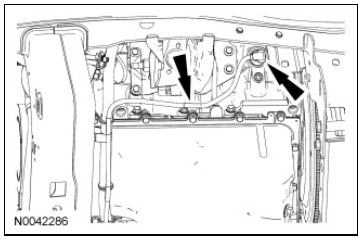
33. Remove the 5 pushpins and the RH splash shield.



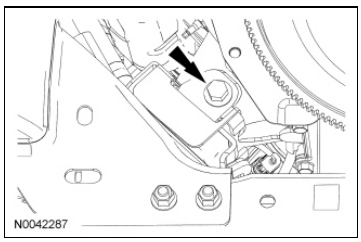
34. Remove the 2 RH engine support insulator nuts.



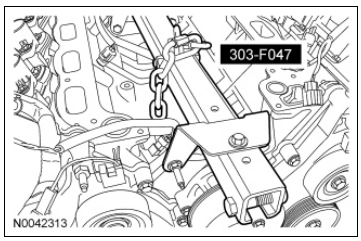
35. If equipped, disconnect the block heater electrical connector and detach the wiring harness retainers.



36. Remove the LH engine support insulator through bolt.



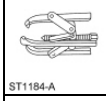
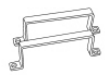
37. Install the Modular Engine Lift Bracket.



38. Attach a suitable floor crane to the Modular Engine Lift Bracket and remove the engine from the vehicle.

Cylinder Head

Special Tool(s)

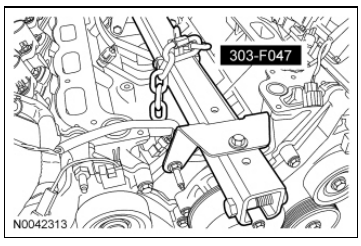
 ST1184-A	3 Jaw Puller 303-D121
 ST2804-A	Compressor, Valve Spring 303-1039
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
 ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent
 ST1730-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)

Material

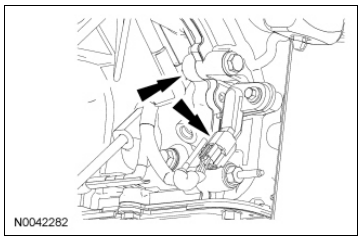
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Silicone Gasket Remover ZC-30	-

All cylinder heads

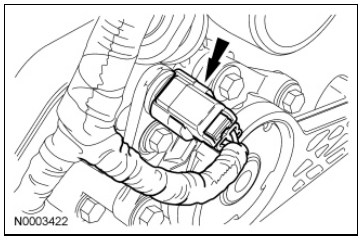
1. Remove the engine. For additional information, refer to Engine in this section.
2. Mount the engine on a suitable work stand.
3. Remove the Modular Engine Lift Bracket.



4. Disconnect the Crankshaft Position (CKP) sensor electrical connector and detach the wiring harness retainer.

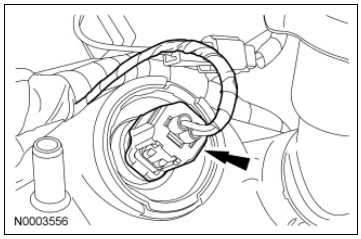


5. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.

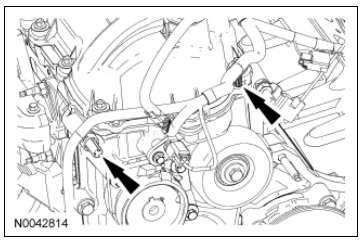


6. **NOTE:** RH shown, LH similar.

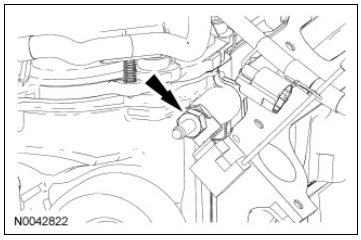
   Disconnect the RH and LH Variable Camshaft Timing (VCT) solenoid electrical connectors.



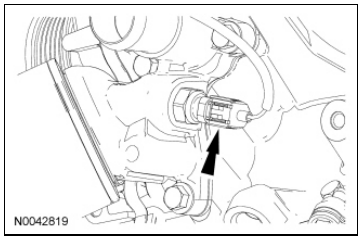
7. Detach the wiring harness retainers.



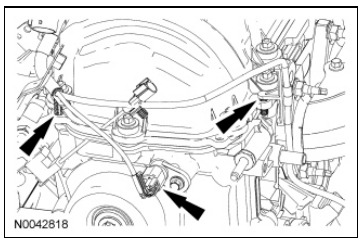
8. Remove the nut and the RH radio ignition interference capacitor.



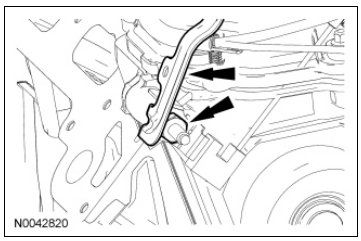
9. Disconnect the Engine Oil Pressure (EOP) sensor electrical connector.



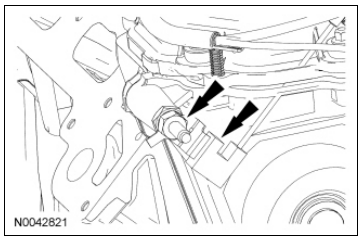
10. Disconnect the LH CMP sensor electrical connector and detach the wiring harness retainers.



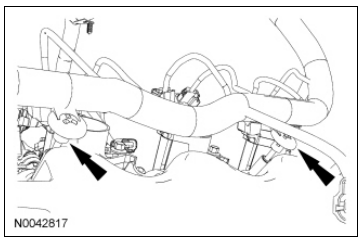
11. Remove the nut and the cooling fan wiring harness bracket.



12. Remove the nut and detach the LH radio interference capacitor.

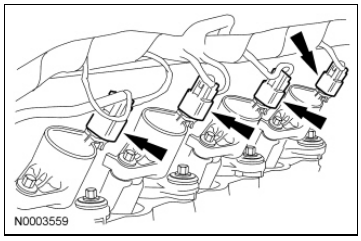


13. Detach the wiring harness retainers from the LH valve cover studs.

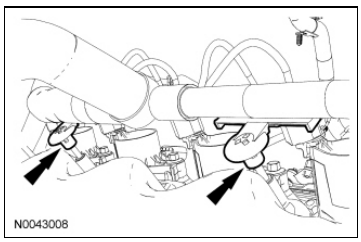


14. **NOTE:** RH shown, LH similar.

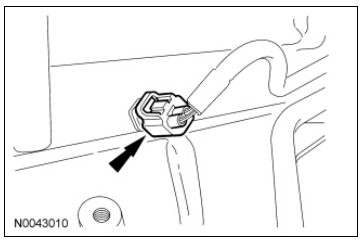
    Disconnect the 4 RH and 4 LH ignition coil electrical connectors.



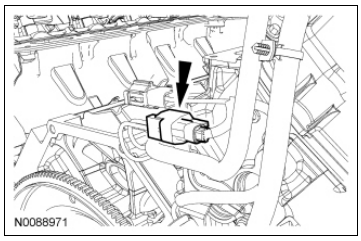
15. Detach the wiring harness retainers from the RH valve cover studs.



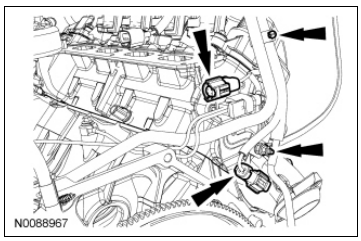
16. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.



17. Disconnect the Knock Sensor (KS) electrical connector.



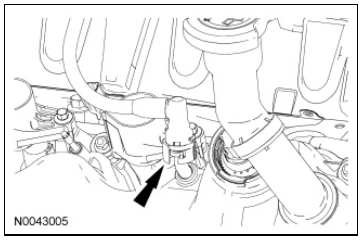
18. Detach the electrical connector and wiring harness retainers and remove the engine wiring harness.



19. **NOTE:** When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

    Remove the breather tube from the RH valve cover.

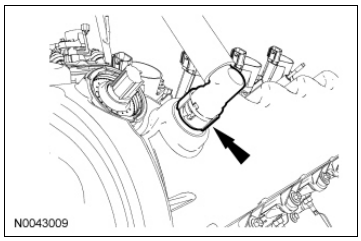
    - Disconnect the quick connect fittings.
        - ♦ Push the connector toward the valve cover to release pressure.
        - ♦ Push the release tab clockwise.
        - ♦ Disconnect the quick connect fitting.



20. **NOTE:** When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

    Remove the PCV tube from the LH valve cover.

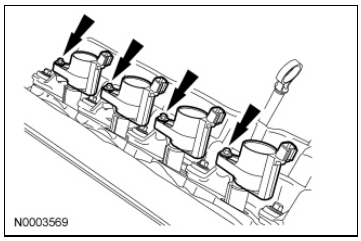
    - Disconnect the quick connect fittings.
        - ♦ Push the connector toward the valve cover to release pressure.
        - ♦ Push the release tab clockwise.
        - ♦ Disconnect the quick connect fitting.



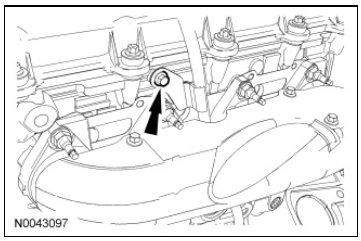
21. Remove and discard the oil filter.

22. **NOTE:** LH shown, RH similar.

    Remove the 8 bolts and the 8 ignition coils.



23. Remove the bolt and position the oil level indicator aside.



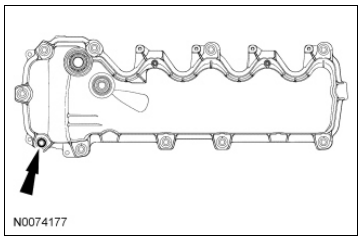
24. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    NOTICE: **Remove the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

NOTE: The bolts are part of the valve cover and should not be removed.

Loosen the 10 bolts and remove the LH valve cover.

- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



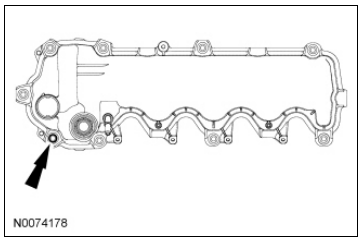
25. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    NOTICE: **Remove the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

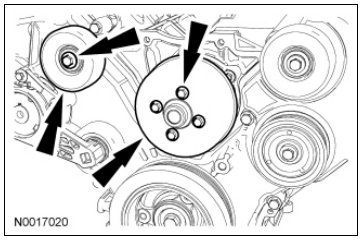
    NOTE: The bolts are part of the valve cover and should not be removed.

    Loosen the 9 bolts and remove the RH valve cover.

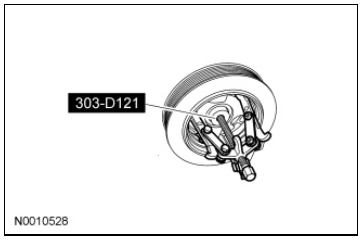
    - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
    - Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



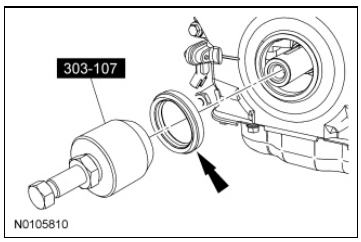
26. Remove the 5 bolts, the coolant pump pulley and the RH side accessory drive belt idler pulley.



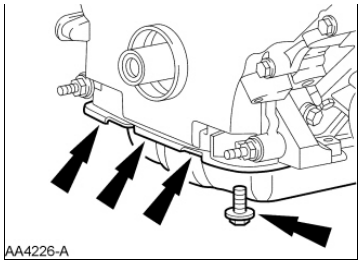
27. Remove and discard the crankshaft pulley bolt. Using the 3 Jaw Puller, remove the crankshaft pulley.



28. Using the Crankshaft Front Seal Remover, remove the crankshaft seal.

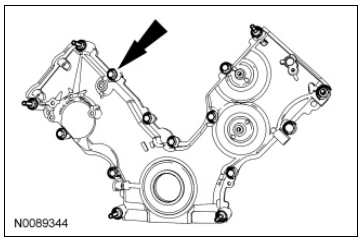


29. Remove the 4 oil pan-to-engine front cover bolts.

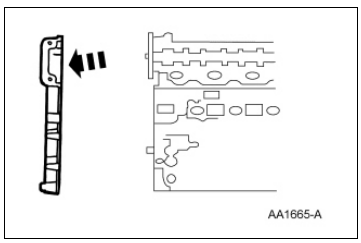


30. **NOTE:** Correct fastener location is essential for the assembly procedure. Record fastener location.

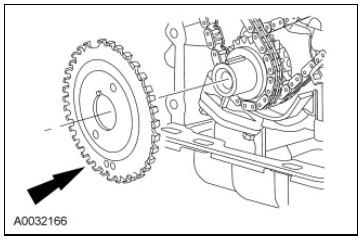
    Remove the 15 engine front cover fasteners.



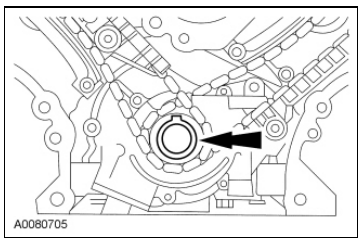
31. Remove the engine front cover from the cylinder block.



32. Remove the crankshaft sensor ring from the crankshaft.

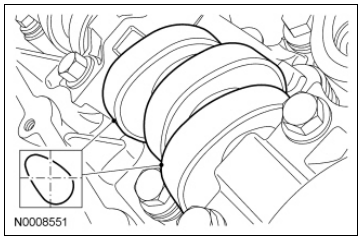


33. Position the crankshaft keyway at the 12 o'clock position.



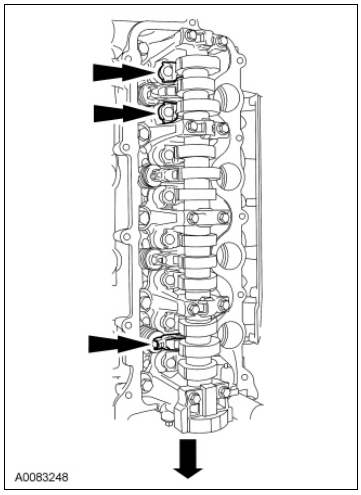
34. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to the 12 o'clock position.

    The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake lobes and the exhaust lobe on the No. 1 cylinder.



35. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

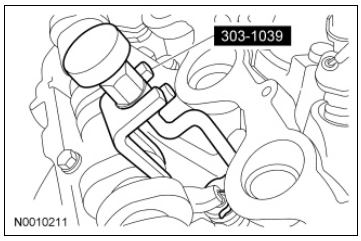
    Remove only the 3 roller followers shown in the illustration from the RH cylinder head.



36. ***NOTICE:*** **Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

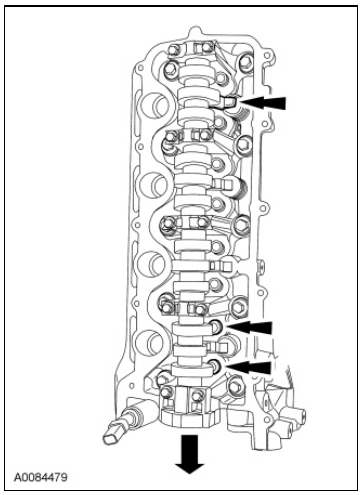
    NOTE: It may be necessary to push the valve down while compressing the spring.

Using the Valve Spring Compressor, remove the 3 roller followers designated in the previous step from the RH cylinder head.



37. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

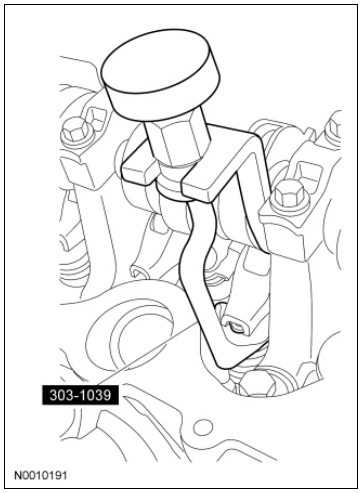
    Remove only the 3 roller followers shown in the illustration from the LH cylinder head.



38. ***NOTICE:*** **Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

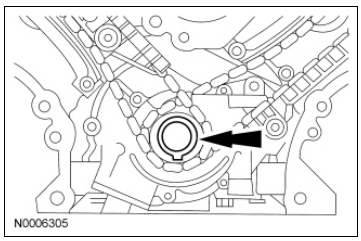
    NOTE: It may be necessary to push the valve down while compressing the spring.

    Using the Valve Spring Compressor, remove the 3 roller followers designated in the previous step from the LH cylinder head.

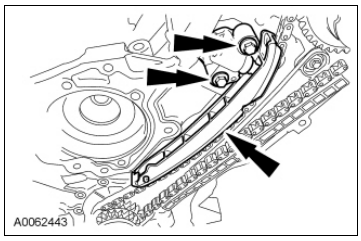


39. **NOTE:** The crankshaft cannot be moved past the 6 o'clock position once set.

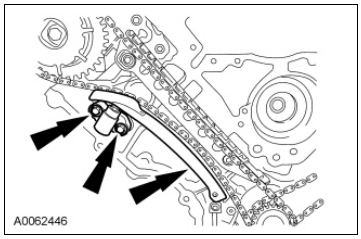
Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



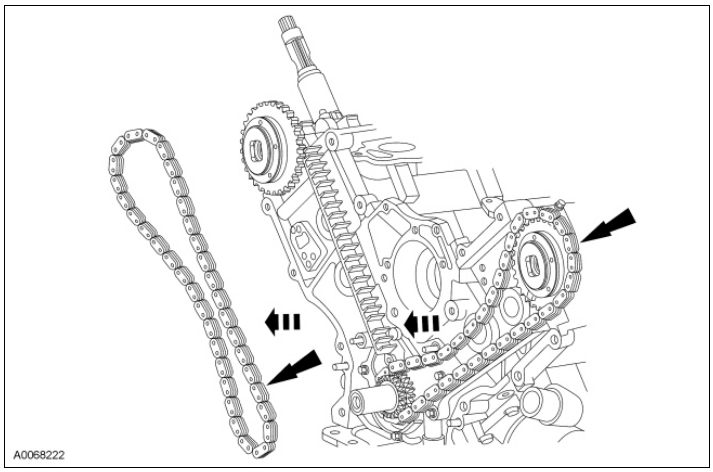
40. Remove the 2 bolts, the LH timing chain tensioner and tensioner arm.



41. Remove the 2 bolts, the RH timing chain tensioner and tensioner arm.

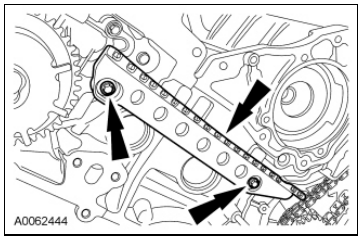


42. Remove the RH and LH timing chains and the crankshaft sprocket.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain and crankshaft sprocket.



43. **NOTE:** RH shown, LH similar.

    Remove the 4 bolts and the LH and RH timing chain guides.



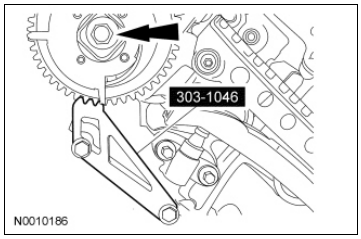
44. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

    NOTICE: **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    Using the Camshaft Phaser Sprocket Holding Tool, remove the bolt and the RH camshaft phaser sprocket assembly.

    - Discard the camshaft phaser sprocket bolt.



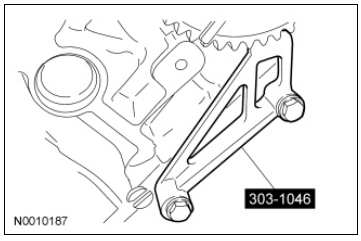
45. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

    NOTICE: **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

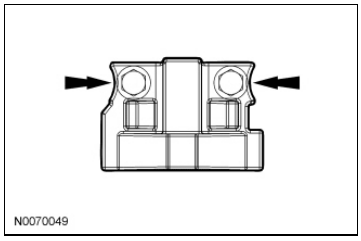
    Using the Camshaft Phaser Sprocket Holding Tool, remove the bolt and the LH camshaft phaser sprocket assembly.

    - Discard the camshaft phaser sprocket bolt.



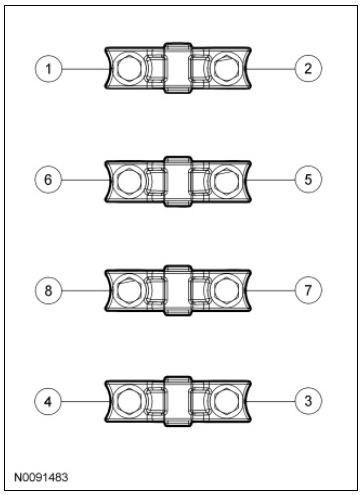
46. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the RH cylinder head camshaft front bearing cap.

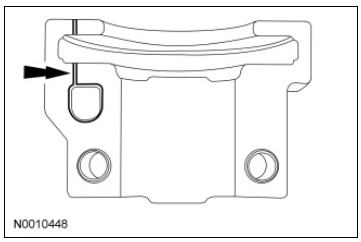


47. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the 8 bolts in the sequence shown and remove the RH cylinder head camshaft bearing caps.



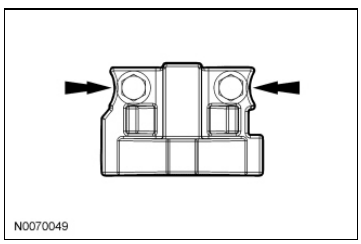
48. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



49. Remove the RH camshaft.

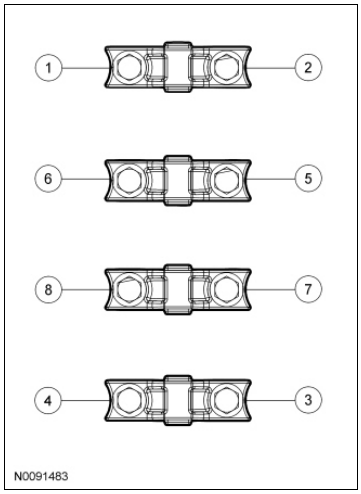
50. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the LH cylinder head camshaft front bearing cap.

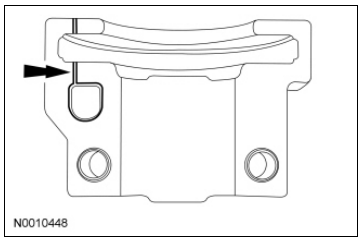


51. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the 8 bolts in the sequence shown and remove the LH cylinder head camshaft bearing caps.



52. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



53. Remove the LH camshaft.

54. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

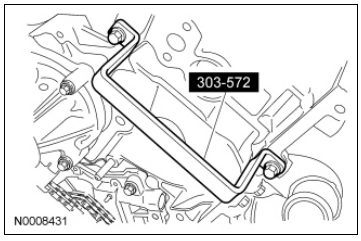
    Remove all of the remaining roller followers from the cylinder heads.

LH cylinder head

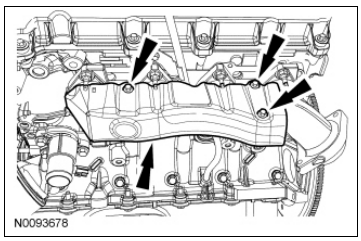
55. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

    Remove the hydraulic lash adjusters from the LH cylinder head.

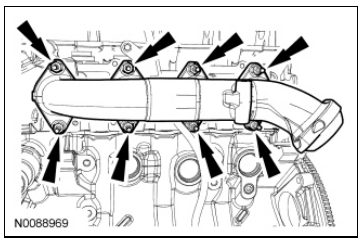
56. Install the Cylinder Head Remover/Installer onto the LH cylinder head.



57. Remove the 3 bolts and the LH exhaust manifold heat shield.



58. Remove the 8 nuts, the LH exhaust manifold and the 2 gaskets.
    - Discard the nuts and the gaskets.



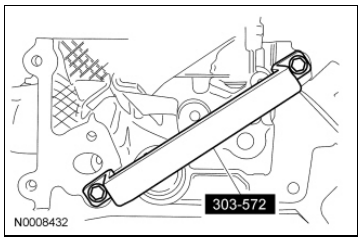
59. Remove and discard the 8 LH exhaust manifold studs.

RH cylinder head

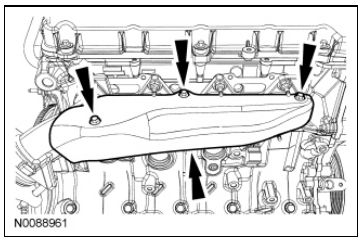
60. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

    Remove the hydraulic lash adjusters from the RH cylinder heads.

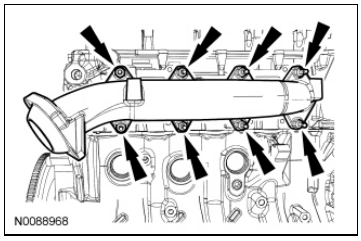
61. Install the Cylinder Head Remover/Installer onto the RH cylinder head.



62. Remove the 3 bolts and the RH exhaust manifold heat shield.

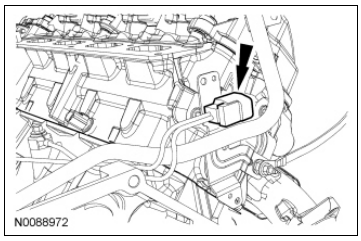


63. Remove the 8 nuts, the RH exhaust manifold and the 2 gaskets.
    - Discard the nuts and the gaskets.

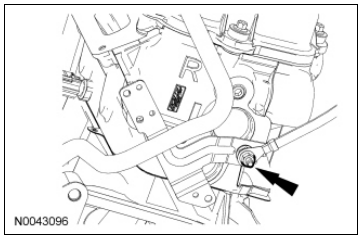


64. Remove and discard the 8 RH exhaust manifold studs.

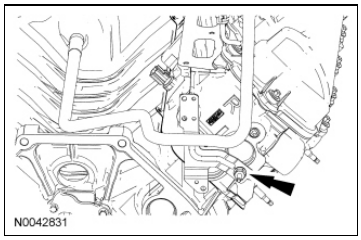
65. Detach the Knock Sensor (KS) electrical connector retainer.



66. Remove the nut and the ground strap.



67. Remove the stud bolt and the heater supply tube and hoses as an assembly.
    - Discard the O-ring seals.



All cylinder heads

68. ***NOTICE:*** **The cylinder head must be cool before removing it from the engine. Cylinder head warpage may result if a warm or hot cylinder head is removed.**

    NOTICE: **Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.**

    NOTICE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

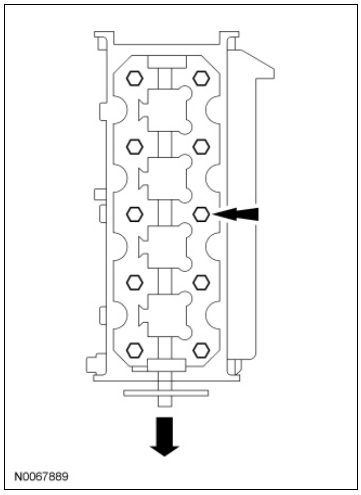
    NOTICE: **Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface, or the cylinder head may be damaged.**

NOTE: The cylinder head bolts must be discarded and new bolts must be installed. They are a tighten-to-yield design and cannot be reused.

NOTE: RH shown, LH similar.

Remove the 20 bolts and the cylinder heads.

- Discard the cylinder head gaskets.
- Discard the cylinder head bolts.



69. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

    NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

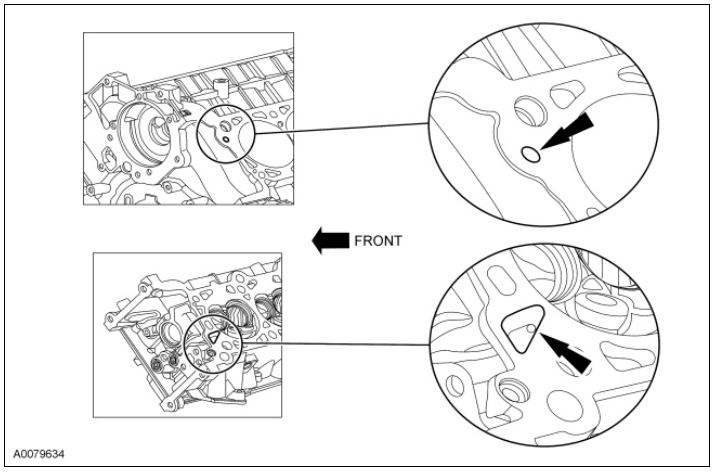
    NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

    Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block in the following sequence.

    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

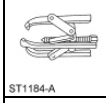
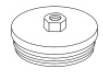
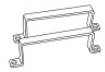
70. **NOTE:** LH shown, RH similar.

    Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion, paying particular attention to the oil pressure feed area. For additional information, refer to Section 303-00 .


FRONT
A0079634

Engine

Special Tool(s)

 ST1184-A	3 Jaw Puller 303-D121
 ST2804-A	Compressor, Valve Spring 303-1039
 ST1337-A	Installer, Connecting Rod 303-442 (T93P-6136-A)
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
 ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073)
 ST1730-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
 ST1382-A	Remover, Crankshaft Rear Seal 303-519 (T95P-6701-EH)
 ST1481-A	Remover, Crankshaft Rear Slinger 303-514 (T95P-6701-AH)
 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Silicone Gasket Remover ZC-30	-

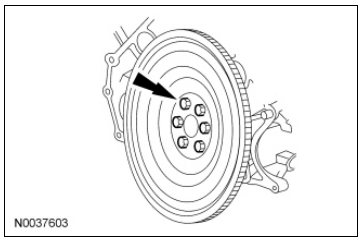
NOTICE: **Remove the cylinder heads before removing the crankshaft. Failure to do so may result in engine damage.**

NOTICE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

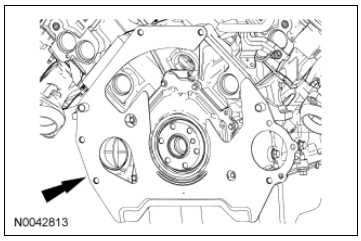
NOTE: The flexplate, the spacer plate, the crankshaft rear seal, the crankshaft rear oil slinger and the rear seal retainer plate must be removed before mounting the engine on the engine stand.

NOTE: For additional information, refer to the exploded views under the Assembly procedure in this section.

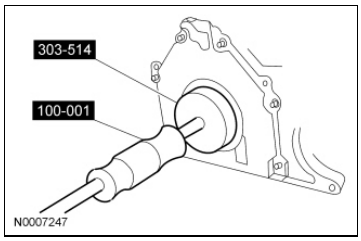
1. Remove the 6 bolts and the flexplate.



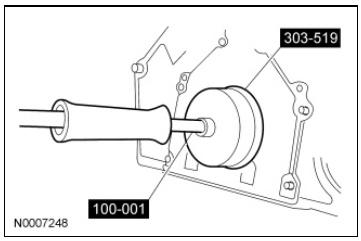
2. Remove the spacer plate.



3. Using the Crankshaft Rear Slinger Remover and the Slide Hammer, remove the crankshaft rear oil slinger.

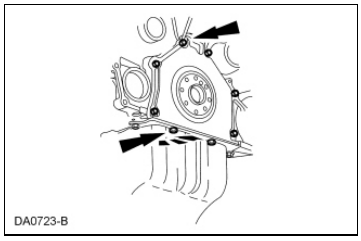


4. Using the Crankshaft Rear Seal Remover and the Slide Hammer, remove the crankshaft rear seal.



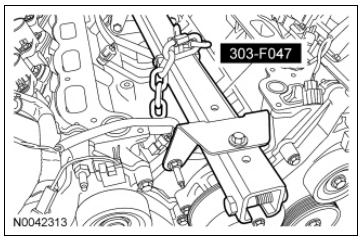
5. Remove the 8 bolts and the crankshaft rear seal retainer plate.
   - ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

     Clean and inspect the sealing surfaces.

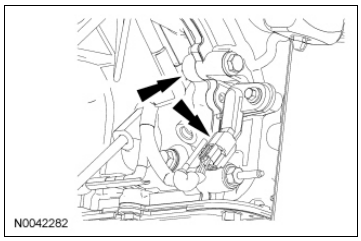


6. Mount the engine on a suitable work stand.

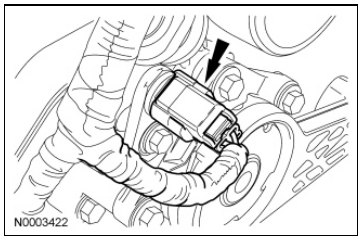
7. Remove the Modular Engine Lift Bracket.



8. Disconnect the Crankshaft Position (CKP) sensor electrical connector and detach the wiring harness retainer.

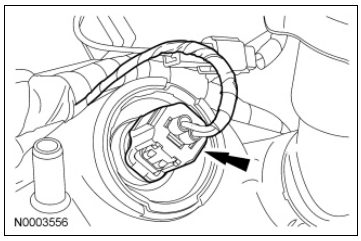


9. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.

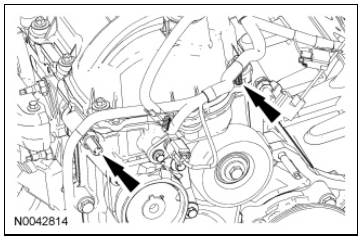


10. **NOTE:** RH shown, LH similar.

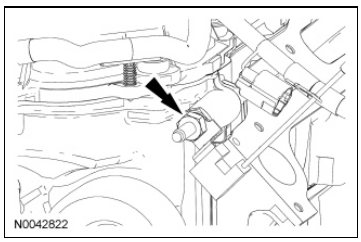
    Disconnect the RH and LH Variable Camshaft Timing (VCT) solenoid electrical connectors.



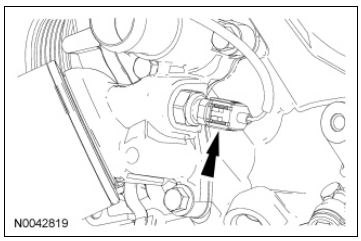
11. Detach the wiring harness retainers.



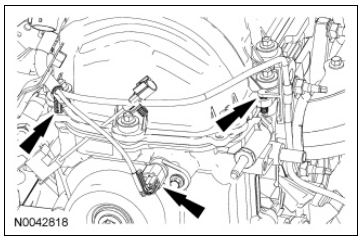
12. Remove the nut and the RH radio ignition interference capacitor.



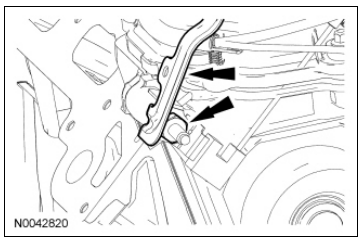
13. Disconnect the Engine Oil Pressure (EOP) sensor electrical connector.



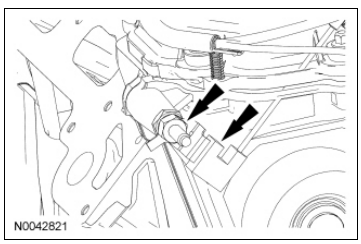
14. Disconnect the LH CMP sensor electrical connector and detach the wiring harness retainers.



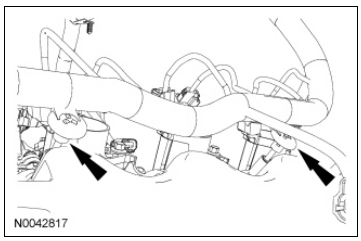
15. Remove the nut and the cooling fan wiring harness bracket.



16. Remove the nut and detach the LH radio interference capacitor.

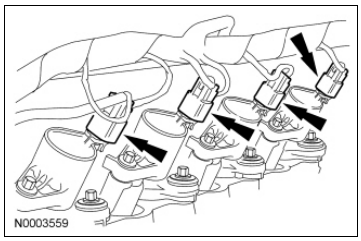


17. Detach the wiring harness retainers from the LH valve cover studs.

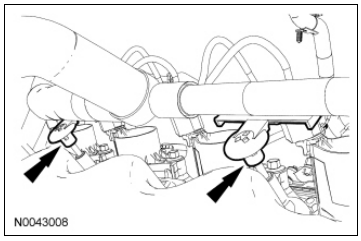


18. **NOTE:** RH shown, LH similar.

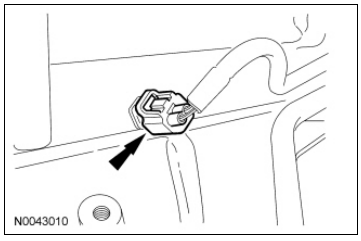
    Disconnect the 4 RH and 4 LH ignition coil electrical connectors.



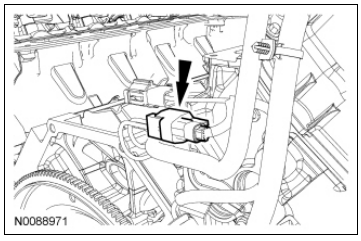
19. Detach the wiring harness retainers from the RH valve cover studs.



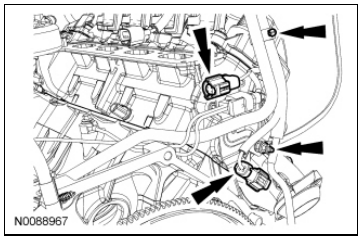
20. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.



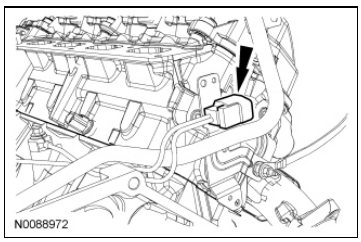
21. Disconnect the Knock Sensor (KS) electrical connector.



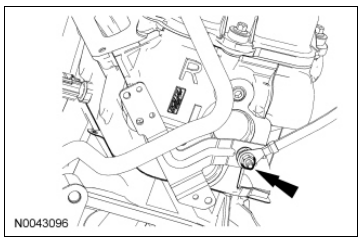
22. Detach the electrical connector and wiring harness retainers and remove the engine wiring harness.



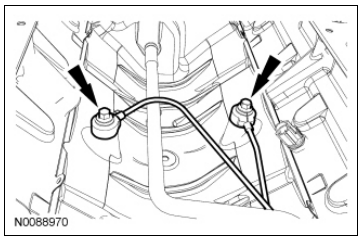
23. Detach the KS electrical connector retainer.



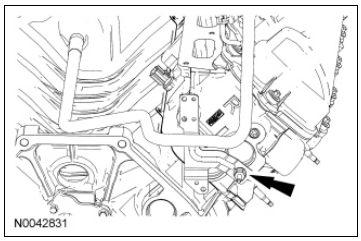
24. Remove the nut and the ground strap.



25. Remove the 2 bolts and the KS .



26. Remove the stud bolt and the heater supply tube and hose as an assembly.
    - Discard the O-ring seals.

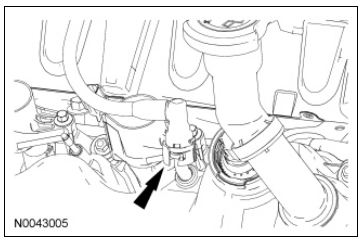


27. **NOTE:** When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

    Remove the breather tube from the RH valve cover.

    - Disconnect the quick connect fittings.
        - ♦ Push the connector toward the valve cover to release pressure.
        - ♦ Push the release tab clockwise.

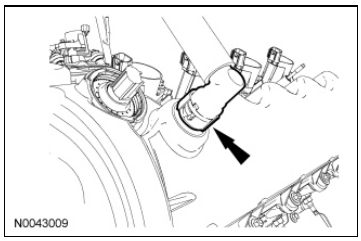
♦ Disconnect the quick connect fitting.



28. **NOTE:** When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

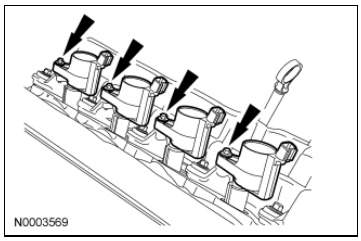
    Remove the PCV tube from the LH valve cover.

    - Disconnect the quick connect fittings.
        - ♦ Push the connector toward the valve cover to release pressure.
        - ♦ Push the release tab clockwise.
        - ♦ Disconnect the quick connect fitting.

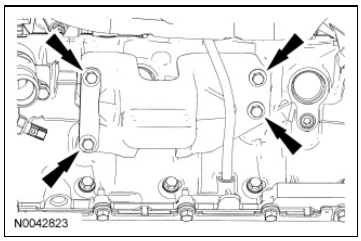


29. **NOTE:** LH shown, RH similar.

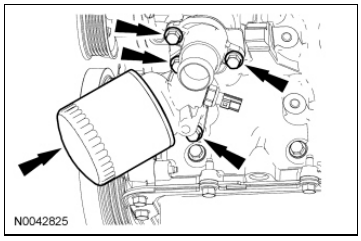
    Remove the 8 bolts and the 8 ignition coils.



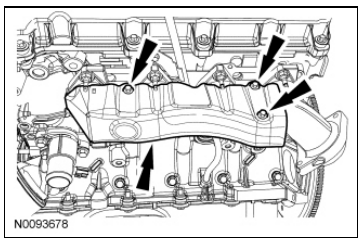
30. Remove the 4 bolts and the LH engine support insulator bracket.



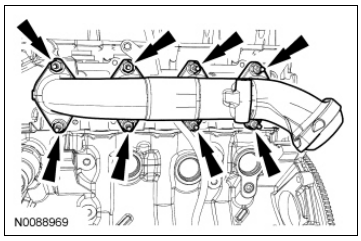
31. Remove and discard the oil filter. Remove the 4 bolts and the oil filter adapter.



32. Remove the 3 bolts and the LH exhaust manifold heat shield.

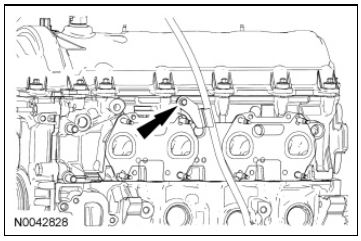


33. Remove the 8 nuts, the LH exhaust manifold and the 2 gaskets.
    - Discard the nuts and the gaskets.

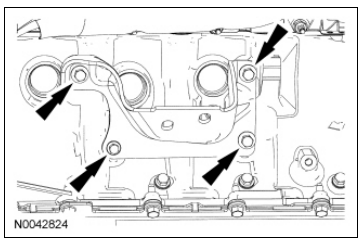


34. Remove and discard the 8 LH exhaust manifold studs.

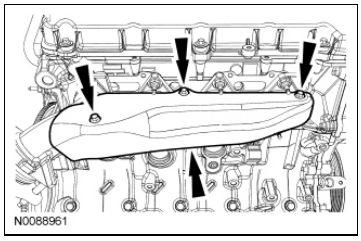
35. Remove the bolt and the oil level indicator tube.



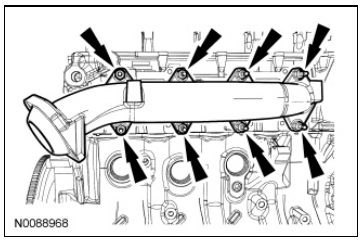
36. Remove the 4 bolts and the RH engine support insulator bracket.



37. Remove the 3 bolts and the RH exhaust manifold heat shield.



38. Remove the 8 nuts, the RH exhaust manifold and the 2 gaskets.
    - Discard the nuts and the gaskets.



39. Remove and discard the 8 RH exhaust manifold studs.

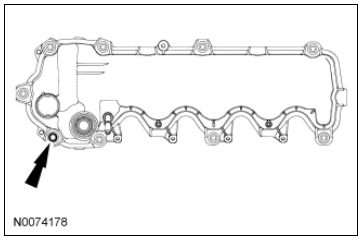
40. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    NOTICE: **Remove the valve covers carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

    NOTE: The bolts are part of the valve cover and should not be removed.

    Loosen the 9 bolts and remove the RH valve cover.

    - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
    - Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



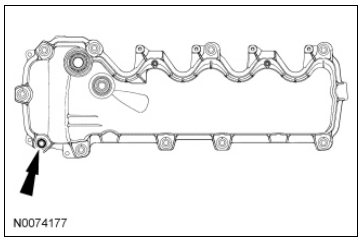
41. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    NOTICE: **Remove the valve covers carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

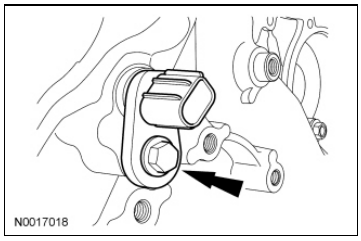
    NOTE: The bolts are part of the valve cover and should not be removed.

    Loosen the 10 bolts and remove the LH valve cover.

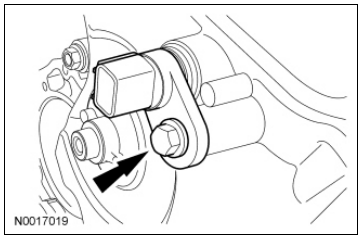
- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



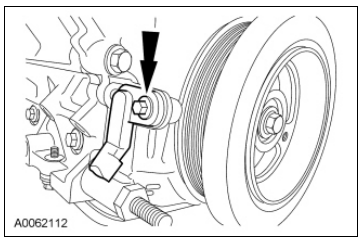
42. Remove the bolt and the RH CMP sensor.



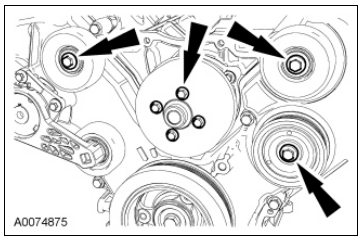
43. Remove the bolt and the LH CMP sensor.



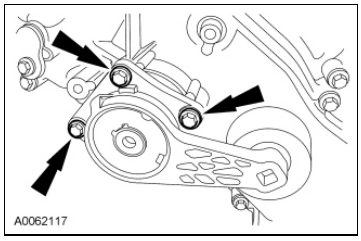
44. Remove the bolt and the CKP sensor.



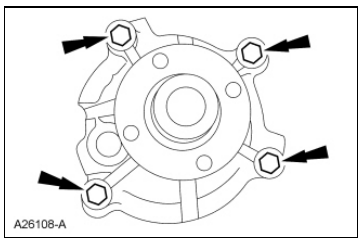
45. Remove the 7 bolts, the coolant pump pulley and the 3 accessory drive belt idler pulleys.



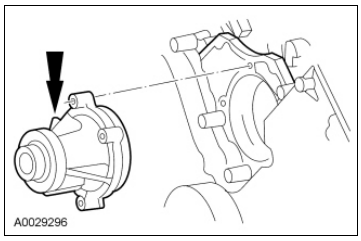
46. Remove the 3 bolts and the accessory drive belt tensioner.



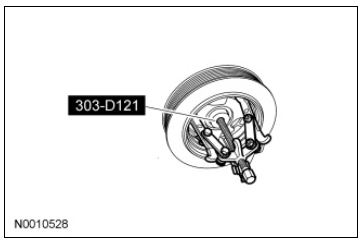
47. Remove the 4 coolant pump bolts.



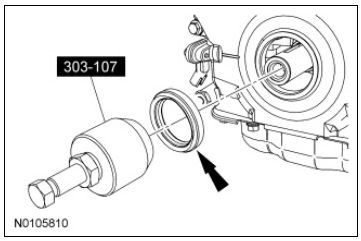
48. Remove the coolant pump from the cylinder block.
    - Discard the O-ring seal.



49. Remove and discard the crankshaft pulley bolt. Using the 3 Jaw Puller, remove the crankshaft pulley.

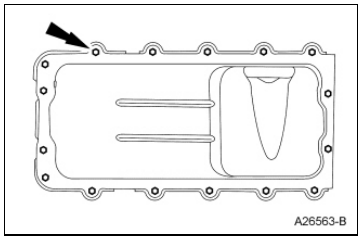


50. Using the Crankshaft Front Seal Remover, remove the crankshaft front seal.



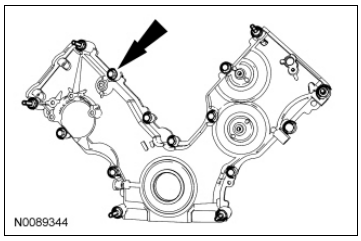
51. Remove the 16 bolts, the oil pan and the oil pan gasket.
    - ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

      Clean and inspect the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

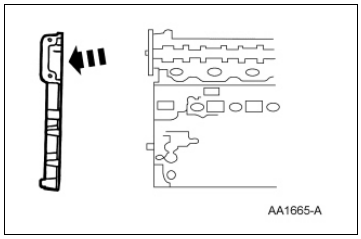


52. **NOTE:** Correct fastener location is essential for the assembly procedure. Record fastener location.

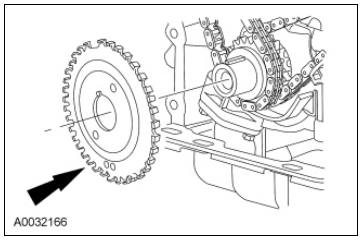
    Remove the 15 engine front cover fasteners.



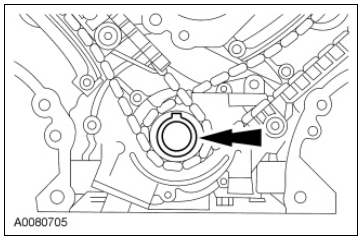
53. Remove the engine front cover from the cylinder block.



54. Remove the crankshaft sensor ring from the crankshaft.

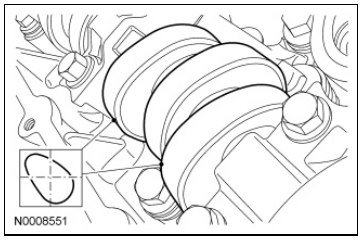


55. Position the crankshaft keyway at the 12 o'clock position.



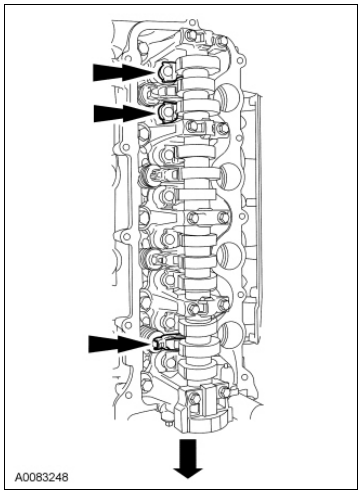
56. **NOTE:** If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to the 12 o'clock position.

    The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake lobes and the exhaust lobe on the No. 1 cylinder.



57. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

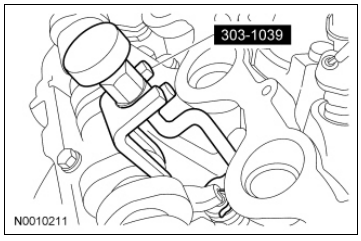
    Remove only the 3 roller followers shown in the illustration from the RH cylinder head.



58. ***NOTICE:*** **Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

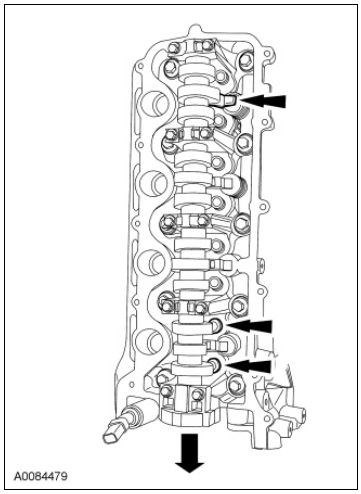
    NOTE: It may be necessary to push the valve down while compressing the spring.

    Using the Valve Spring Compressor, remove the 3 roller followers designated in the previous step from the RH cylinder head.



59. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

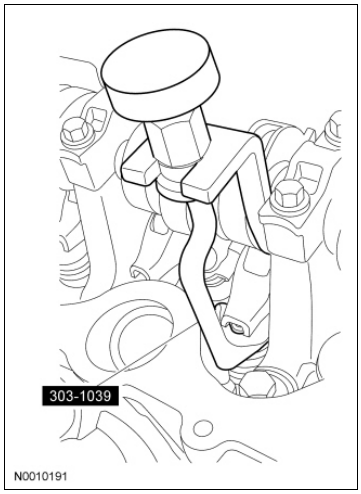
    Remove only the 3 roller followers shown in the illustration from the LH cylinder head.



60. ***NOTICE:*** **Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.**

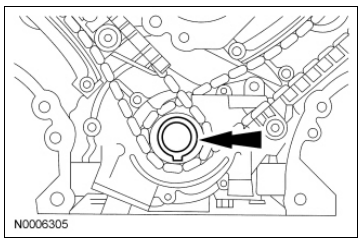
    NOTE: It may be necessary to push the valve down while compressing the spring.

    Using the Valve Spring Compressor, remove the 3 roller followers designated in the previous step from the LH cylinder head.

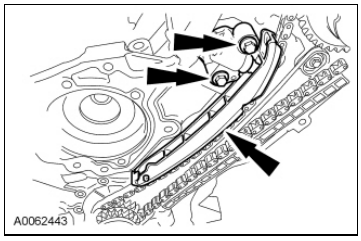


61. ***NOTICE:*** **The crankshaft cannot be moved past the 6 o'clock position once set, or the engine may be damaged.**

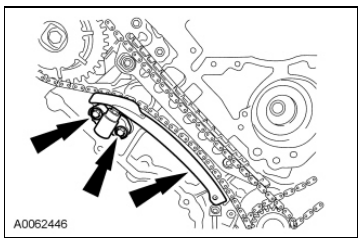
    Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



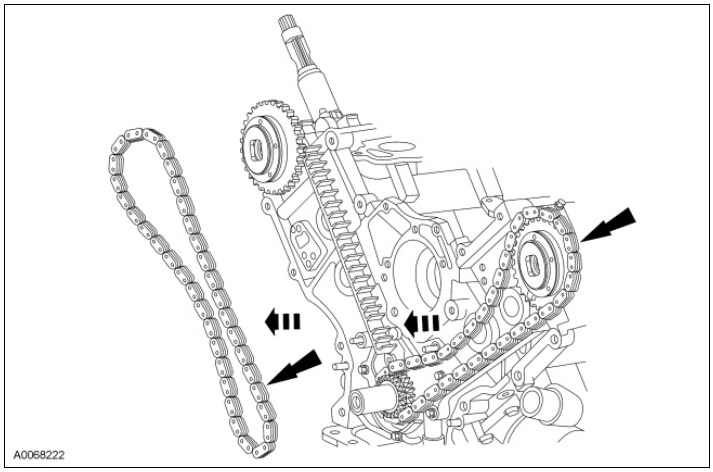
62. Remove the 2 bolts, the LH timing chain tensioner and tensioner arm.



63. Remove the 2 bolts, the RH timing chain tensioner and tensioner arm.

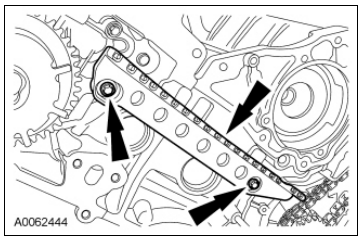


64. Remove the RH and LH timing chains and the crankshaft sprocket.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain and crankshaft sprocket.



65. **NOTE:** RH shown, LH similar.

    Remove the 4 bolts and the LH and RH timing chain guides.



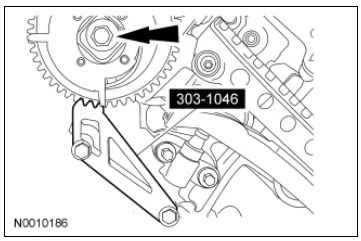
66. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

NOTICE: **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

Using the Camshaft Phaser Sprocket Locking Tool, remove the bolt and the RH camshaft phaser sprocket assembly.

- Discard the camshaft phaser sprocket bolt.



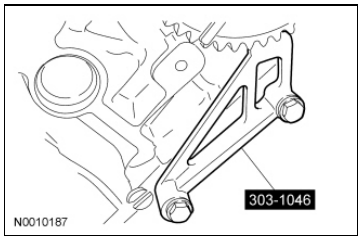
67. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

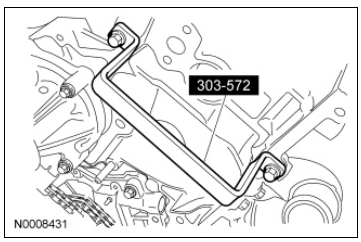
    NOTICE: **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    Using the Camshaft Phaser Sprocket Locking Tool, remove the bolt and the LH camshaft phaser sprocket assembly.

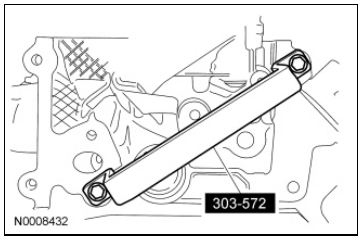
    - Discard the camshaft phaser sprocket bolt.



68. Install the Cylinder Head Remover/Installer onto the LH cylinder head.

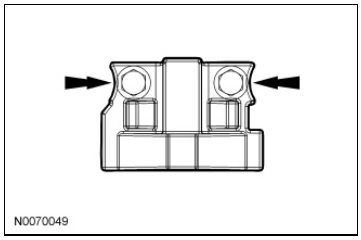


69. Install the Cylinder Head Remover/Installer onto the RH cylinder head.



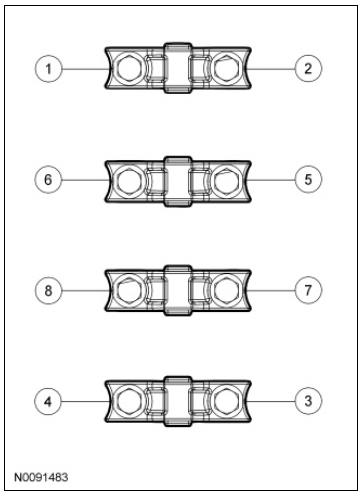
70. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the RH cylinder head camshaft front bearing cap.

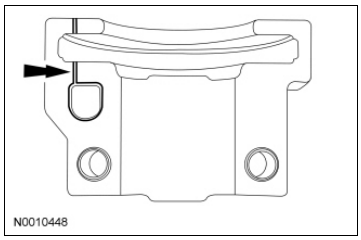


71. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the 8 bolts in the sequence shown and remove the RH cylinder head camshaft bearing caps.



72. Clean and inspect the RH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



73. Remove the RH camshaft.

74. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

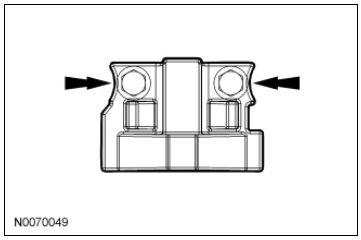
    Remove the remaining roller followers from the RH cylinder head.

75. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

    Remove the hydraulic lash adjusters from the RH cylinder head.

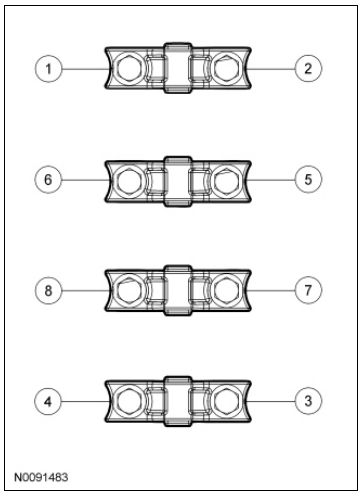
76. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

    Remove the 2 bolts and the LH cylinder head camshaft front bearing cap.

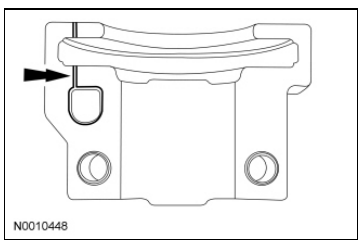


77. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the 8 bolts in the sequence shown and remove the LH cylinder head camshaft bearing caps.



78. Clean and inspect the LH camshaft bearing caps.
    - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



79. Remove the LH camshaft.

80. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

    Remove the remaining roller followers from the LH cylinder head.

81. **NOTE:** If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

    Remove the hydraulic lash adjusters from the LH cylinder head.

82. ***NOTICE:*** **The cylinder head must be cool before removing it from the engine. Cylinder head warpage may result if a warm or hot cylinder head is removed.**

    NOTICE: **Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Failure to follow these instructions may result in engine damage.**

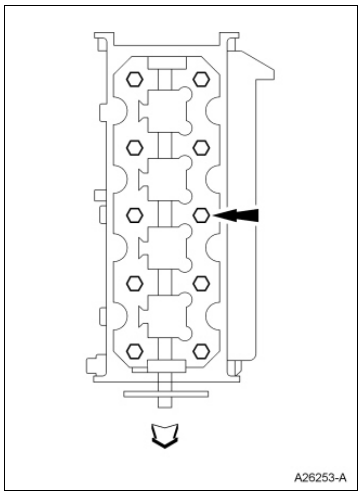
    NOTICE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

    NOTICE: **Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface, or the cylinder head may be damaged.**

    NOTE: RH shown, LH similar.

    Remove the 20 bolts and the cylinder heads.

    - Discard the cylinder head gaskets.
    - Discard the cylinder head bolts.



83. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

    NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

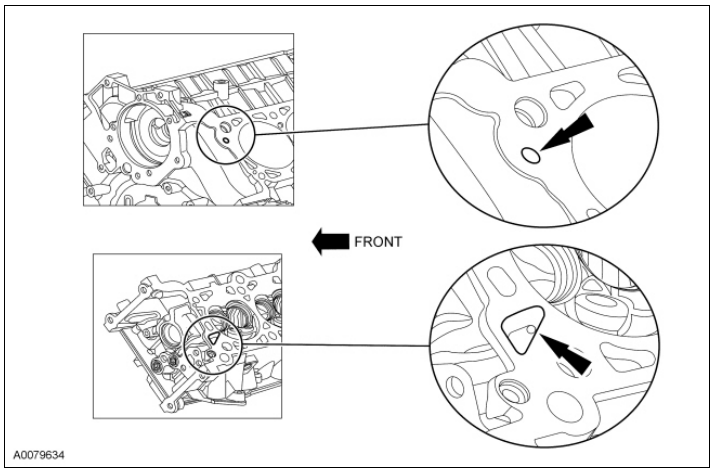
NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block in the following sequence.

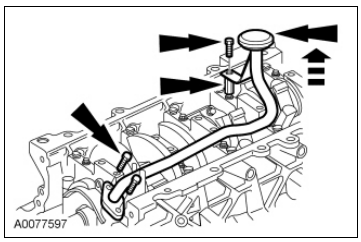
1. Remove any large deposits of silicone or gasket material with a plastic scraper.
2. Apply silicone gasket remover, following package directions and allow to set for several minutes.
3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

84. **NOTE:** LH shown, RH similar.

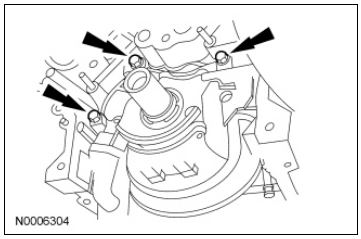
Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion, paying particular attention to the oil pressure feed area. For additional information, refer to Section 303-00 .



85. Remove the 3 bolts, the oil pump screen and pickup tube and the spacer.



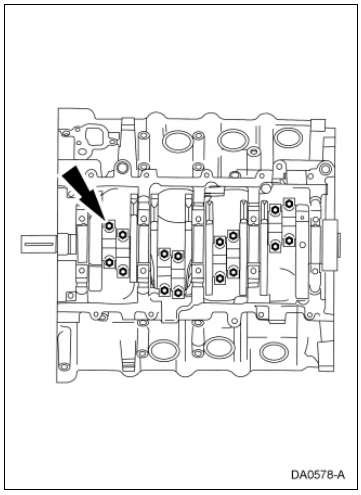
86. Remove the 3 bolts and the oil pump.



87. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following the manufacturer's instructions.

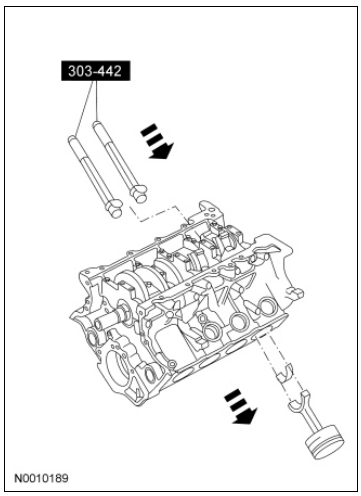
88. ***NOTICE:*** **Verify that the connecting rods and rod caps have orientation numbers cast into them. If not, number the connecting rods and rod caps for correct orientation. If the connecting rods and caps are assembled incorrectly, the engine may be damaged.**

    Remove the 16 bolts and the connecting rod caps. Discard the bolts.



89. ***NOTICE:*** **Remove the piston and connecting rod assemblies carefully, or the cylinder walls or crankshaft journals may be damaged.**

    Use the Connecting Rod Installer to push the piston through the top of the cylinder block.

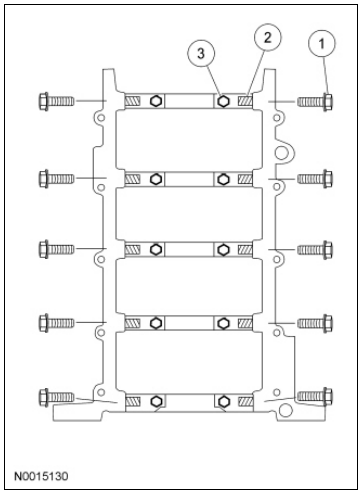


90. Disassemble the 8 pistons. For additional information, refer to Piston in this section.

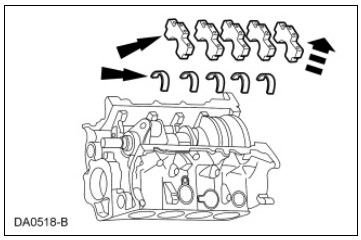
91. **NOTE:** Note the location of the stud bolt for assembly reference.

    Remove the fasteners.

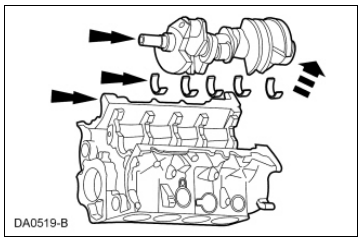
    1. Remove and discard the 10 cross-mounted main cap bolts.
    2. Loosen the 10 jack screws.
    3. Remove and discard the 9 main bearing cap bolts and the stud bolt.



92. Remove the 5 main bearing caps, the lower crankshaft main bearings and the lower thrust washer.

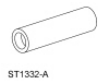


93. Remove the crankshaft, the upper crankshaft main bearings and the upper thrust washers from the cylinder block.



Cylinder Head

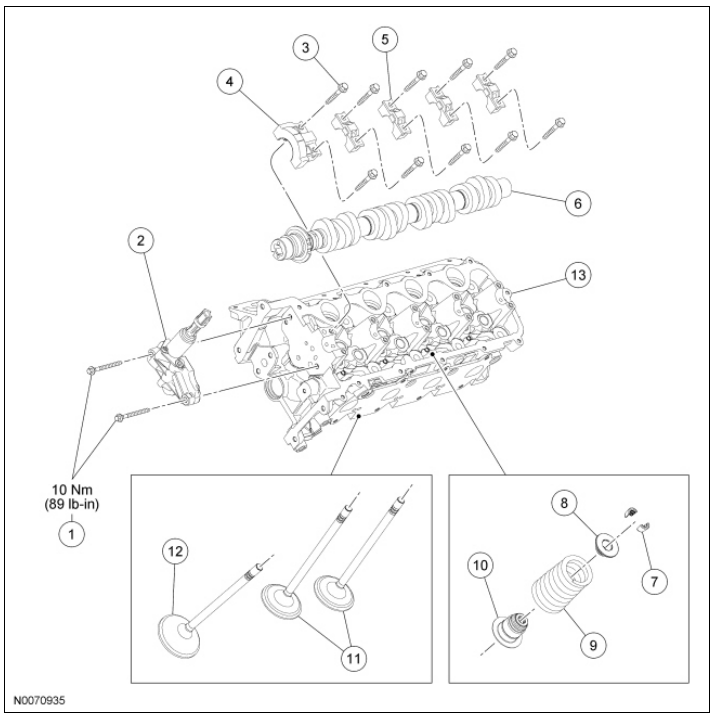
Special Tool(s)

 ST2604-A	Compressor, Valve Spring 303-1039
 ST1332-A	Installer, Valve Stem Oil Seal 303-383 (T91T-6571-A)

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: LH side shown, RH side similar.



Item	Part Number	Description

1	W701520	Variable Camshaft Timing (VCT) housing assembly bolts (2 required)
2	6C261 LH/ 6C260 RH	VCT housing assembly
3	N807834	Camshaft bearing cap bolt (10 required)
4	6B284	Camshaft front bearing cap
5	6B280	Camshaft bearing cap (4 required)
6	6C255 LH/ 6251 RH	Camshaft
7	6518	Valve spring retainer key (24 required)
8	6514	Valve spring retainer (12 required)
9	6513	Valve spring (12 required)
10	6A517	Valve seal (12 required)
11	6507	Intake valves (8 required)
12	6505	Exhaust valve (4 required)
13	6050 LH/ 6049 RH	Cylinder head

Disassembly

1. Remove the bolts and the Variable Camshaft Timing (VCT) housing.
   - Discard the gasket.

2. Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

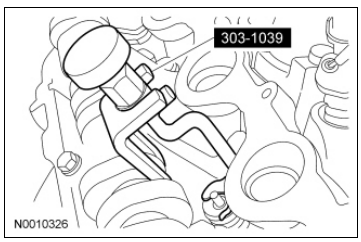
3. **NOTE:** The camshaft must be installed in the head to use the Valve Spring Compressor to compress the valve springs.

   NOTE: Lubricate the camshaft bearing caps with clean engine oil.

   Install the camshaft bearing caps in their original locations.

   - Position the front camshaft bearing cap.
   - Position the remaining camshaft bearing caps.
   - Install the bolts finger-tight.

4. Using the Valve Spring Compressor, compress the valve spring and remove the valve spring retainer keys.



5. Remove the valve spring retainer, the valve spring and the valve seal.
   - Discard the valve seal.

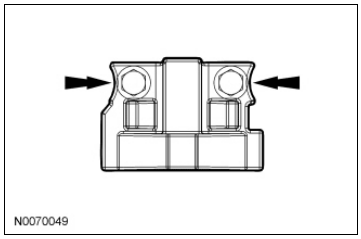
6. Remove the valve from the cylinder head.

7. Repeat the previous 3 steps for each valve.

8. Inspect the components. For additional information, refer to Section 303-00 .

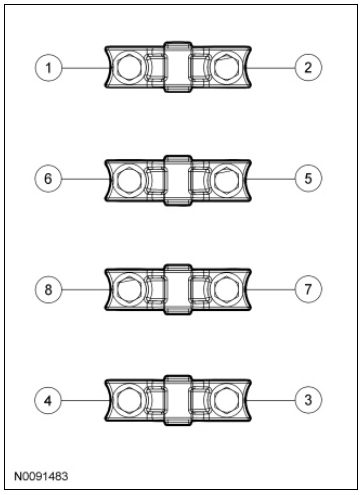
9. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

   Remove the 2 bolts and the cylinder head camshaft front bearing cap.



10. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

    Remove the remaining bolts in the sequence shown and remove the cylinder head camshaft bearing caps.



11. Remove the camshaft.

12. Check the cylinder head for distortion. For additional information, refer to Section 303-00 .

Assembly

1. Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

2. **NOTE:** Lubricate the camshaft bearing caps with clean engine oil.

   Install the camshaft bearing caps in their original locations.

   - Position the front camshaft bearing cap.
   - Position the remaining camshaft bearing caps.
   - Install the bolts finger-tight.

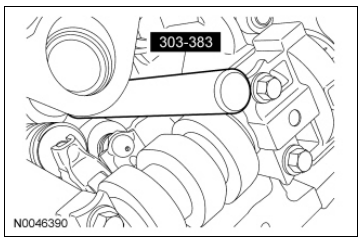
3. **NOTE:** Lubricate the valve stem with clean engine oil prior to installation.

Install the valve into the cylinder head.

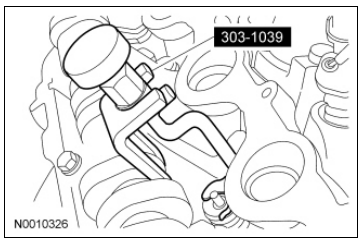
4. **NOTE:** Lubricate the valve seal and valve stem with clean engine oil prior to installation.

   Position a new valve seal onto the valve stem.

5. Using the Valve Stem Oil Seal Installer, install the new valve seal.



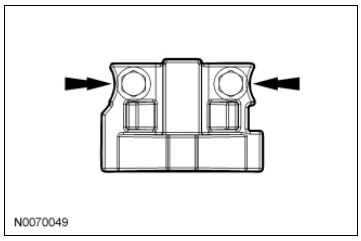
6. Using the Valve Spring Compressor, install the valve spring, the valve spring retainer and the valve spring retainer keys.



7. Repeat the previous 2 steps for each valve.

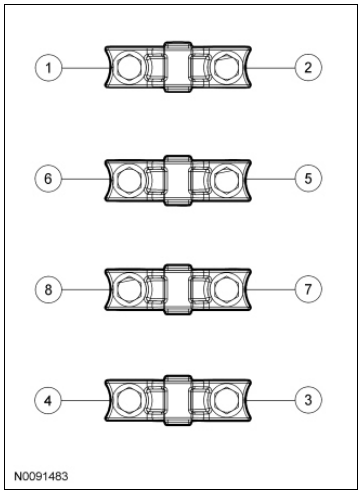
8. ***NOTICE:*** **Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.**

   Remove the 2 bolts and the cylinder head camshaft front bearing cap.



9. ***NOTICE:*** **The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.**

   Remove the remaining bolts in the sequence shown and remove the cylinder head camshaft bearing caps.



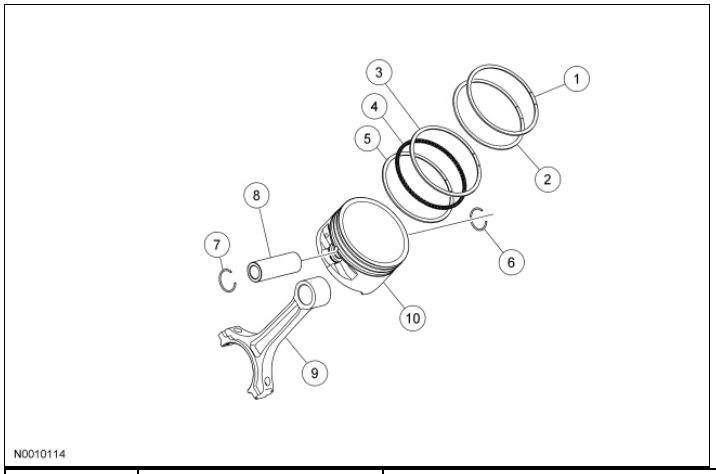
10. Remove the camshaft.

11. Install a new gasket, the VCT housing and the bolts.
    - Tighten to 10 Nm (89 lb-in).

Piston

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



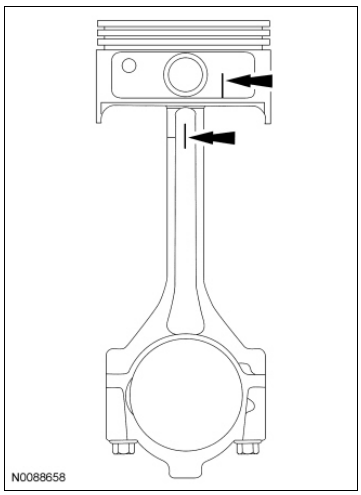
Item	Part Number	Description
1	6150	Piston compression ring, upper
2	6152	Piston compression ring, lower
3	6159	Piston oil control segment ring, upper
4	6161	Piston oil control spacer
5	6159	Piston oil control segment ring, lower
6	6140	Piston pin retainer
7	6140	Piston pin retainer
8	6135	Piston pin
9	6200	Connecting rod
10	6110	Piston

Disassembly

⚠ WARNING: Since the retainer ring has a tendency to spring out, cover the end of the pin bore with a hand or shop rag when removing the ring. Wear eye protection. Failure to follow these instructions may result in serious personal injury.

1. Remove the piston rings from the piston.
    - Discard the piston rings.

2. Mark the piston and the connecting rod on the same side for assembly reference.



3. Remove the piston pin retainers and the piston pin.

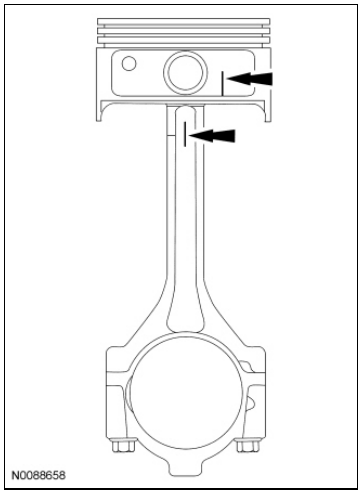
4. Separate the piston from the connecting rod.

5. Clean and inspect the piston and connecting rod. For additional information, refer to Section 303-00 .

Assembly

1. **NOTE:** The connecting rod must be installed into the piston with the marks made during disassembly on the same side. If a new piston or connecting rod is being installed, it can be installed in either direction.

   Position the connecting rod in the piston.



2. Lubricate the piston pin and pin bore with clean engine oil.

3. Install the piston pin in the piston and connecting rod assembly.

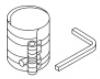
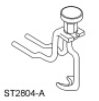
4. Install the piston pin retaining clips in the piston.

5. Lubricate the piston and the new piston rings with clean engine oil.

6. Install the piston rings onto the piston.

Engine

Special Tool(s)

 ST2806-A	Alignment Pins, Cylinder Head 303-1040 (SR-015486)
 ST1376-A	Compressor, Piston Ring 303-D032 (D81L-6002-C) or equivalent
 ST2804-A	Compressor, Valve Spring 303-1039
 ST1337-A	Installer, Connecting Rod 303-442 (T93P-6136-A)
 ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST1482-A	Installer, Crankshaft Oil Slinger 303-517 (T95P-6701-CH)
 ST1479-A	Installer, Crankshaft Rear Seal 303-516 (T95P-6701-EH)
 ST1480-A	Installer, Crankshaft Rear Seal 303-518 (T95P-6701-DH)
 ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
 ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent
 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)

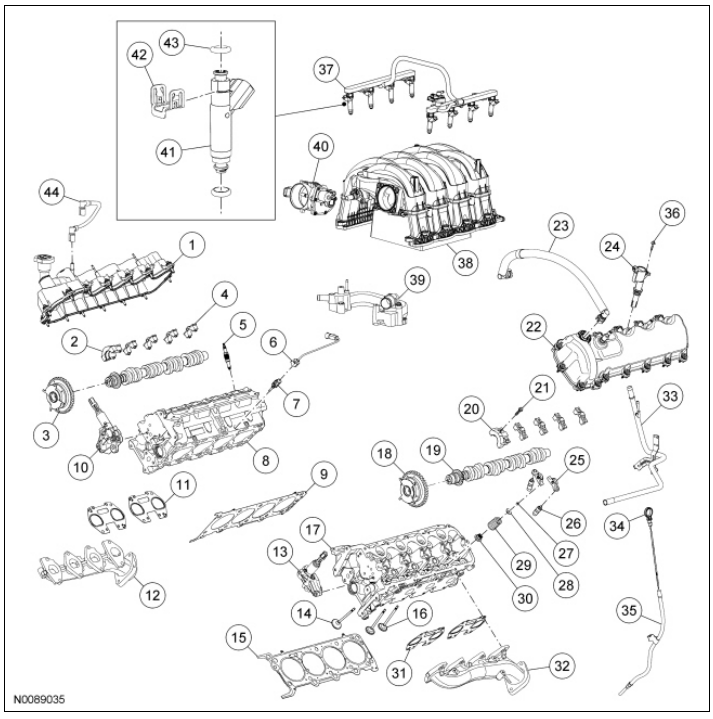
General Equipment

Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA

Material

Item	Specification
Gasket Maker TA-16	WSK-M2G348-A5
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada); or equivalent	WSS-M97B51-A1
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

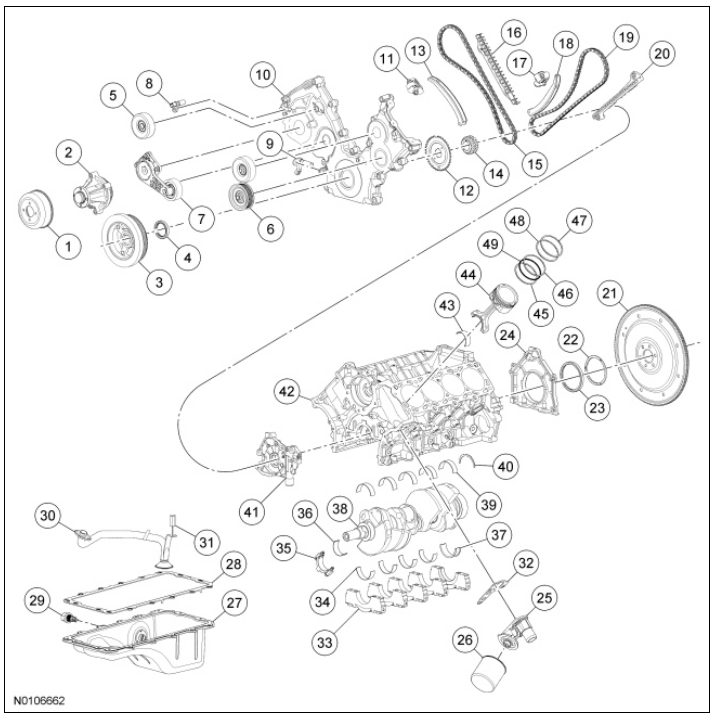
Engine - Upper End



Item	Part Number	Description
1	6582	RH valve cover
2	6B284	RH camshaft thrust bearing cap
3	6C524	RH camshaft phaser sprocket
4	6B280	Camshaft bearing cap (8 required)
5	12405	Spark plug (8 required)
6	14B485	Cylinder Head Temperature (CHT) sensor jumper harness
7	6G004	CHT sensor
8	6049	RH cylinder head
9	6051	RH cylinder head gasket
10	6C261	RH Variable Camshaft Timing (VCT) oil control solenoid assembly
11	9Y431	Exhaust manifold gasket (2 required)
12	9430	Exhaust manifold - RH
13	6C261	LH VCT oil control solenoid assembly
14	6505	Exhaust valve (8 required)
15	6083	LH cylinder head gasket
16	6507	Intake valve (16 required)
17	6050	LH cylinder head
18	6C524	LH camshaft phaser sprocket
19	6C255	LH camshaft
20	6B284	LH camshaft thrust bearing cap
21	N807834	Camshaft bearing cap bolt (20 required)
22	6A505	LH valve cover
23	6K817	PCV tube
24	12A366	Ignition coil (8 required)
25	6529	Roller follower (24 required)
26	6C501	Hydraulic lash adjuster (24 required)
27	6518	Valve spring retainer key (48 required)
28	6514	Valve spring retainer (24 required)
29	6513	Valve spring (24 required)
30	6A517	Valve stem seal (24 required)
31	9Y431	Exhaust manifold gasket (2 required)
32	9431	LH exhaust manifold
33	18B63	Coolant tube
34	6750	Oil level indicator
35	6K873	Oil level indicator tube
36	W706175	Ignition coil bolt (8 required)
37	9F792	Fuel rail assembly
38	9424	Intake manifold assembly
39	8C369	Engine coolant crossover
40	9F991	Electronic throttle body

41	9F593	Fuel injector (8 required)
42	9C995	Fuel injector clip (8 required)
43	9F798	O-ring seal (16 required)
44	6758	PCV breather hose

Engine - Lower End



Item	Part Number	Description
1	8A528	Coolant pump pulley
2	8501	Coolant pump
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal
5	19A216	Accessory drive belt idler pulley (2 required)
6	6C348	Accessory drive belt idler pulley
7	6B209	Accessory drive belt tensioner
8	6B288	Camshaft Position (CMP) sensor (2 required)
9	6C315	Crankshaft Position (CKP) sensor
10	6C086	Engine front cover
11	6L266	RH timing chain tensioner
12	12A227	Ignition pulse wheel
13	6K255	RH tensioner arm
14	6306	Crankshaft sprocket
15	6268	RH timing chain
16	6M256	RH timing chain guide
17	6M269	LH timing chain tensioner
18	6M274	LH tensioner arm

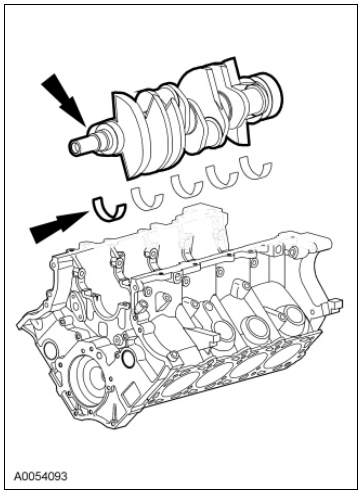
19	6268	LH timing chain
20	6B274	LH timing chain guide
21	6375	Flexplate
22	6701	Crankshaft oil slinger
23	6310	Crankshaft rear seal
24	6K318	Crankshaft rear seal retainer plate
25	6881	Oil filter adapter
26	6714	Oil filter
27	6675	Oil pan
28	6710	Oil pan gasket
29	12A648	Engine oil temperature sensor
30	6622	Oil pump screen and pickup tube
31	N806180	Oil pump screen and pickup tube spacer
32	6A636	Oil filter adapter gasket
33	6325	Crankshaft main bearing cap (5 required)
34	6A338	Lower crankshaft bearing (4 required)
35	6210	Connecting rod cap (8 required)
36	6211	Connecting rod lower bearing (8 required)
37	6K302	Lower crankshaft thrust washer
38	6303	Crankshaft
39	6333	Upper crankshaft bearing (5 required)
40	6A341	Upper crankshaft thrust washer
41	6621	Oil pump
42	6010	Cylinder block
43	6211	Connecting rod upper bearing (8 required)
44	6110	Piston (8 required)
45	6159	Outer oil control ring (8 required)
46	6159	Outer oil control ring (8 required)
47	6150	Upper compression ring (8 required)
48	6152	Lower compression ring (8 required)
49	6161	Inner oil control ring (8 required)

1. **NOTE:** Before assembling the cylinder block, all sealing surfaces must be free of chips, dirt, paint and foreign material. Also, make sure the coolant and oil passages are clear.

   Install the crankshaft main bearings.

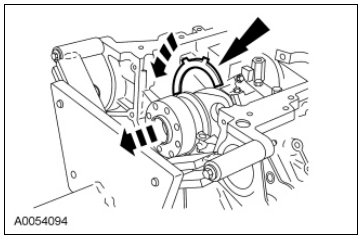
   - Install the crankshaft upper main bearings into the cylinder block.
   - Install the crankshaft lower main bearings into the bearing caps.
   - Make sure all oil passages are aligned.
   - Lubricate all main bearings with clean engine oil.

2. Lubricate the crankshaft bearing journals with clean engine oil. Install the crankshaft onto the upper crankshaft main bearings.



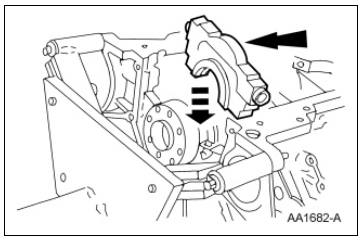
3. **NOTE:** The oil groove on the thrust washer must face toward the rear of the engine (against the crankshaft thrust surface).

   Push the crankshaft rearward and install the rear crankshaft upper thrust washer at the back of the No. 5 main boss.



NOTE: Rotate the 10 jackscrews into the main bearing caps enough to provide clearance to the cylinder block prior to installing the bearing caps.

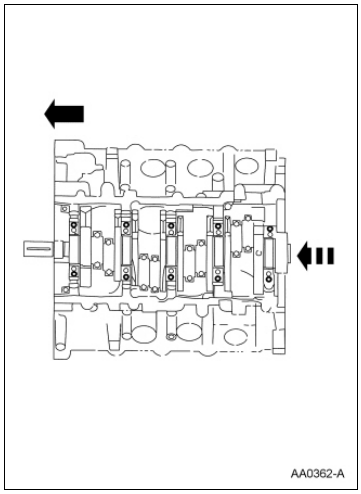
4. Install the thrust washer on the rear (No. 5) main bearing cap and install the rear (No. 5) main bearing cap.



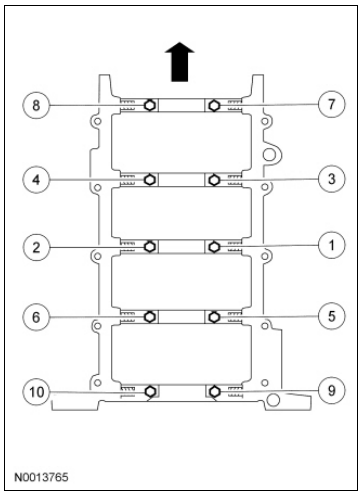
5. **NOTE:** Install the stud bolt in the same position from which it was removed.

   Install the crankshaft lower main bearings into the main bearing caps and lubricate them with clean engine oil. Locate the main bearing cap on the cylinder block and, keeping the cap as square as possible, alternately draw the cap down evenly using the cap fasteners.

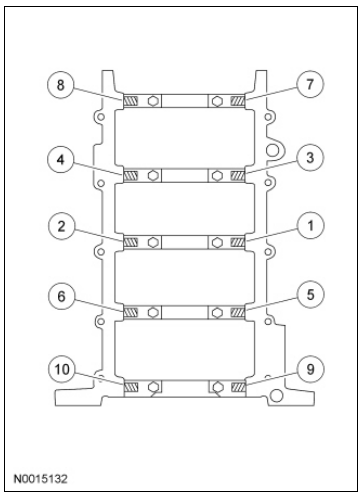
6. Push the crankshaft forward to seat the crankshaft thrust washer. Hold the crankshaft in the forward position.



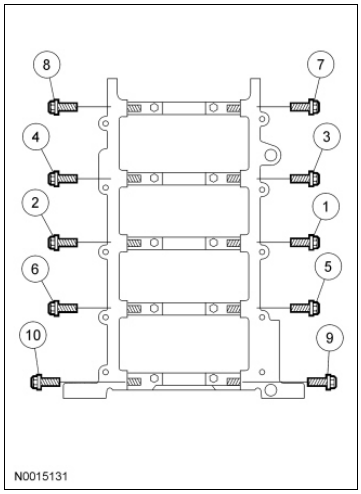
7. Tighten the 10 vertical main bearing cap fasteners in the sequence shown, in 2 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



8. Tighten the 10 jackscrews against the cylinder block in the sequence shown in 2 stages.
    - Stage 1: Tighten to 5 Nm (44 lb-in).
    - Stage 2: Tighten to 10 Nm (89 lb-in).



9. Install the 10 side bolts and tighten them in the sequence shown.
    - Tighten to 21 Nm (15 lb-ft).



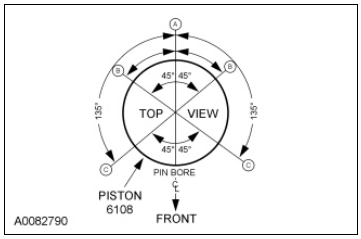
10. Check the crankshaft end play. For additional information, refer to Section 303-00 .

11. Check that crankshaft torque-to-turn does not exceed 6 Nm (53 lb-in).

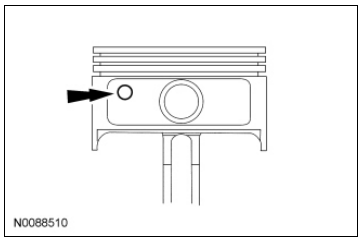
12. Check the piston-to-cylinder block and piston ring clearances. For additional information, refer to Section 303-00 .

13. Assemble the pistons. For additional information, refer to Piston in this section.

14. Make sure the ring gaps (oil spacer-A, oil ring-B and compression ring-C) are correctly spaced around the circumference of the piston.



15. Make sure the dimple in the piston faces the front of the engine.

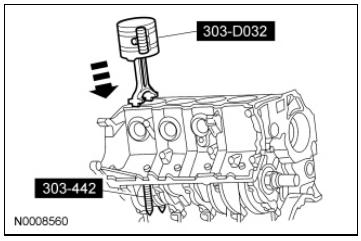


16. ***NOTICE:*** **Install the piston and connecting rod assemblies carefully, or the cylinder walls or crankshaft journals may be damaged.**

    NOTE: The following piston installation steps are for all 8 connecting rods, rod bearings and pistons. Only one connecting rod, rod bearing and piston shown.

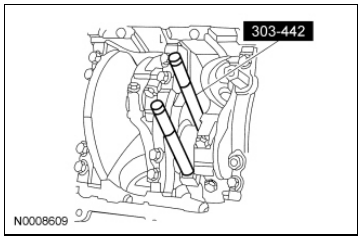
    Use the Piston Ring Compressor and the Connecting Rod Installer to install the connecting rod with the upper connecting rod bearing in place.

    - Lubricate the piston and ring with clean engine oil.
    - Lubricate the rod bearings with clean engine oil.



17. ***NOTICE:*** **Remove the Connecting Rod Installer carefully, or the crankshaft journals may be damaged.**

    Once the connecting rod is seated on the crankshaft journal, remove the Connecting Rod Installer.



18. ***NOTICE:*** **The rod cap installation must keep the same orientation as marked during disassembly, or the engine may be damaged.**

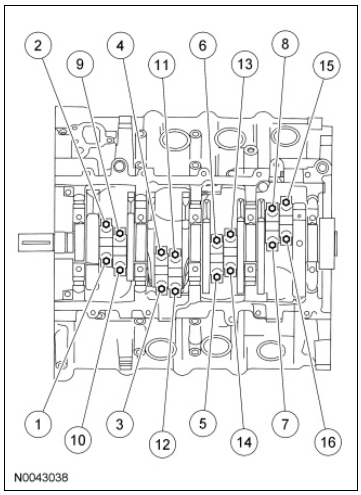
    NOTE: The connecting rod caps are of the "cracked" design and must mate with the connecting rod ends. Excessive bearing clearance will result if not mated correctly.

    Position the lower bearing and connecting rod and install the 2 new bolts loosely.

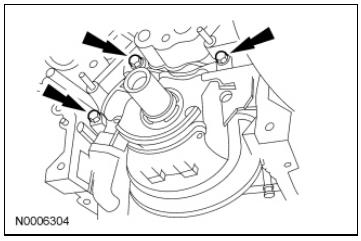
19. **NOTE:** Main bearing caps removed from art for clarity.

    Tighten the 16 connecting rod cap bolts in 2 stages, in the sequence shown.

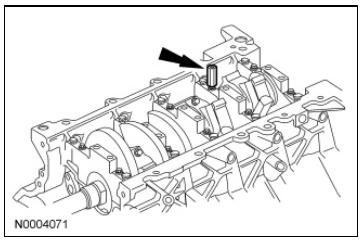
    - Stage 1: Tighten to 43 Nm (32 lb-ft).
    - Stage 2: Tighten an additional 105 degrees.



20. Position the oil pump and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



21. Install the pickup tube spacer.
    - Tighten to 25 Nm (18 lb-ft).

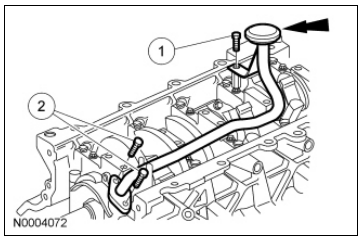


22. ***NOTICE:*** **Make sure the O-ring is in place and not damaged. A missing or damaged O-ring may cause foam in the lubrication system, low oil pressure and severe engine damage.**

    NOTE: Clean and inspect the mating surfaces and install a new O-ring. Lubricate the O-ring with clean engine oil.

    Position the oil pump screen and pickup tube and install the 3 bolts.

    1. Tighten to 25 Nm (18 lb-ft).
    2. Tighten to 10 Nm (89 lb-in).



23. ***NOTICE:*** **Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore, or the engine may be damaged.**

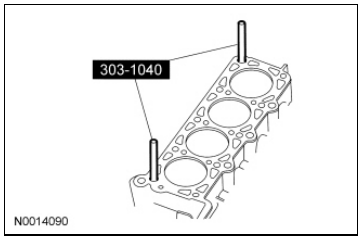
    NOTE: The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.

    NOTE: The cylinder head bolts must be discarded and new bolts installed. They are a tighten-to-yield design and cannot be reused.

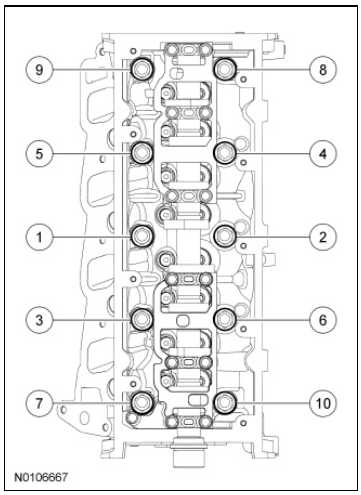
    NOTE: Do not turn the crankshaft until instructed to do so.

    NOTE: LH shown, RH similar.

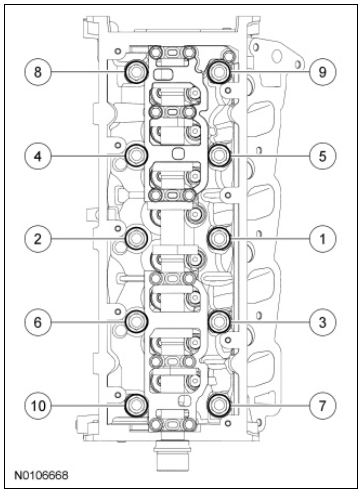
    Using the Cylinder Head Alignment Pins, position the cylinder head gaskets and cylinder heads over the dowels and install the 20 cylinder head bolts loosely.



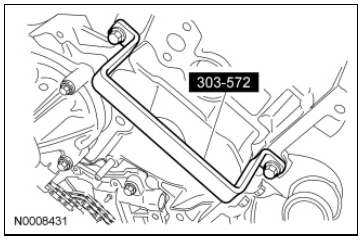
24. Tighten the 10 LH cylinder head bolts in 6 stages, in the sequence shown.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.
    - Stage 3: Loosen all 10 bolts a minimum of one full turn (360 degrees).
    - Stage 4: Tighten to 40 Nm (30 lb-ft).
    - Stage 5: Tighten an additional 90 degrees.
    - Stage 6: Tighten an additional 90 degrees.



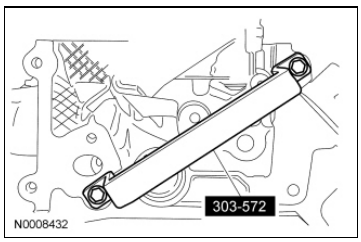
25. Tighten the 10 RH cylinder head bolts in 6 stages, in the sequence shown.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.
    - Stage 3: Loosen all 10 bolts a minimum of one full turn (360 degrees).
    - Stage 4: Tighten to 40 Nm (30 lb-ft).
    - Stage 5: Tighten an additional 90 degrees.
    - Stage 6: Tighten an additional 90 degrees.



26. Remove the Cylinder Head Remover/Installer from the LH cylinder head.

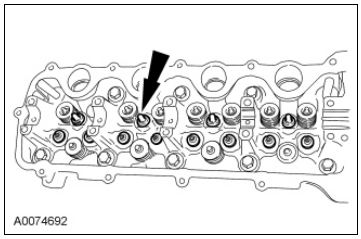


27. Remove the Cylinder Head Remover/Installer from the RH cylinder head.



28. **NOTE:** Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

    Install the hydraulic lash adjusters into the RH and LH cylinder heads.



29. **NOTE:** Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

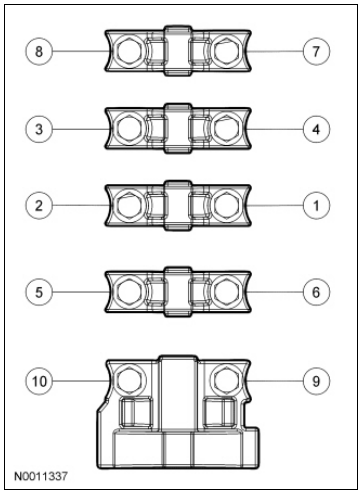
    Install the LH and RH camshafts.

30. **NOTE:** LH shown, RH similar.

    NOTE: Lubricate the camshaft bearing caps with clean engine oil.

    Install the LH and RH camshaft bearing caps in their original locations.

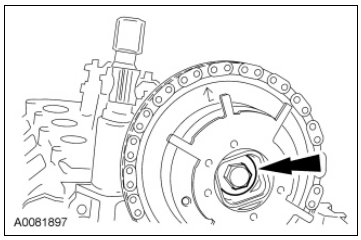
    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the 20 bolts loosely.
    - Tighten to 10 Nm (89 lb-in) in the sequence shown.



31. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTE: LH shown, RH similar.

    Position the camshaft phaser sprockets and install 2 new camshaft phaser bolts finger-tight.



32. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

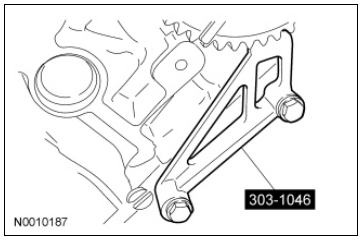
    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

    NOTICE: **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

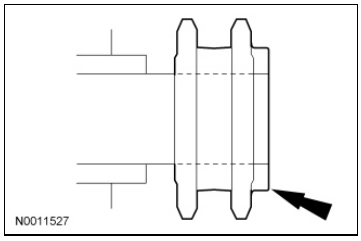
    NOTE: LH shown, RH similar.

    Using the Camshaft Phaser Sprocket Locking Tool, tighten the LH and RH camshaft phaser sprocket bolts in 2 stages.

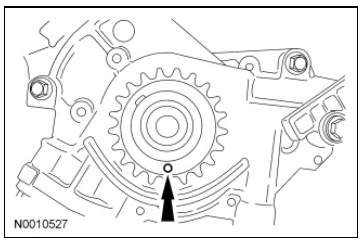
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



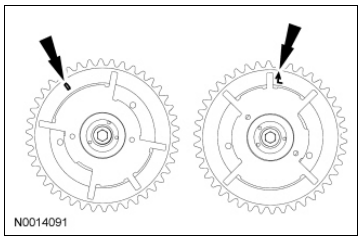
33. Install the crankshaft sprocket, making sure the flange faces forward.



34. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.



35. Rotate the camshaft sprockets to position the RH camshaft sprocket timing mark in the 11 o'clock position and the LH camshaft sprocket timing mark in the 12 o'clock position.



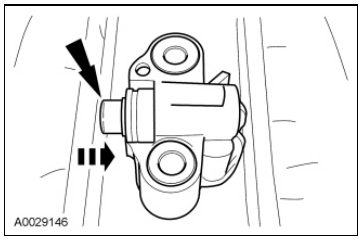
36. ***NOTICE:*** **If one or both tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, cuts or separation from the tensioner body, or permanent compression of the seal bead is observed, install a new tensioner, or engine damage may occur.**

    Inspect the RH and LH timing chain tensioners.

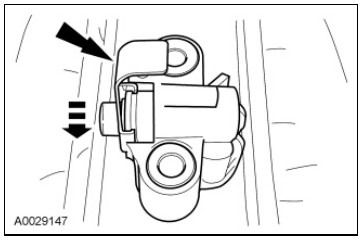
    - Install new tensioners as necessary.

37. ***NOTICE:*** **Timing chain procedures must be followed exactly or damage to valves and pistons will result.**

    Compress the tensioner plunger, using a vise.

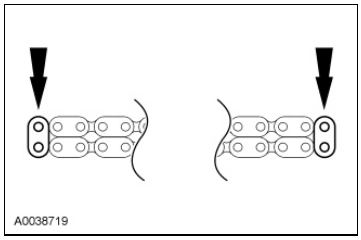


38. Install a retaining clip on the tensioner to hold the plunger in during installation.

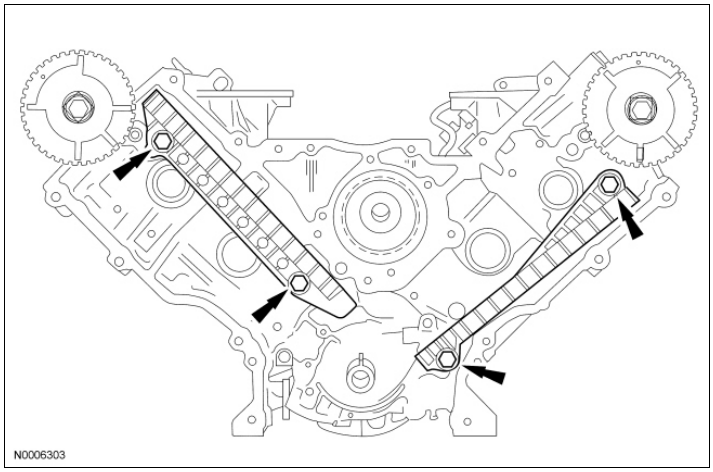


39. Remove the tensioner from the vise.

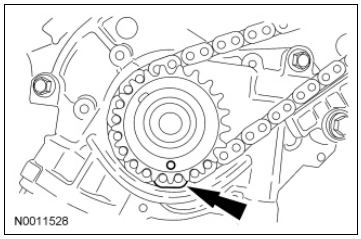
40. If the copper links are not visible, mark one link on one end and one link on the other end and use as timing marks.



41. Install the LH and RH timing chain guides and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

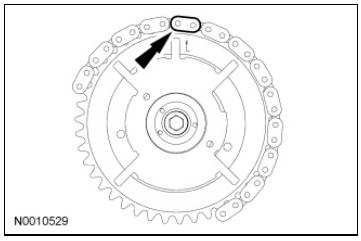


42. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



43. **NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.

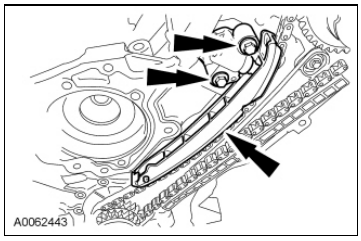
    Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.



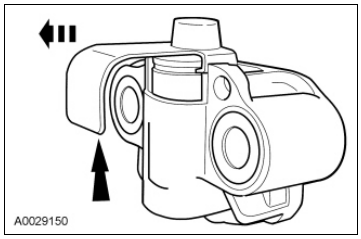
44. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

    Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and the 2 bolts.

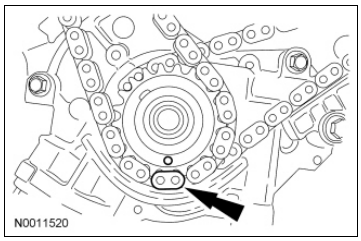
    - Tighten to 25 Nm (18 lb-ft).



45. Remove the retaining clip from the LH timing chain tensioner.



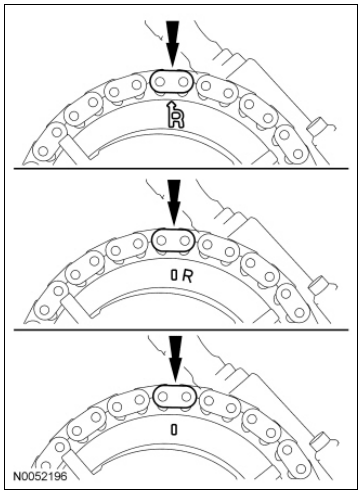
46. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.



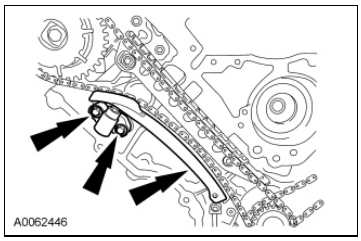
47. **NOTE:** The lower half of the timing chain must be positioned above the tensioner arm dowel.

    NOTE: The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

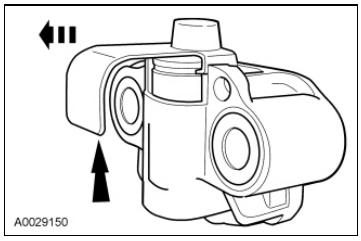
    Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.



48. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and 2 bolts.
    - Tighten to 25 Nm (18 lb-ft).

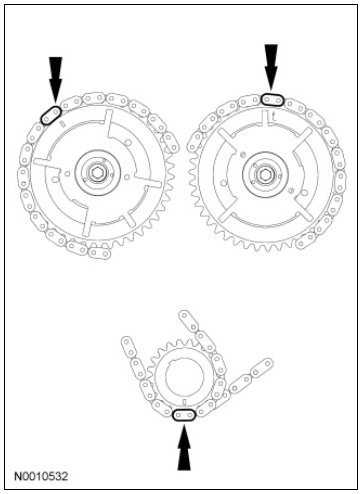


49. Remove the retaining clip from the RH timing chain tensioner.

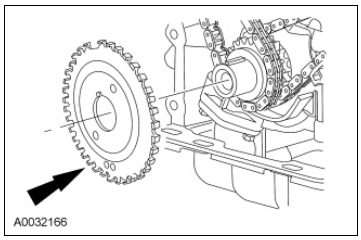


50. **NOTE:** The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

    As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.

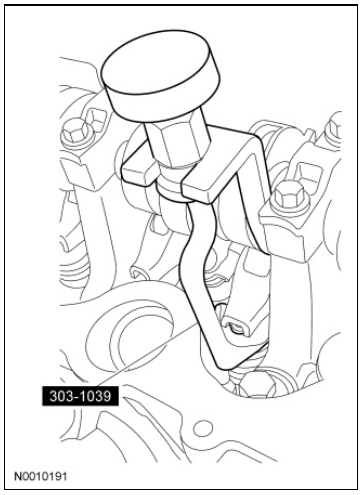


51. Install the crankshaft sensor ring on the crankshaft.



52. **NOTE:** Lubricate the roller followers with clean engine oil prior to installation.

    Using the Valve Spring Compressor, install all of the camshaft roller followers.

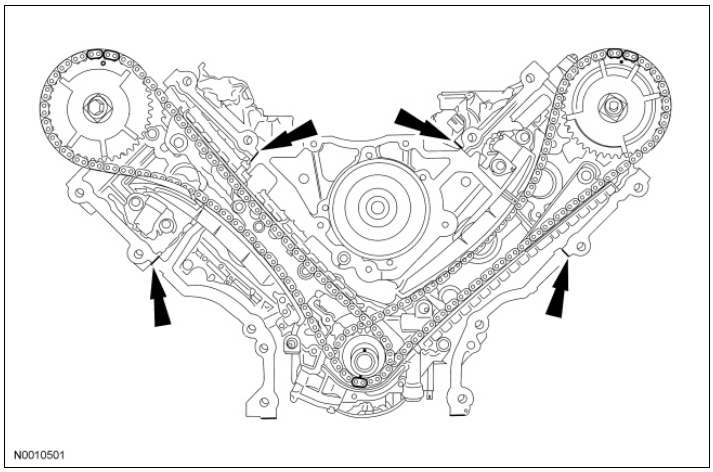


53. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

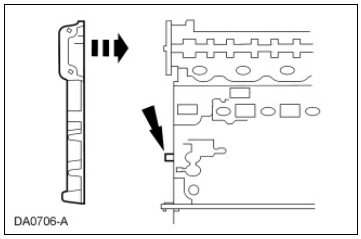
    NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

    NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

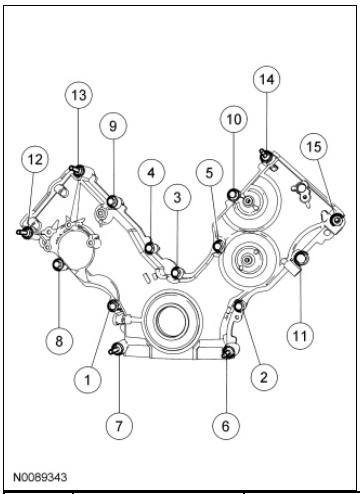
Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface at the locations shown.



54. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the 15 fasteners finger-tight.



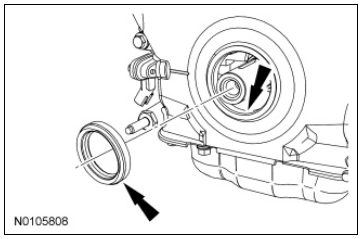
55. Tighten the 15 engine front cover fasteners in the sequence shown to 25 Nm (18 lb-ft).



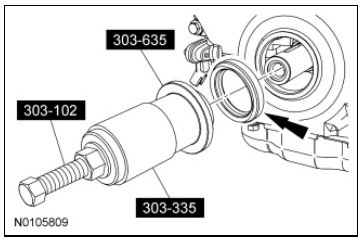
Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10

7	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1

56. Lubricate the engine front cover and the crankshaft front oil seal inner lip with clean engine oil.

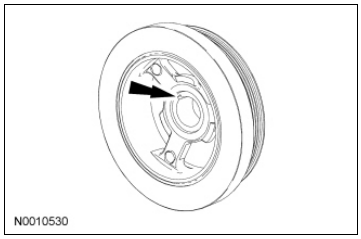


57. Using the Crankshaft Front Seal Installer, the Front Cover Seal Installer and the Crankshaft Vibration Damper Installer, install the crankshaft front oil seal into the engine front cover.

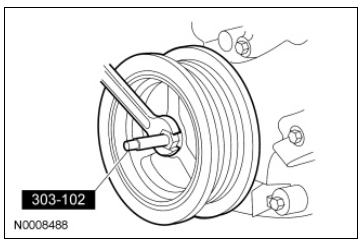


58. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



59. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.

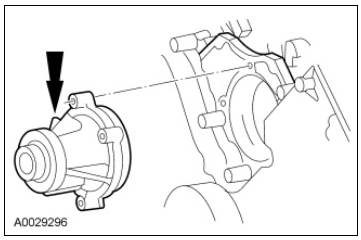


60. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen 360 degrees.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

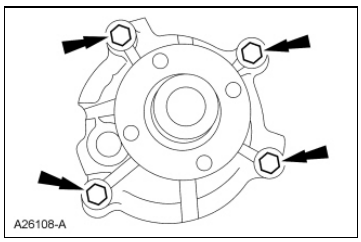
61. ***NOTICE:*** **Do not rotate the coolant pump housing once the coolant pump has been positioned in the cylinder block. Damage to the O-ring seal will occur.**

    NOTE: Lubricate the new O-ring seal using clean engine coolant and install the O-ring seal onto the coolant pump.

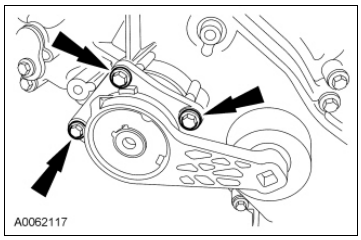
    Position the coolant pump and install the 4 bolts loosely.



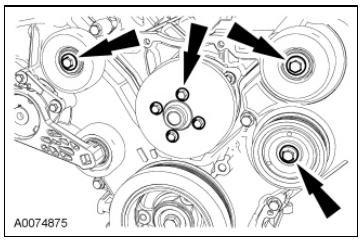
62. Tighten the 4 coolant pump bolts.
    - Tighten to 25 Nm (18 lb-ft).



63. Position the accessory drive belt tensioner and install the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

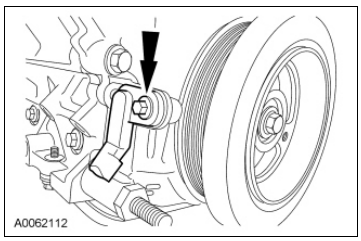


64. Install the 3 accessory drive belt idler pulleys, the coolant pump pulley and the 7 bolts.
    - Tighten to 25 Nm (18 lb-ft).

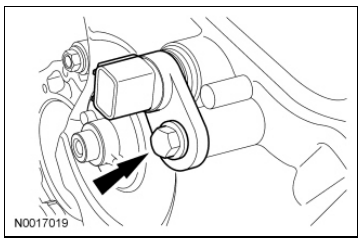


65. Install the Crankshaft Position (CKP) sensor and the bolt.

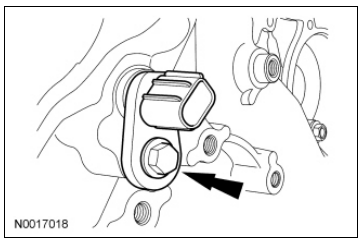
- Tighten to 10 Nm (89 lb-in).



66. Install the LH Camshaft Position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

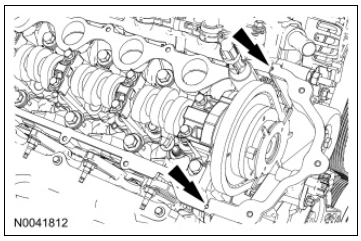


67. Install the RH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).



68. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

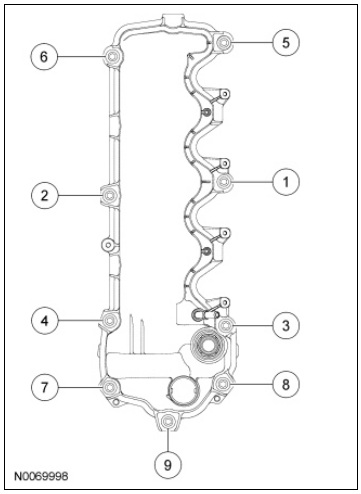
    Apply silicone gasket and sealant in 2 places where the engine front cover meets the RH cylinder head.



69. ***NOTICE:*** **Install the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

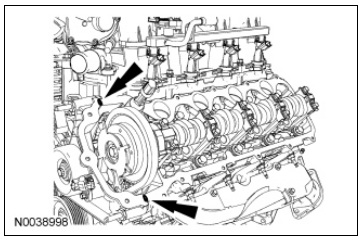
    Position the RH valve cover and gasket on the cylinder head and tighten the 9 bolts in the sequence shown.

    - Tighten to 10 Nm (89 lb-in).



70. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

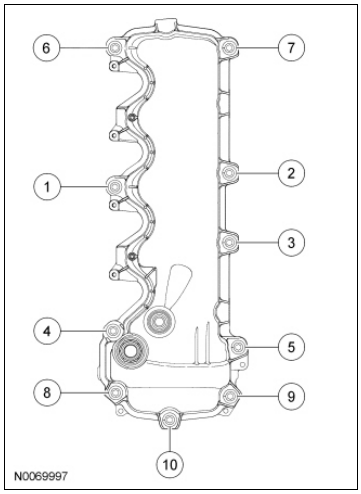
    Apply silicone gasket and sealant in 2 places where the engine front cover meets the LH cylinder head.



71. ***NOTICE:*** **Install the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

    Position the LH valve cover and gasket on the cylinder head and tighten the 10 bolts in the sequence shown.

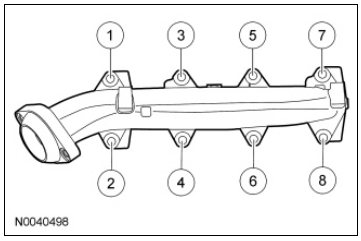
    - Tighten to 10 Nm (89 lb-in).



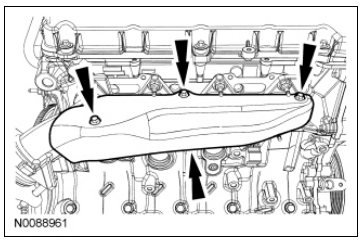
72. Inspect the RH exhaust manifold for flatness. For additional information, refer to Section 303-00 .

73. Install 8 new RH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

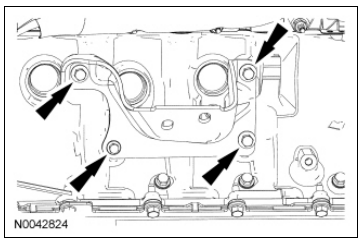
74. Position new gaskets, the RH exhaust manifold and tighten the 8 new nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



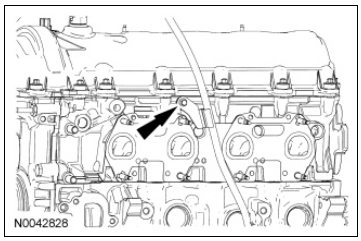
75. Position the RH heat shield and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



76. Position the RH engine support insulator bracket and install the 4 bolts.
    - Tighten to 72 Nm (53 lb-ft).



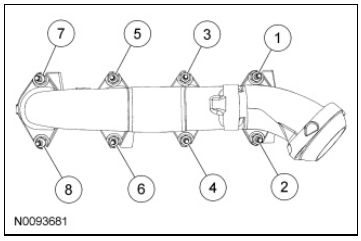
77. Position the oil level indicator tube and install the bolt.
    - Install a new O-ring seal and lubricate the O-ring seal with clean engine oil prior to installation.
    - Tighten to 10 Nm (89 lb-in).



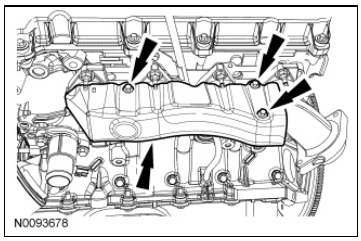
78. Inspect the LH exhaust manifold for flatness. For additional information, refer to Section 303-00 .

79. Install 8 new LH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

80. Position new gaskets, the LH exhaust manifold and tighten the 8 new nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



81. Position the LH exhaust manifold heat shield and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



82. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

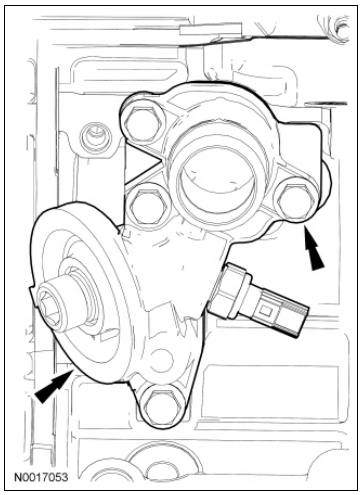
    Clean the oil filter adapter sealing surfaces using silicone gasket remover, metal surface prep and a plastic scraping tool. Follow the directions on the packaging.

83. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    NOTE: Clean and inspect the mating surfaces and install new gaskets.

    Position the oil filter adapter and install the 4 bolts.

    - Tighten to 25 Nm (18 lb-ft).

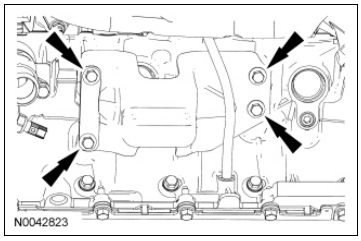


84. **NOTE:** Lubricate the oil filter gasket with clean engine oil.

    Install a new oil filter.

- Tighten the oil filter until the gasket makes contact, then use an oil filter strap wrench to tighten the filter an additional 270 degrees.

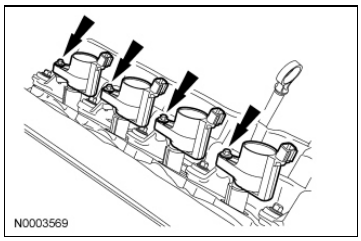
85. Position the LH engine support insulator bracket and install the 4 bolts.
    - Tighten to 72 Nm (53 lb-ft).



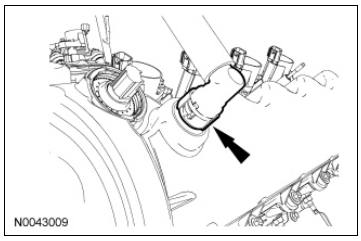
86. **NOTE:** LH shown, RH similar.

    Install the 8 ignition coils and the 8 bolts.

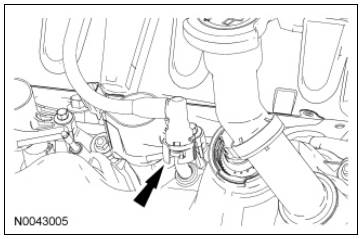
    - Tighten to 6 Nm (53 lb-in).



87. Connect the PCV hose to the LH valve cover.



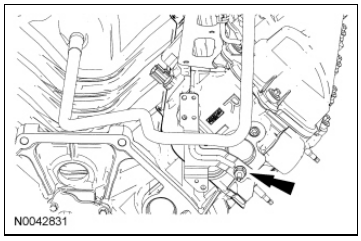
88. Connect the breather tube to the RH valve cover.



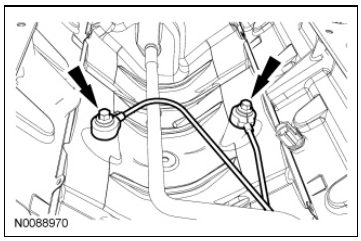
89. **NOTE:** Install new O-ring seals and lubricate the O-ring seals with clean engine coolant.

    Position the heater supply tube and the hoses as an assembly and install the stud bolt.

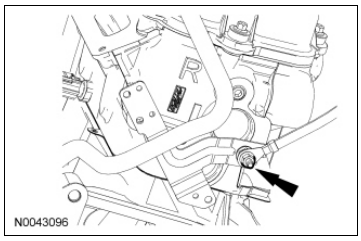
    - Tighten to 10 Nm (89 lb-in).



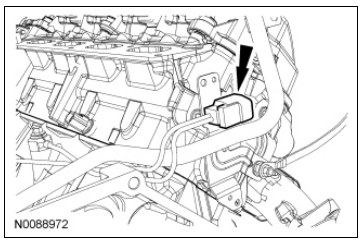
90. Position the Knock Sensor (KS) and install the 2 bolts.
    - Tighten to 20 Nm (177 lb-in).



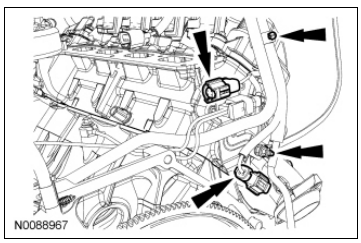
91. Position the ground strap and install the nut.



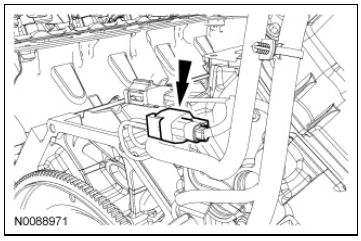
92. Attach the KS electrical connector retainer.



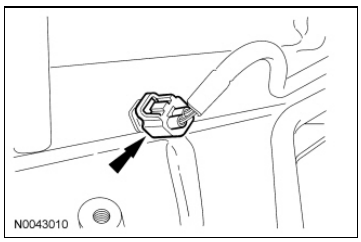
93. Position the wiring harness and attach the electrical connector and wiring harness retainers to the heater supply tube.



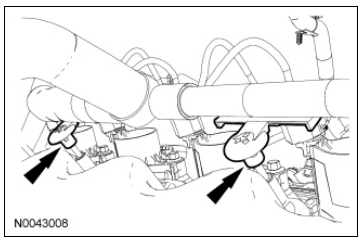
94. Connect the KS electrical connector.



95. Connect the Cylinder Head Temperature (CHT) sensor electrical connector.

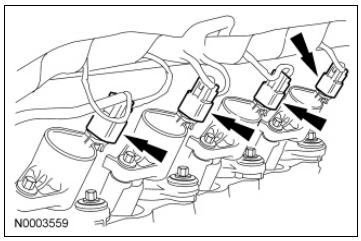


96. Attach the wiring harness retainers to the RH valve cover studs.

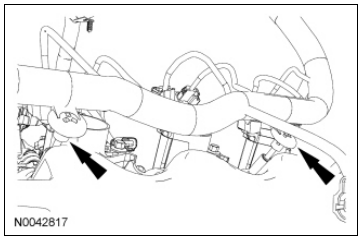


97. **NOTE:** RH shown, LH similar.

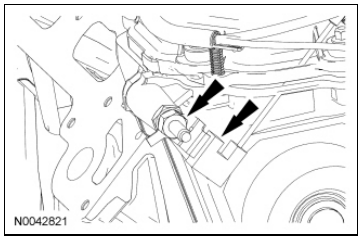
Connect the 4 RH and 4 LH ignition coil electrical connectors.



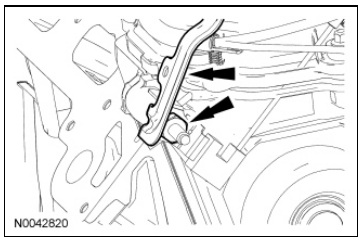
98. Attach the wiring harness retainers to the LH valve cover studs.



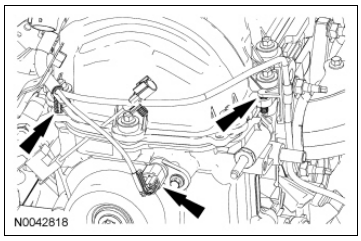
99. Position the LH radio interference capacitor and install the nut.
    - Tighten to 25 Nm (18 lb-ft).



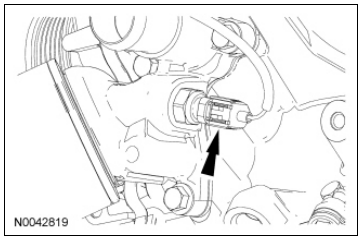
100. Position the cooling fan wiring harness and install the nut.
    - Tighten to 25 Nm (18 lb-ft).



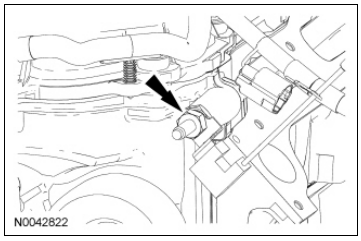
101. Connect the LH Camshaft Position (CMP) sensor and attach the wiring harness retainers.



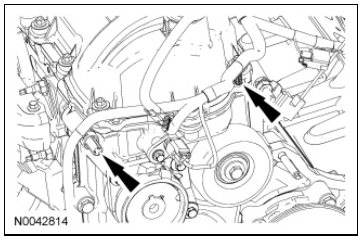
102. Connect the Engine Oil Pressure (EOP) sensor electrical connector.



103. Position the RH radio interference capacitor and install the nut.
    - Tighten to 25 Nm (18 lb-ft).

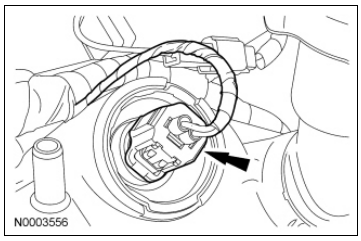


104. Attach the wiring harness retainers.

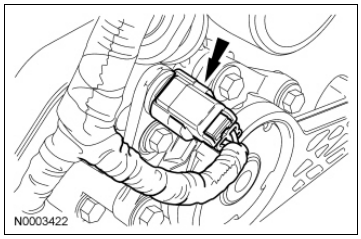


105. **NOTE:** RH shown, LH similar.

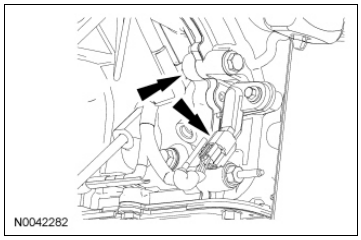
    Connect the RH and LH Variable Camshaft Timing (VCT) solenoid electrical connectors.



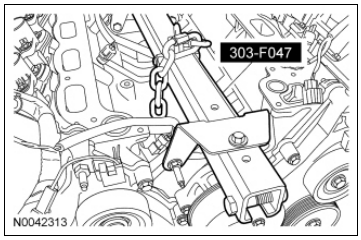
106. Connect the RH CMP sensor electrical connector.



107. Connect the CKP sensor electrical connector and attach the wiring harness retainer.



108. Install the Modular Engine Lift Bracket.



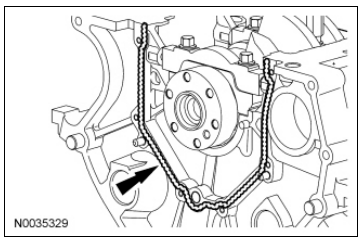
109. Using a suitable floor crane, remove the engine from the engine stand.

110. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the aluminum retainer plate. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

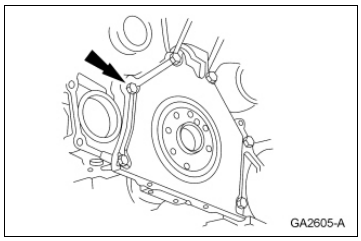
Inspect the crankshaft rear seal retainer plate. Clean the mating surface for the rear seal retainer plate with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

111. **NOTE:** The crankshaft rear seal retainer plate does not have a sealant groove. Gasket maker must be applied to the crankshaft rear seal retainer plate mating surface on the engine block.

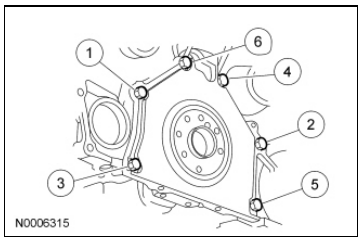
    Apply a bead of gasket maker to the crankshaft rear seal retainer mating surface on the engine block.



112. Install the crankshaft rear seal retainer plate and loosely install the 6 bolts.



113. Tighten the 6 bolts in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).

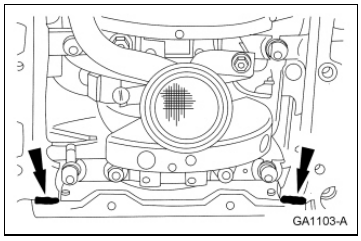


114. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Inspect the oil pan. Clean the mating surface for the oil pan with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

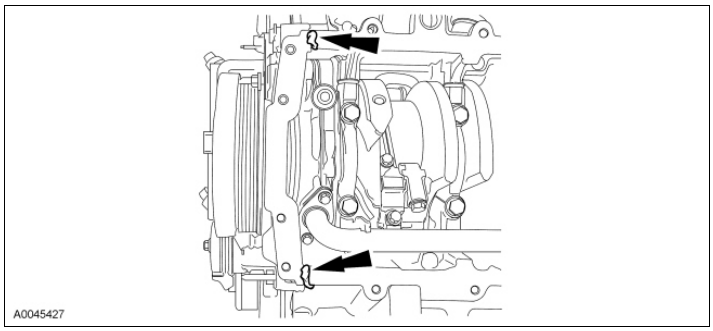
115. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

    Apply silicone gasket and sealant at the crankshaft rear seal retainer plate-to-cylinder block sealing surface.

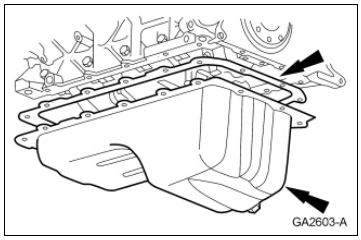


116. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

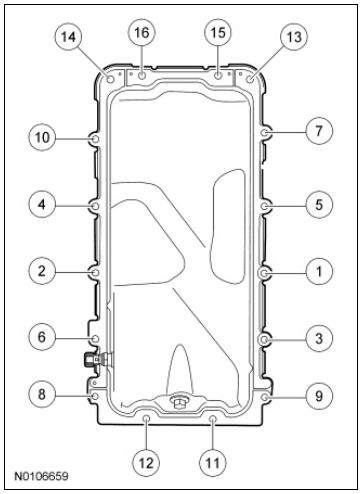
    Apply silicone gasket and sealant at the engine front cover-to-cylinder block sealing surface.



117. Install the oil pan gasket and the oil pan and loosely install the 16 bolts.

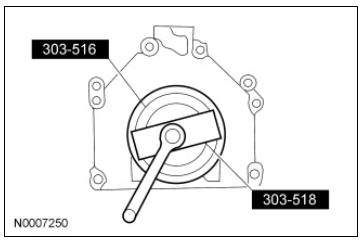


118. Tighten the 16 bolts in 3 stages, in the sequence shown.
    - Stage 1: Tighten to 2 Nm (18 lb-in).
    - Stage 2: Tighten to 20 Nm (177 lb-in).
    - Stage 3: Tighten an additional 60 degrees.

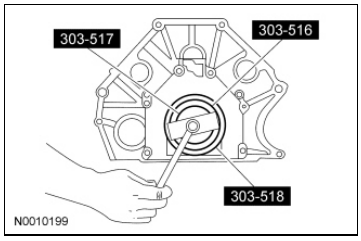


119. **NOTE:** Lubricate the inner lip of the crankshaft rear seal with clean engine oil.

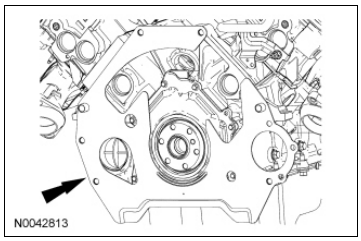
Using the 2 Crankshaft Rear Seal Installers, install a new crankshaft rear seal.



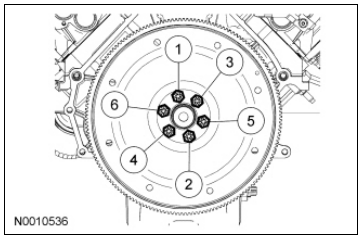
120. Using the 2 Crankshaft Rear Seal Installers and the Crankshaft Oil Slinger Installer, install the crankshaft rear oil slinger.



121. Install the spacer plate.

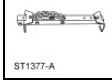


122. Position the flexplate and install the 6 bolts in the sequence shown.
    - Tighten to 80 Nm (59 lb-ft).



Engine

Special Tool(s)

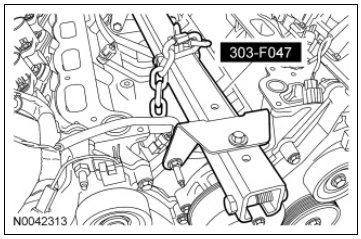
 ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent

Material

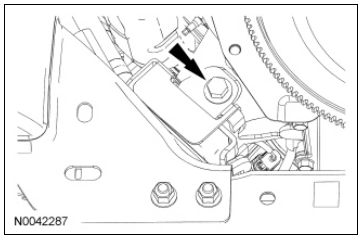
Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

1. Position the engine in the vehicle and remove the floor crane.

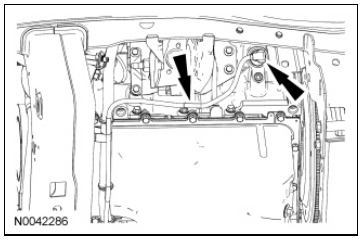
2. Remove the Modular Engine Lift Bracket.



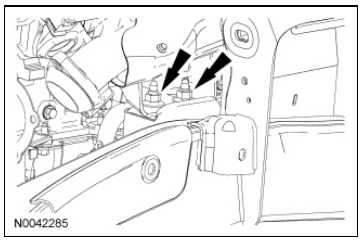
3. Install the LH engine support insulator through bolt.
   - Tighten to 103 Nm (76 lb-ft).



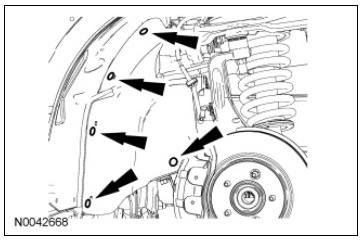
4. If equipped, attach the block heater wiring harness retainers and connect the block heater electrical connector.



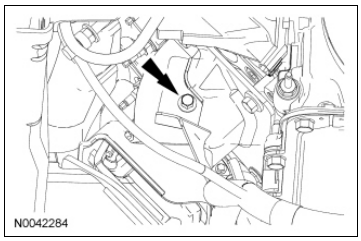
5. Install the 2 RH engine support insulator nuts.
    - Tighten to 90 Nm (66 lb-ft).



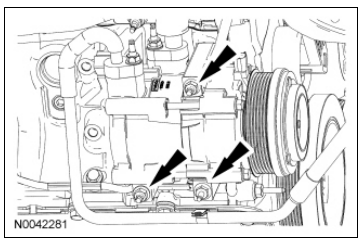
6. Position the RH splash shield and install the 5 pushpins.



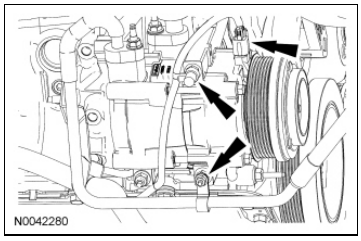
7. Position the battery cable bracket on the RH engine support insulator bracket and install the bolt.
    - Tighten to 15 Nm (133 lb-in).



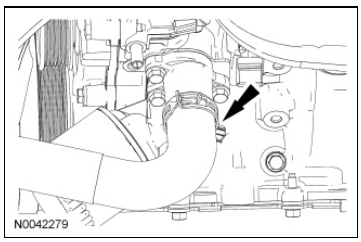
8. Position the A/C compressor and install the 2 nuts and the stud bolt.
    - Tighten to 25 Nm (18 lb-ft).



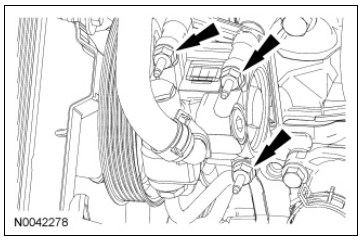
9. Position the A/C hose bracket and install the nut. Attach the wiring harness retainer and connect the A/C clutch electrical connector.
    - Tighten to 20 Nm (177 lb-in).



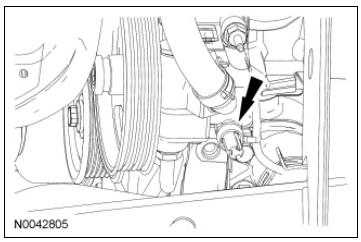
10. Connect the lower radiator hose to the oil filter adapter.



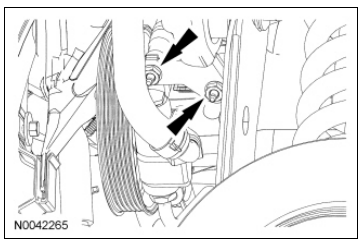
11. Position the power steering pump and install the 3 stud bolts.
    - Tighten to 25 Nm (18 lb-ft).



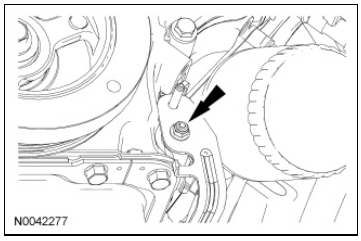
12. Attach the wiring harness retainer to the power steering pump stud bolt.



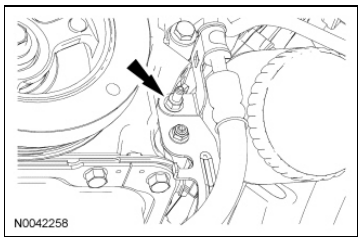
13. Position the wiring harness bracket and install the 2 nuts.
    - Tighten to 10 Nm (89 lb-in).



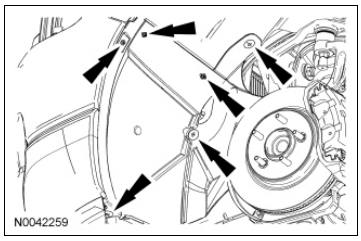
14. Position the wiring harness bracket and install the nut.
    - Tighten to 10 Nm (89 lb-in).



15. Position the power steering pressure hose bracket and install the nut.
    - Tighten to 10 Nm (89 lb-in).

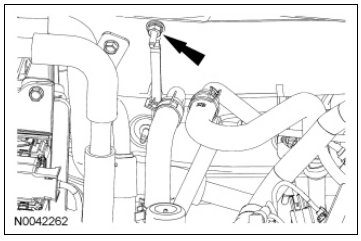


16. Position the inner fender splash shield and install the 3 pushpins and 3 screws.

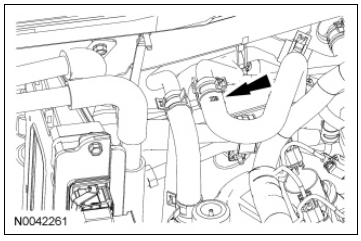


17. Install the transmission. For additional information, refer to Section 307-01B .

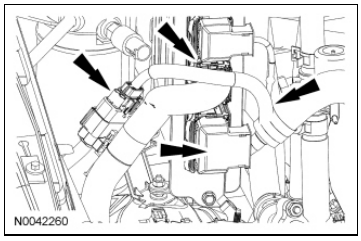
18. Position the ground wire on the cowl and install the nut.
    - Tighten to 12 Nm (106 lb-in).



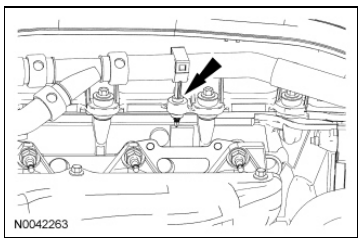
19. Connect the heater hose.



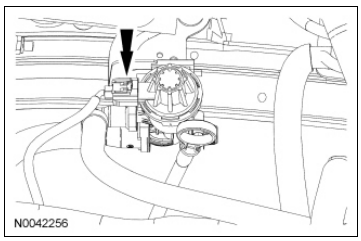
20. Attach the wiring harness pin-type retainer, and connect the 2 PCM electrical connectors and the in-line electrical connector.



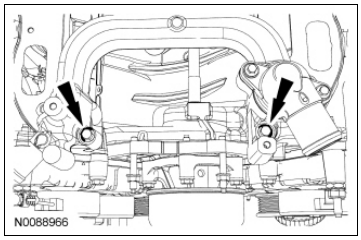
21. Attach the heater hose retainer to the RH valve cover.



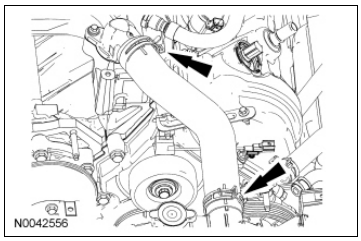
22. Connect the Evaporative Emission (EVAP) canister purge valve electrical connector.



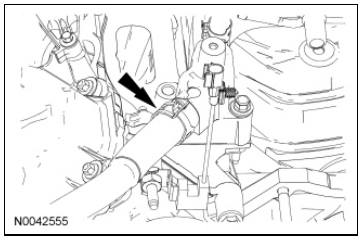
23. Position 2 new gaskets, the coolant crossover and install the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



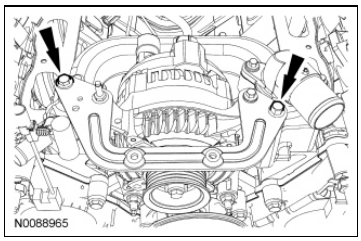
24. Install the upper radiator hose.



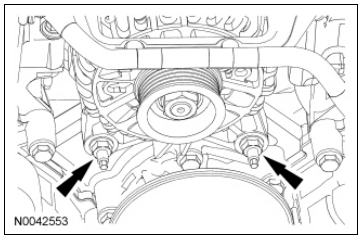
25. Connect the heater hose.



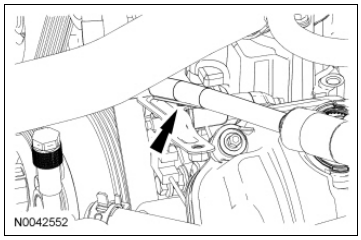
26. Position the alternator, alternator bracket and the wiring harness as an assembly and install the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



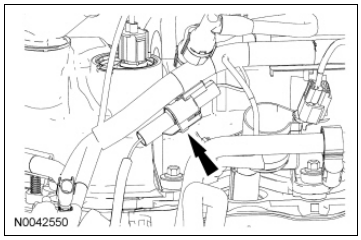
27. Tighten the 2 nuts
    - Tighten to 25 Nm (18 lb-ft).



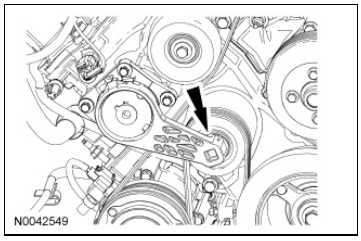
28. Attach the wiring harness retainer to the cooling fan wiring harness bracket.



29. Connect the electrical connector.

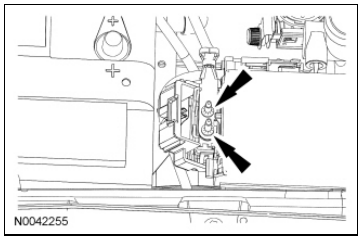


30. Rotate the accessory drive belt tensioner clockwise and install the accessory drive belt.



31. Install the cooling fan. For additional information, refer to Section 303-03 .

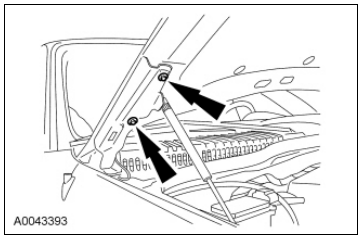
32. Connect the wiring harness terminals, install the 2 nuts and close the cover.
    - Tighten to 12 Nm (106 lb-in).



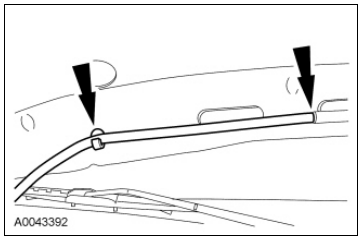
33. ***NOTICE:*** **If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.**

    Install the intake manifold. For additional information, refer to Intake Manifold in this section.

34. Position the hood and install the 4 bolts.
    - Tighten to 12 Nm (106 lb-in).



35. Connect the windshield washer hose.



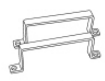
36. Fill the engine with clean engine oil.

37. Fill and bleed the cooling system. For additional information, refer to Section 303-03 .

38. Carry out the fluid level check for the transmission. For additional information, refer to Section 307-01B .

Cylinder Head

Special Tool(s)

 ST2806-A	Alignment Pins, Cylinder Head 303-1040 (SR-015486)
 ST2804-A	Compressor, Valve Spring 303-1039
 ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST2428-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
 ST2807-A	Locking Tool, Camshaft Phaser Sprocket 303-1046
 ST1377-A	Modular Engine Lift Bracket 303-F047 (014-00073) or equivalent
 ST1668-A	Remover/Installer, Cylinder Head 303-572 (T97T-6000-A)

General Equipment

Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada); or equivalent	WSS-M97B51-A1
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor	WSS-M2C930-A

Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Silicone Gasket Remover ZC-30	-

All cylinder heads

1. ***NOTICE:*** **Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore. Failure to follow this instruction may result in engine damage.**

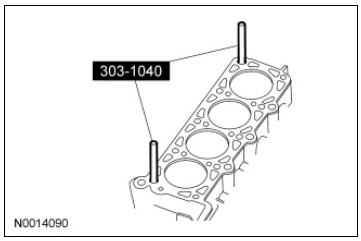
   NOTE: The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.

   NOTE: The cylinder head bolts must be discarded and new bolts installed. They are a tighten-to-yield design and cannot be reused.

   NOTE: Do not turn the crankshaft until instructed to do so.

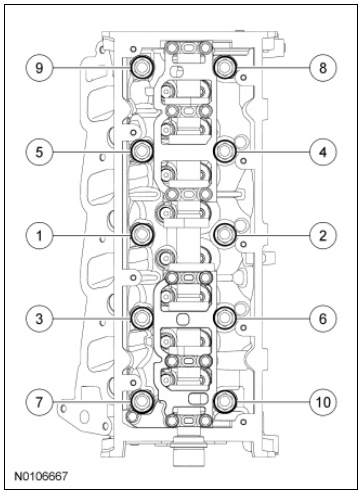
   NOTE: LH shown, RH similar.

   Using the Cylinder Head Alignment Pins, position the cylinder head gaskets and cylinder heads over the dowels and install the 20 cylinder head bolts loosely.

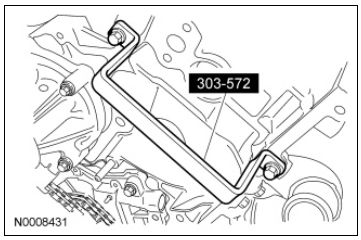


LH cylinder head

2. Tighten the 10 LH cylinder head bolts in 6 stages, in the sequence shown.
   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten an additional 90 degrees.
   - Stage 3: Loosen all 10 bolts a minimum of one full turn (360 degrees).
   - Stage 4: Tighten to 40 Nm (30 lb-ft).
   - Stage 5: Tighten an additional 90 degrees.
   - Stage 6: Tighten an additional 90 degrees.



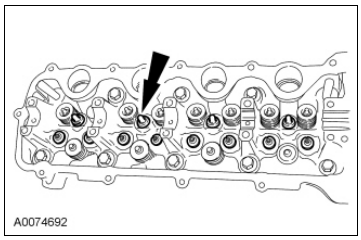
3. Remove the Cylinder Head Remover/Installer from the LH cylinder head.



4. **NOTE:** Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

   NOTE: The hydraulic lash adjusters must be installed in their original locations.

   Install the hydraulic lash adjusters into the LH cylinder head.

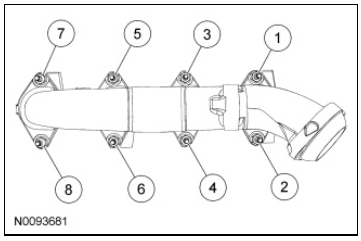


5. Remove the oil level indicator tube, install a new O-ring seal, and lubricate the O-ring seal with clean engine oil. Position the oil level indicator tube loosely in the engine block before installing the LH exhaust manifold.

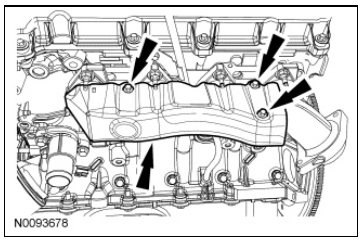
6. Clean and inspect the LH exhaust manifold. For additional information, refer to Section 303-00 .

7. Install 8 new LH exhaust manifold studs.
   - Tighten to 12 Nm (106 lb-in).

8. Position 2 new gaskets, the LH exhaust manifold and tighten the 8 new nuts in the sequence shown.
   - Tighten to 25 Nm (18 lb-ft).

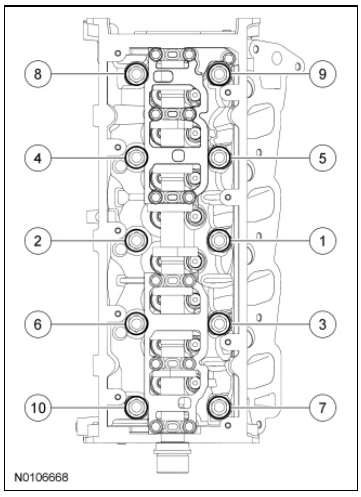


9. Position the LH exhaust manifold heat shield and install the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).

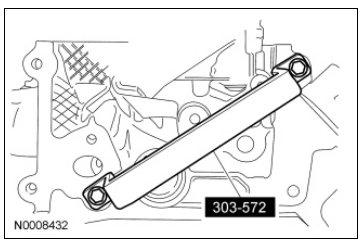


RH cylinder head

10. Tighten the 10 RH cylinder head bolts in 6 stages, in the sequence shown.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.
    - Stage 3: Loosen all 10 bolts a minimum of 1 full turn (360 degrees).
    - Stage 4: Tighten to 40 Nm (30 lb-ft).
    - Stage 5: Tighten an additional 90 degrees.
    - Stage 6: Tighten an additional 90 degrees.



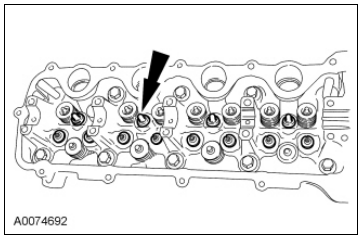
11. Remove the Cylinder Head Remover/Installer from the RH cylinder head.



12. **NOTE:** Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

NOTE: The hydraulic lash adjusters must be installed in their original locations.

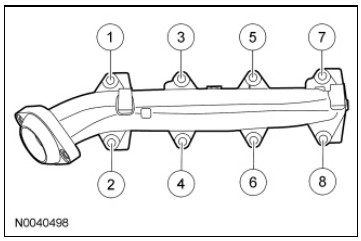
Install the hydraulic lash adjusters into the RH cylinder head.



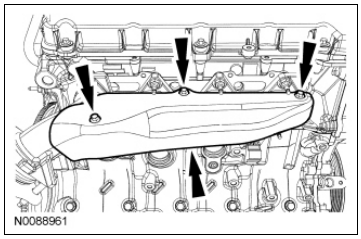
13. Clean and inspect the RH exhaust manifold. For additional information, refer to Section 303-00 .

14. Install 8 new RH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

15. Position 2 new gaskets, the RH exhaust manifold and tighten the 8 new nuts in the sequence shown.
    - Tighten to 25 Nm (18 lb-ft).



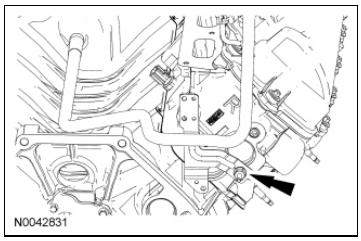
16. Position the RH heat shield and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).



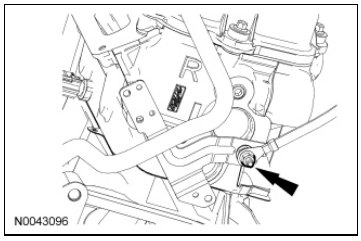
17. **NOTE:** Install new O-ring seals and lubricate the O-ring seals with clean engine coolant.

    Position the heater supply tube and the hose as an assembly and install the stud bolt.

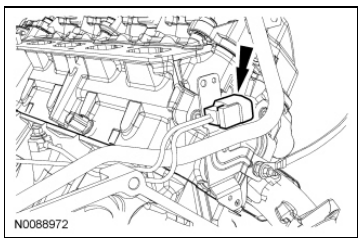
    - Tighten to 10 Nm (89 lb-in).



18. Position the ground strap and install the nut.
    - Tighten to 10 Nm (89 lb-in).



19. Attach the Knock Sensor (KS) electrical connector retainer.



All cylinder heads

20. **NOTE:** Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

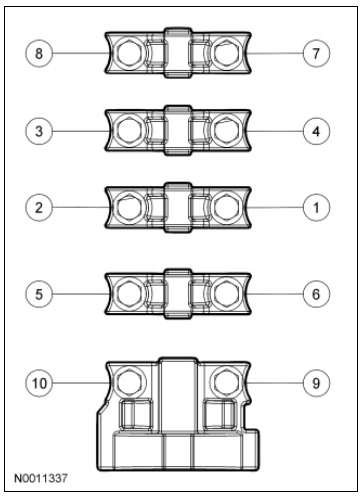
    Install the LH and RH camshafts.

21. **NOTE:** LH shown, RH similar.

    NOTE: Lubricate the camshaft bearing caps with clean engine oil.

    Install the LH and RH camshaft bearing caps in their original locations.

    - Position the front camshaft bearing cap.
    - Position the remaining camshaft bearing caps.
    - Install the 20 bolts loosely.
    - Tighten to 10 Nm (89 lb-in) in the sequence shown.

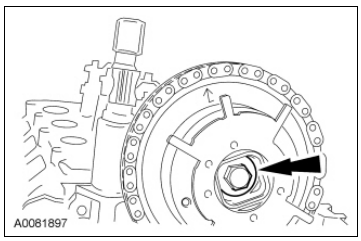


22. *NOTICE:* **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

    NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

NOTE: LH shown, RH similar.

Install the camshaft phaser sprockets and new camshaft phaser bolts finger-tight.



23. ***NOTICE:*** **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

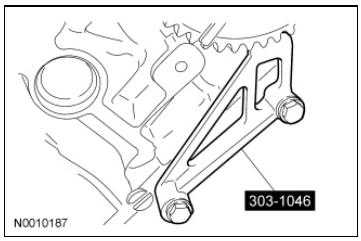
    NOTICE: **Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.**

    NOTICE: **Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

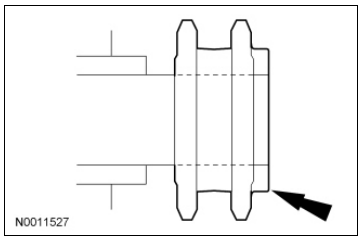
    NOTE: LH shown, RH similar.

    Using the Camshaft Phaser Sprocket Locking Tool, tighten the 2 camshaft phaser sprocket bolts in 2 stages.

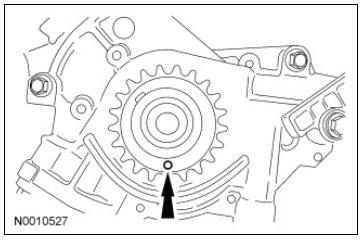
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten an additional 90 degrees.



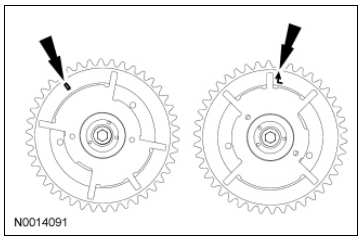
24. Install the crankshaft sprocket, making sure the flange faces forward.



25. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.



26. Rotate the camshaft sprockets to position the RH camshaft sprocket timing mark in the 11 o'clock position and the LH camshaft sprocket timing mark in the 12 o'clock position.



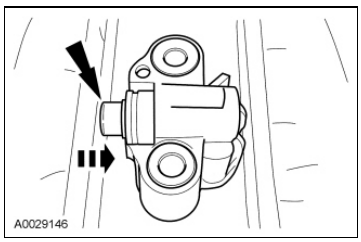
27. ***NOTICE:*** **If one or both tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. If cracks, tears, cuts or separation from the tensioner body, or permanent compression of the seal bead, is observed, install a new tensioner, or engine damage may occur.**

    Inspect the RH and LH timing chain tensioners.

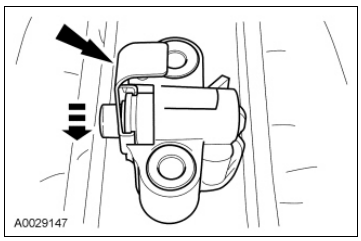
    - Install new tensioners, as necessary.

28. ***NOTICE:*** **Timing chain procedures must be followed exactly or damage to valves and pistons will result.**

    Compress the tensioner plunger, using a vise.

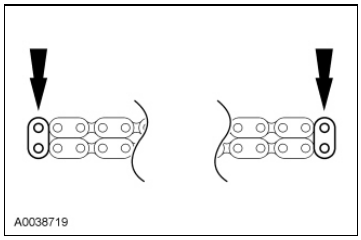


29. Install a retaining clip on the tensioner to hold the plunger in during installation.

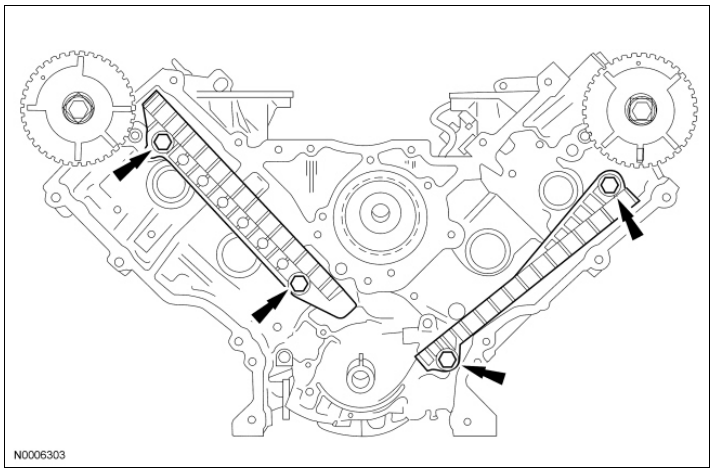


30. Remove the tensioner from the vise.

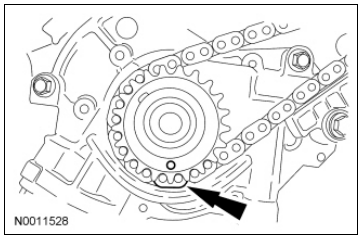
31. If the copper links are not visible, mark one link on one end and one link on the other end and use as timing marks.



32. Install the LH and RH timing chain guides and the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

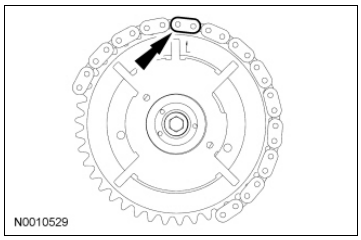


33. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



34. **NOTE:** Make sure the upper half of the timing chain is below the tensioner arm dowel.

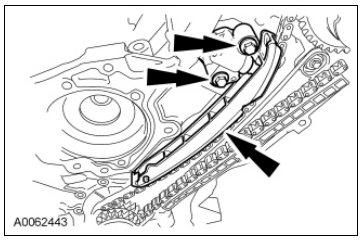
    Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.



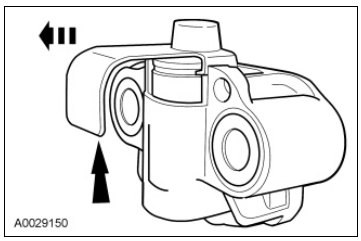
35. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

    Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and 2 bolts.

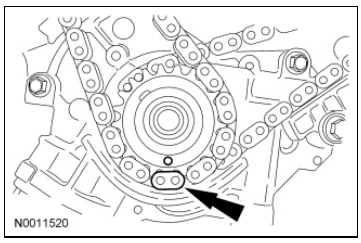
    - Tighten to 25 Nm (18 lb-ft).



36. Remove the retaining clip from the LH timing chain tensioner.



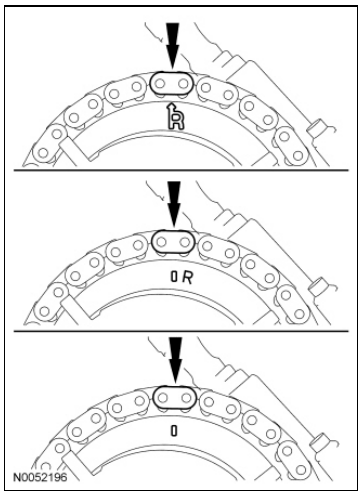
37. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.



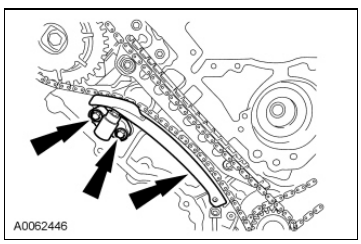
38. **NOTE:** The lower half of the timing chain must be positioned above the tensioner arm dowel.

    NOTE: The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

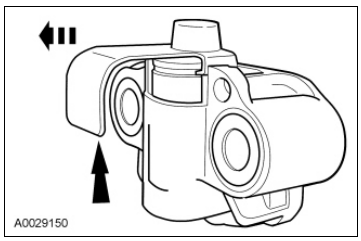
    Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.



39. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and 2 bolts.
    - Tighten to 25 Nm (18 lb-ft).

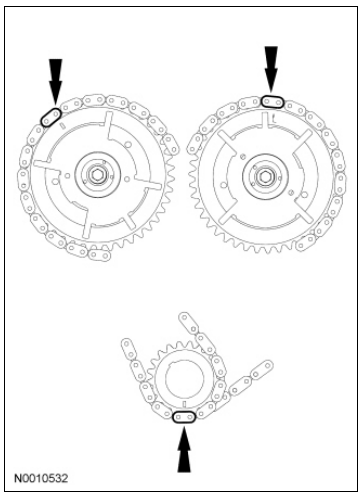


40. Remove the retaining clip from the RH timing chain tensioner.

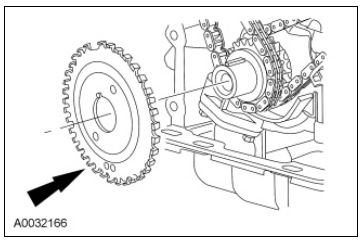


41. **NOTE:** The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

    As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.

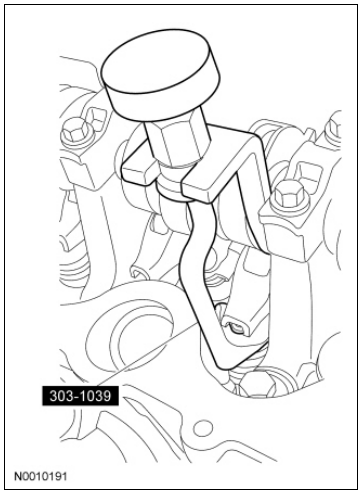


42. Install the crankshaft sensor ring on the crankshaft.



43. **NOTE:** Lubricate the roller followers with clean engine oil prior to installation.

    Using the Valve Spring Compressor, install all of the camshaft roller followers.

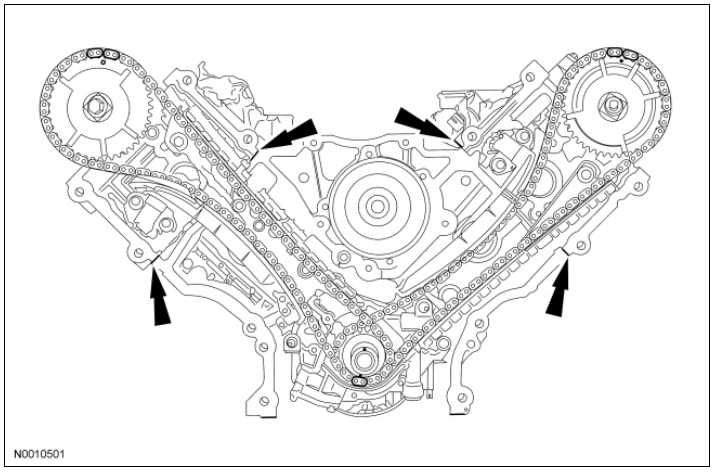


44. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

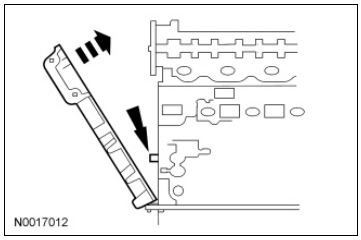
    NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

    NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

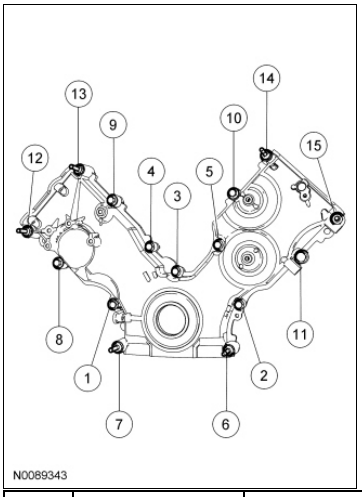
    Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface at the locations shown.



45. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the 15 fasteners finger-tight.

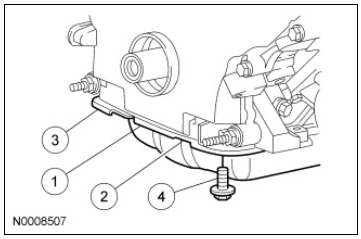


46. Tighten the 15 engine front cover fasteners in the sequence shown to 25 Nm (18 lb-ft).

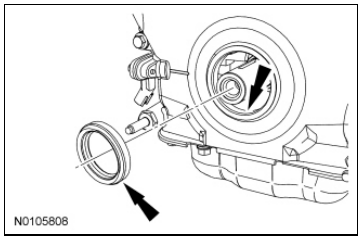


Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1

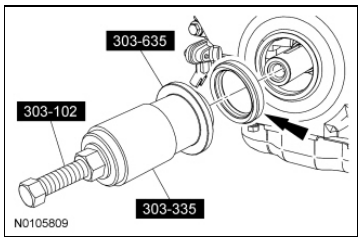
47. Loosely install the 4 bolts, then tighten the bolts in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 20 Nm (177 lb-in).
    - Stage 2: Tighten an additional 60 degrees.



48. Lubricate the engine front cover and the crankshaft seal inner lip with clean engine oil.

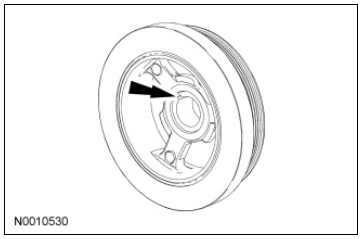


49. Using the Crankshaft Front Seal Installer, the Front Cover Seal Installer and the Crankshaft Vibration Damper Installer, install the crankshaft front oil seal into the engine front cover.

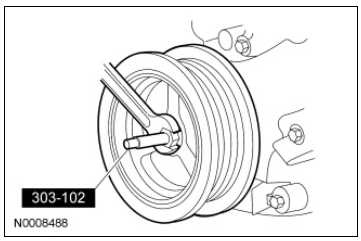


50. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep and silicone gasket remover. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

    Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.

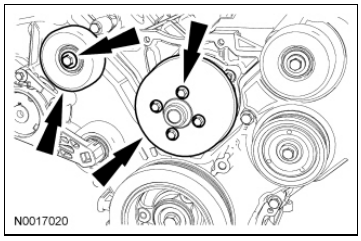


51. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.



52. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen 360 degrees.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

53. Install the RH side accessory drive belt idler pulley, the coolant pump pulley and the 5 bolts.
    - Tighten to 25 Nm (18 lb-ft).

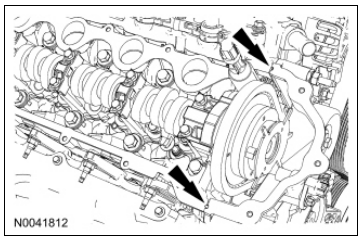


54. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

    Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

55. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

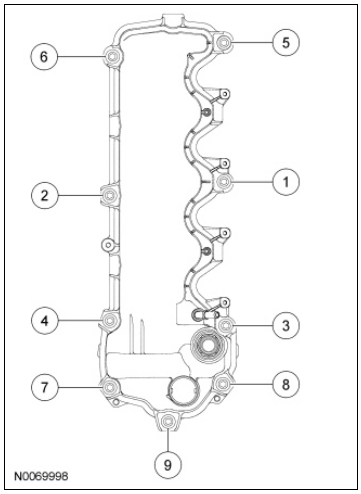
    Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



56. ***NOTICE:*** **Install the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

    Position the RH valve cover and gasket on the cylinder head and tighten the 9 bolts in the sequence shown.

    - Tighten to 10 Nm (89 lb-in).

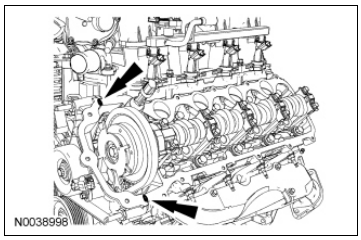


57. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

58. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

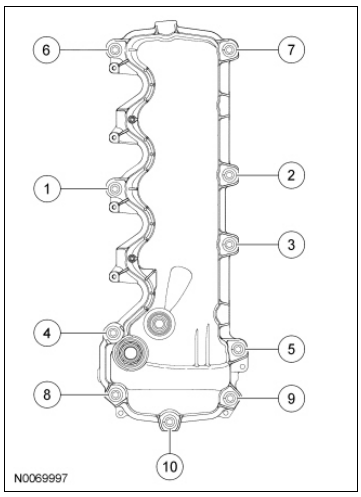
    Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.



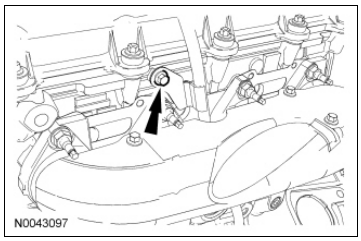
59. ***NOTICE:*** **Install the valve cover carefully, or the Variable Camshaft Timing (VCT) solenoid may be damaged.**

    Position the LH valve cover and gasket on the cylinder head and tighten the 10 bolts in the sequence shown.

    - Tighten to 10 Nm (89 lb-in).



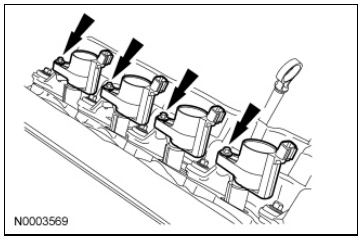
60. Position the oil level indicator tube and install the bolt.
    - Tighten to 10 Nm (89 lb-in).



61. **NOTE:** LH shown, RH similar.

    Install the 8 ignition coils and the 8 bolts.

    - Tighten to 6 Nm (53 lb-in).

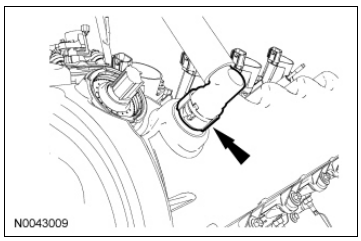


62. **NOTE:** Lubricate the oil filter gasket with clean engine oil.

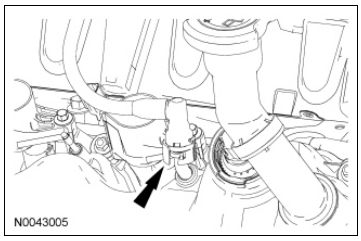
    Install a new oil filter.

    - Tighten the oil filter until the gasket makes contact, then use an oil filter strap wrench to tighten the filter an additional 270 degrees.

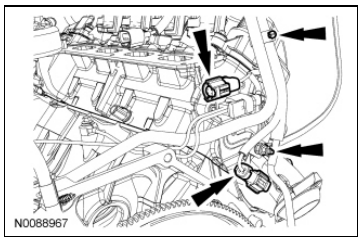
63. Connect the PCV hose to the LH valve cover.



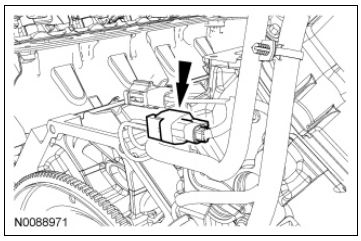
64. Connect the breather tube to the RH valve cover.



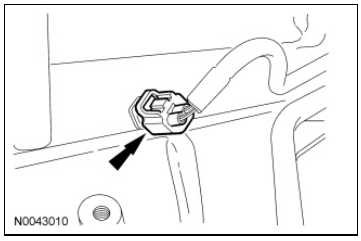
65. Position the engine wiring harness and attach the electrical connector and wiring harness retainers to the heater supply tube.



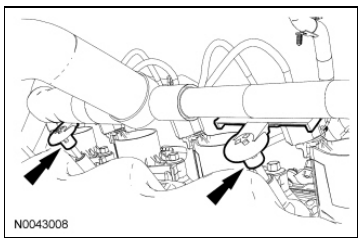
66. Connect the KS electrical connector.



67. Connect the Cylinder Head Temperature (CHT) sensor electrical connector.

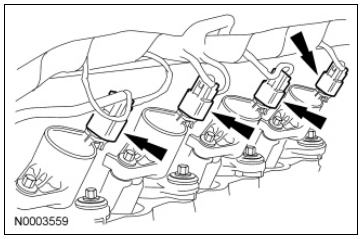


68. Attach the wiring harness retainers to the RH valve cover studs.

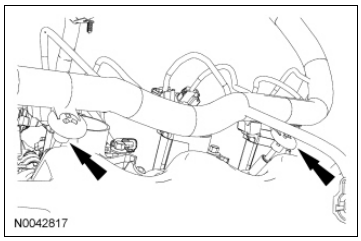


69. **NOTE:** RH shown, LH similar.

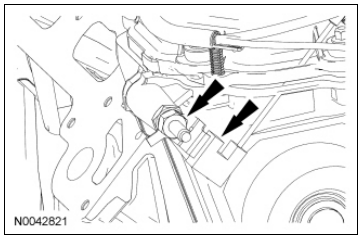
Connect the 4 RH and 4 LH ignition coil electrical connectors.



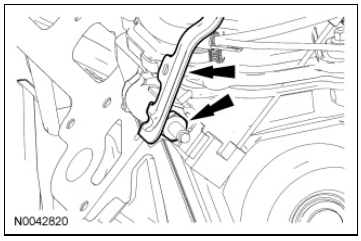
70. Attach the wiring harness retainers to the LH valve cover studs.



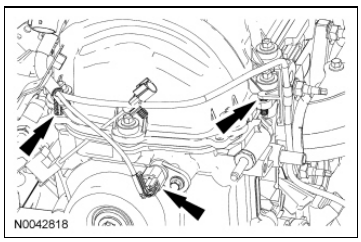
71. Position the LH radio interference capacitor and install the nut.
    - Tighten to 25 Nm (18 lb-ft).



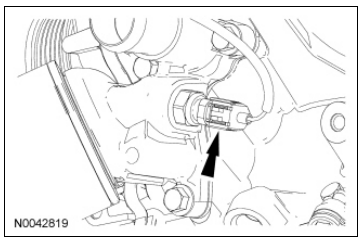
72. Position the cooling fan wiring harness and install the nut.
    - Tighten to 25 Nm (18 lb-ft).



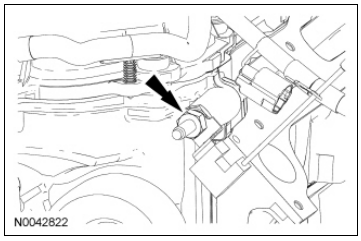
73. Connect the LH Camshaft Position (CMP) and attach the wiring harness retainers.



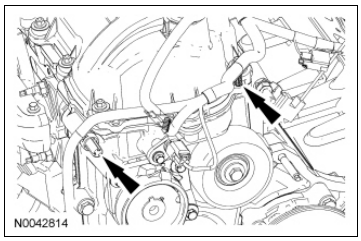
74. Connect the Engine Oil Pressure (EOP) sensor electrical connector.



75. Position the RH radio interference capacitor and install the nut.
    - Tighten to 25 Nm (18 lb-ft).

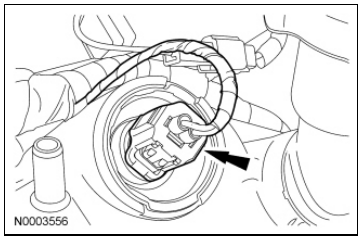


76. Attach the wiring harness retainers.

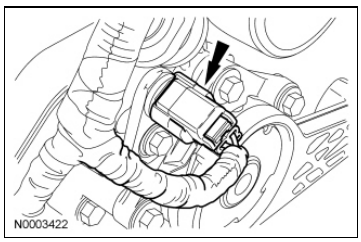


77. **NOTE:** RH shown, LH similar.

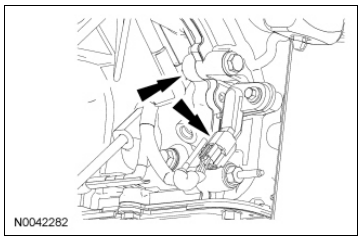
    Connect the RH and LH Variable Camshaft Timing (VCT) solenoid electrical connectors.



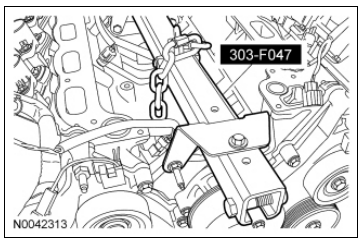
78. Connect the RH CMP sensor electrical connector.



79. Connect the Crankshaft Position (CKP) sensor electrical connector and attach the wiring harness retainer.



80. Install the Modular Engine Lift Bracket.



81. Using a suitable floor crane, remove the engine from the engine stand.

82. Install the engine. For additional information, refer to Engine in this section.

Material

Item	Specification	Fill Capacity
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada)	WSS-M97B51-A1	4.0L SOHC without auxiliary heater - 11.5L (12.2 qt), 4.0L SOHC with auxiliary heater - 13.2L (14 qt), 4.6L (3V) without auxiliary heater - 13.2L (14 qt), 4.6L (3V) with auxiliary heater - 14.9L (15.7 qt)
Motorcraft® Premium Cooling System Flush VC-1	ESR-M14P7-A	-

General Specifications

Item	Specification
Pressure Tests	
Complete cooling system maximum pressure	152 kPa (22 psi)
Pressure relief cap	124-152 kPa (18-22 psi)
Radiator out of vehicle	138 kPa (20 psi)
Thermostat Opening Temperature 4.0L SOHC	
Starts to open	90-94°C (194-201°F)
Fully open	106°C (223°F)
Thermostat Opening Temperature 4.6L (3V)	
Starts to open	87-91°C (189-196°F)
Fully open	100°C (212°F)

Torque Specifications

Description	Nm	lb-ft	lb-in

Block heater screw	4	-	35
Coolant crossover manifold assembly bolts	10	-	89
Coolant expansion tank bolts	6	-	53
Coolant pump bolts (4.0L)	10	-	89
Coolant pump bolts (4.6L)	25	18	-
Coolant pump pulley bolts	25	18	-
Fan-to-electronic fan clutch bolts	7	-	62
Fan clutch nut	55	41	-
Fan shroud bolts	7	-	62
Fan wiring harness bracket bolt	7	-	62
Generator bracket-to-coolant crossover bolts (4.6L)	10	-	89
Generator-to-engine block nuts (4.6L)	25	18	-
Power steering fluid reservoir bolt	10	-	89
Radiator support bracket-to-A/C condenser bolts	12	-	106
Radiator support bracket-to-radiator bolts	12	-	106
Radiator support bracket-to-radiator support bolts	15	-	133
Thermostat housing bolts (4.6L)	10	-	89
Thermostat housing bolts (4.0L)	11	-	97
Thermostat housing cover bolts	10	-	89

Engine Cooling

NOTICE: **All vehicles are filled with Motorcraft® Premium Gold Engine Coolant. Do not mix coolant types. Mixing coolant types degrades the coolant's corrosion protection.**

NOTE: If cooling system stop leak pellets are used, Motorcraft® Premium Gold Engine Coolant may darken from yellow to golden tan.

The engine cooling system consists of the following:

- Block heater
- Fan blade and clutch
- Fan shroud
- Coolant expansion tank
- Thermostat
- Thermostat housing assembly (4.0L SOHC)
- Coolant pump
- Radiator
- Radiator cap
- Radiator hose
- Heater tube assembly (4.0L SOHC)

The radiator allows excess engine heat to be transferred to the air.

The coolant pump forces coolant to flow through the cooling system.

The thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

The radiator cap serves as the location for filling the cooling system and provides for a controlled pressure in the cooling system. When the pressure reaches a predetermined level, a valve in the radiator cap opens to allow coolant to flow into the coolant expansion tank. As the engine cools, a valve in the radiator cap allows for coolant to flow from the coolant expansion tank back into the radiator.

The coolant expansion tank holds surplus coolant, allows for coolant expansion and replenishes coolant to the cooling system. It is equipped with a non-pressurized cap which allows coolant to be added to keep it filled to prescribed levels.

The electronically controlled fan clutch is controlled by the PCM based upon requests for airflow to cool the engine, transmission and A/C condenser. If no cooling is required, the electronics permit the fan to spin at a slower speed yielding improved fuel economy.

The optional block heater keeps the engine coolant warm during cold weather. The electrical heating element is installed in a core plug opening and uses a standard 110V electrical supply.

Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the coolant expansion tank.

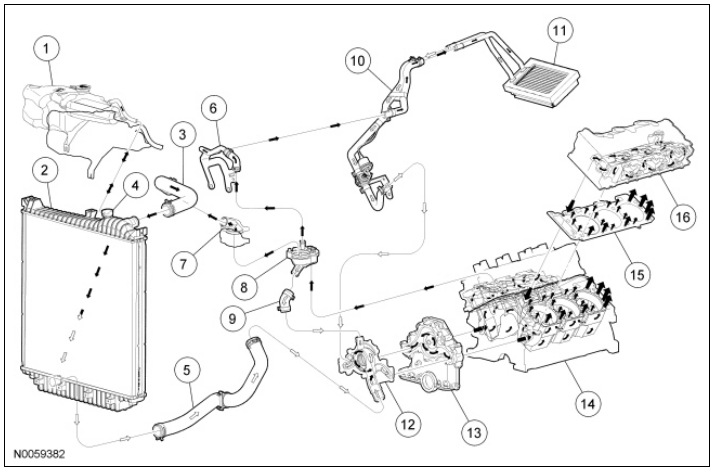
When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- add Motorcraft® Premium Gold Engine Coolant. Do not mix coolant types.
- do not add orange-colored Motorcraft® Specialty Orange Engine Coolant. Mixing coolants may degrade the coolant's protection rating.
- do not add alcohol or methanol or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- do not mix with recycled coolant. Use of such a coolant may harm the engine and cooling system components.

Coolant Flow Diagram, 4.0 SOHC Without Oil Cooler and Without Auxiliary Heater

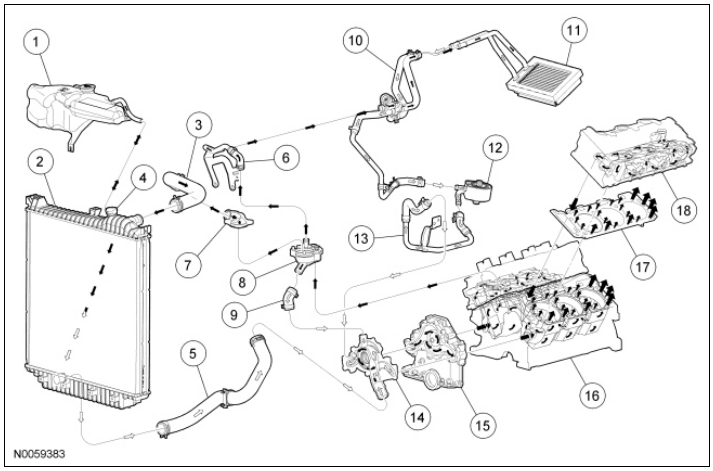
NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	8A080	Coolant expansion tank
2	8005	Radiator
3	8620	Upper radiator hose
4	8100	Radiator cap
5	8286	Lower radiator hose
6	18696	Heater inlet tube assembly
7	8592	Thermostat housing outlet
8	8592	Thermostat housing
9	8548	Coolant bypass hose
10	18C266	Heater hose assembly
11	18476	Heater core
12	8501	Coolant pump
13	6019	Engine front cover
14	6010	Engine block
15	6051	Cylinder head gasket
16	6049	Cylinder head

Coolant Flow Diagram 4.0L SOHC With Oil Cooler and Without Auxiliary Heater

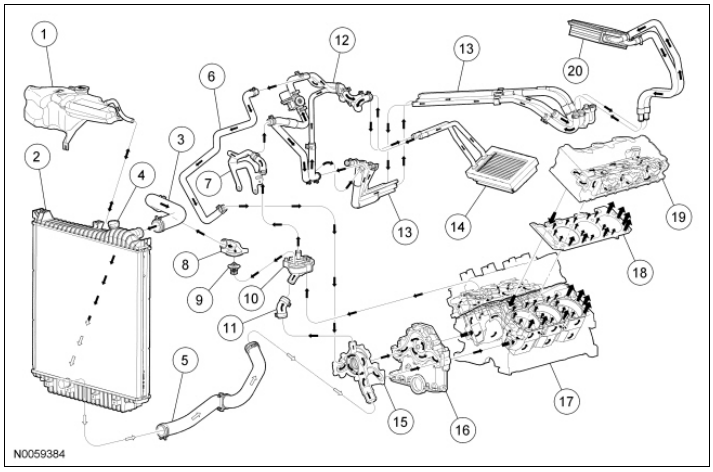
NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	8A080	Coolant expansion tank
2	8005	Radiator
3	8620	Upper radiator hose
4	8100	Radiator cap
5	8286	Lower radiator hose
6	18696	Heater inlet tube assembly
7	8592	Thermostat housing outlet
8	8592	Thermostat housing
9	8548	Coolant bypass hose
10	18C266	Heater hose assembly
11	18476	Heater core
12	6A642	Oil cooler
13	6N867	Oil cooler outlet hose
14	8501	Coolant pump
15	6019	Engine front cover
16	6010	Engine block
17	6051	Cylinder head gasket
18	6049	Cylinder head

Coolant Flow Diagram 4.0L SOHC Without Oil Cooler and With Rear Heater

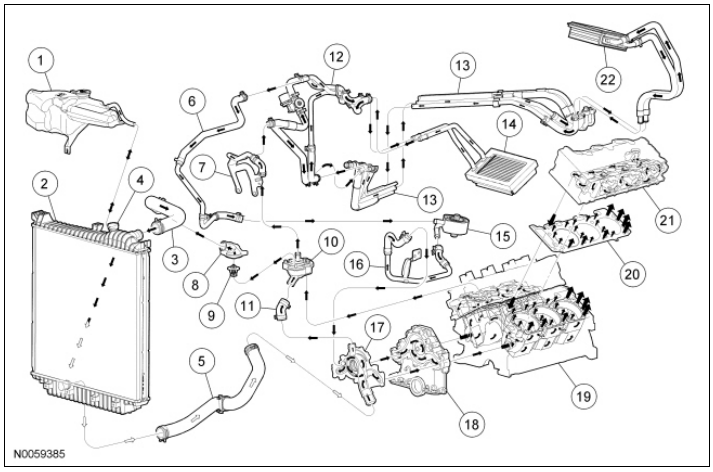
NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	8A080	Coolant expansion tank
2	8005	Radiator
3	8620	Upper radiator hose
4	8100	Radiator cap
5	8286	Lower radiator hose
6	18472	Heater core outlet hose
7	18696	Heater core inlet tube assembly
8	8592	Thermostat housing outlet
9	8575	Thermostat
10	8592	Thermostat housing
11	8548	Coolant bypass hose
12	18B402	Heater core hose and tube assembly
13	18K470	Auxiliary heater and A/C tube assembly
14	18476	Heater core
15	8501	Coolant pump
16	6019	Engine front cover
17	6010	Engine block
18	6051	Cylinder head gasket
19	6049	Cylinder head
20	18476	Auxiliary heater core

Coolant Flow Diagram 4.0L SOHC With Oil Cooler and With Auxiliary Heater

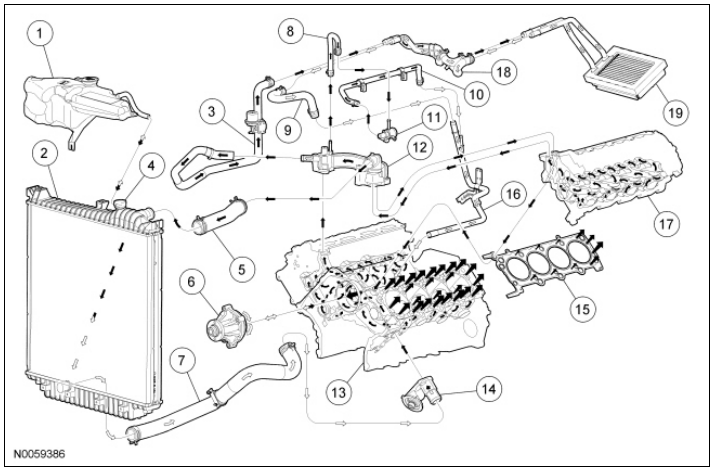
NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	8A080	Coolant expansion tank
2	8005	Radiator
3	8620	Upper radiator hose
4	8100	Radiator cap
5	8286	Lower radiator hose
6	18472	Heater core outlet hose
7	18696	Heater core inlet tube assembly
8	8592	Thermostat housing outlet
9	8575	Thermostat
10	8592	Thermostat housing
11	8548	Coolant bypass hose
12	18B402	Heater core hose and tube assembly
13	18K470	Auxiliary heater and A/C tube assembly
14	18476	Heater core
15	6A642	Oil cooler
16	6N867	Oil cooler outlet hose
17	8501	Coolant pump
18	6019	Engine front cover
19	6010	Cylinder block
20	6051	Cylinder head gasket
21	6049	Cylinder head
22	18476	Auxiliary heater core

Coolant Flow Diagram 4.6L (3V) Without Auxiliary Heater

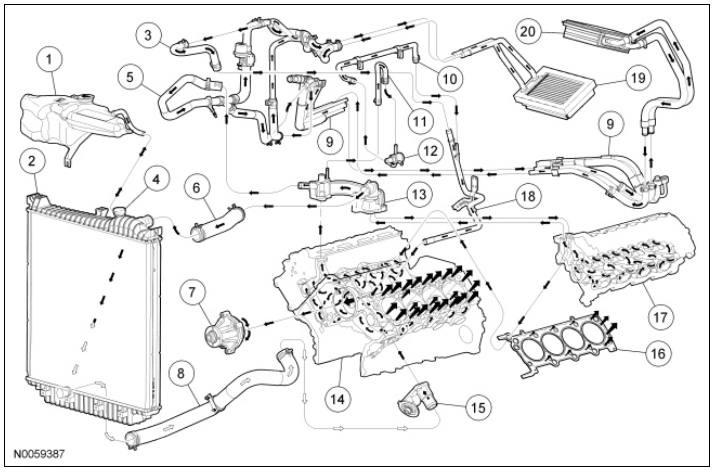
NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	8A080	Coolant expansion tank
2	8005	Radiator
3	18472	Heater core inlet hose
4	8100	Radiator cap
5	8620	Upper radiator hose
6	8501	Coolant pump
7	8286	Lower radiator hose
8	18465	Heated PCV fitting inlet hose
9	18472	Heater core outlet hose
10	18465	Heated PCV fitting outlet hose
11	9A474	Heated PCV fitting
12	8C368	Coolant crossover manifold assembly
13	6010	Cylinder block
14	6881	Oil filter adapter
15	6051	Cylinder head gasket
16	18663	Heater core outlet tube assembly
17	6049	Cylinder head
18	18C553	Heater core hose assembly
19	18476	Heater core

Coolant Flow Diagram 4.6L (3V) With Auxiliary Heater

NOTE: Black arrows indicate hot, white arrows indicate cold.



Item	Part Number	Description
1	8A080	Coolant expansion tank
2	8005	Radiator
3	18472	Heater core outlet hose
4	8100	Radiator cap
5	18K470	Heater core hose assembly
6	8620	Upper radiator hose
7	8501	Coolant pump
8	8286	Lower radiator hose
9	18K470	Auxiliary heater and A/C tube assembly
10	18465	Heated PCV fitting outlet hose
11	18465	Heated PCV fitting inlet hose
12	9A474	Heated PCV fitting
13	8C368	Coolant crossover manifold assembly
14	6010	Cylinder block
15	6881	Oil filter adapter
16	6051	Cylinder head gasket
17	6049	Cylinder head
18	18663	Heater core outlet tube
19	18476	Heater core
20	18476	Auxiliary heater core

Engine Cooling

Special Tool(s)

 ST1720-A	Coolant/Battery Refractometer 023-00164 or equivalent
 ST1474-A	Pressure Test Kit 014-R1072 or equivalent
 ST3254-A	UViewÂ® Combustion Leak Tester UVU560000-R or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware or equivalent scan tool

Material

Item	Specification
MotorcraftÂ® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada)	WSS-M97B51-A1

Principles of Operation

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. The coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

The coolant expansion tank holds surplus coolant, allows for coolant expansion and replenishes coolant to the cooling system. It is equipped with a non-pressurized cap which allows coolant to be added to the tank to keep it filled to prescribed levels.

The cooling fan draws air through the radiator to help cool the system coolant as it passes through the radiator.

The thermostat monitor is a function of the PCM and is designed to verify correct thermostat operation. The monitor will be executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a malfunction occurs, DTC P0125 or P0128 is set, and the Malfunction Indicator Lamp (MIL) will be illuminated.

For engine specific information, refer to Engine Cooling in the Description and Operation portion of this

section.

Inspection and Verification

⚠ WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

NOTICE: **The engine cooling system is filled with MotorcraftÂ® Premium Gold Engine Coolant. Do not mix coolant types. Mixing coolant types degrades the corrosion protection of MotorcraftÂ® Premium Gold Engine Coolant. Failure to follow these instructions may result in engine or cooling system damage.**

1. Verify the customer concern.
2. Visually check the engine coolant level at the coolant expansion tank when the system is cold.
3. Make sure the pressure relief cap is installed correctly.
4. Record any cooling system DTCs retrieved. Refer to the PCM DTC Chart in this section for DTC descriptions.
5. **NOTE:** Take note of any coolant odor or steam coming from cooling system components.

   If the system coolant is filled correctly and no DTCs associated with fail-safe cooling are retrieved, verify the customer's concern by operating the engine to duplicate the condition.
6. **NOTE:** Refer to the coolant flow diagram in the Description and Operation Engine Cooling portion of this section.

   Inspect to determine if any of the following mechanical or electrical concerns apply.

Visual Inspection Chart

Mechanical	Electrical
• Leaks or weeps at: ♦ Hoses ♦ Tubes ♦ Clamp joints ♦ Gaskets ♦ O-rings ♦ Thermostat housing ♦ Radiator ♦ Pressure relief cap ♦ Coolant pump ♦ Heater core (wet floor or coolant odor in vehicle) ♦ Heater control valve	• Inoperative or damaged: ♦ Electronically actuated fan clutch ♦ Electronically actuated fan clutch controller ♦ Wiring, connectors, relays or modules ♦ Engine Coolant Temperature (ECT) sensor (4.0L SOHC) ♦ Cylinder Head Temperature (CHT) sensor (4.6L [3V]) ♦ Mass Air Flow (MAF) sensor ♦ Vehicle Speed Sensor (VSS)

♦ Coolant crossover manifold assembly (4.6L [3V]) ♦ Oil cooler ♦ Coolant expansion tank ♦ Cylinder block core plugs ♦ Cylinder head core plugs ♦ Block heater (if equipped)	

Visual Inspection Chart

Mechanical	Electrical
• Cracked or damaged: ♦ Hoses ♦ Tubes ♦ Hose clamps ♦ Heater control valve ♦ Thermostat housing ♦ Radiator ♦ Pressure relief cap ♦ Cooling fan ♦ Fan clutch ♦ Coolant pump ♦ Coolant expansion tank ♦ Oil cooler ♦ Coolant crossover manifold assembly (4.6L [3V]) ♦ Cylinder block core plugs ♦ Cylinder head core plugs ♦ Block heater (if equipped) • Restricted airflow through the A/C condenser/radiator • Drive belt loose, worn or installed incorrectly • Broken or weak drive belt tensioner • Excessive white or light gray exhaust smoke (may have burnt coolant odor) • Coolant in engine oil • Engine oil in coolant • Coolant in automatic transmission fluid • Automatic transmission fluid in coolant	â

7. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary. Test the system for normal operation.

8. Inspect the coolant condition in the following sequence:
    1. Inspect the coolant color.
        - ♦ If MotorcraftÂ® Premium Gold Engine Coolant has a clear or pale yellow color, this indicates higher water content than required. Test the engine coolant freezing point range with the Coolant/Battery Refractometer. The freezing point should be in the range -45Â°C to -23Â°C (-49Â°F to -9Â°F). If the vehicle is driven in cold climates less than -36Â°C (-33Â°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50

ethylene glycol to distilled water.
- A pale green color indicates incorrect coolant (green in color) may have been added to the system. Use of incorrect (green in color) coolant degrades the corrosion protection of MotorcraftÂ® Premium Gold Engine Coolant. Flush the system and refill with the correct mixture of distilled water and MotorcraftÂ® Premium Gold Engine Coolant.
- **NOTE:** If cooling system stop leak pellets are used, MotorcraftÂ® Premium Gold Engine Coolant may darken from yellow to golden tan.

  Dark brown could indicate a commercially available stop leak may have been used. Flush the system and refill with the correct mixture of distilled water and MotorcraftÂ® Premium Gold Engine Coolant.
- A light or reddish brown color indicates that rust may be present in the cooling system. Flush the system and refill with the correct mixture of distilled water and MotorcraftÂ® Premium Gold Engine Coolant.
- An iridescent sheen on top of the coolant could indicate a trace of oil is entering the system. For information on engine diagnosis, refer to Section 303-00 .
- A milky brown color may indicate that engine oil is entering the cooling system. Pressure test the cooling system. Refer to component tests in this section. If engine oil is suspected, the cause of the leak may be internal to the engine. Refer to Section 303-00 .
- A red, orange or light green colored sheen on top of the coolant may indicate that transmission fluid is entering the cooling system. The cause may be a leaky radiator. Pressure test the cooling system. Refer to the component tests in this section.

2. If the engine coolant appearance is acceptable, test the engine coolant freezing point range with the Coolant/Battery Refractometer. The freezing point should be in the range -45Â°C to -23Â°C (-49Â°F to -9Â°F). If the vehicle is driven in cold climates less than -36Â°C (-33Â°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
   - Maximum coolant concentration is 60/40 for cold weather areas.
   - Minimum coolant concentration is 40/60 for warm weather areas.
3. Adjust coolant range and level if necessary:
   - If coolant is low, add specified coolant mixture only.
   - If the engine coolant tests too weak, remove some of the engine coolant and add undiluted engine coolant until the readings are within acceptable levels.
   - If the engine coolant tests strong, remove some of the engine coolant and add distilled water until the readings are within acceptable levels.

9. If an obvious cause for an observed or reported concern is found, correct the cause and test the system for normal operation before proceeding to the next step.

10. **NOTE:** Make sure to use the latest scan tool software release.

    If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

11. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

    If the scan tool does not communicate with the VCM :

    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM .
    - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

12. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to Section 418-00 to diagnose no response from the PCM.

13. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
    - If the network test passes, retrieve and record continuous memory DTCs.

14. Clear the continuous DTCs and carry out the self-test diagnostics PCM.

15. If the DTCs recovered are related to the concern, go to the PCM DTC Chart. For all other DTCs, refer to Section 419-10 .

16. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

PCM DTC Chart

DTC	Description	Action
P0217	Engine Coolant Overtemperature Condition	GO to Pinpoint Test B .
P1285	Cylinder Head Overtemperature Condition	GO to Pinpoint Test B .
P1299	Cylinder Head Overtemperature Protection Active	GO to Pinpoint Test B .
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	GO to Pinpoint Test C .
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	GO to Pinpoint Test C .
P0480 P0481 P0482	Fan 1, 2 or 3 Control Circuit, Respectively	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
All Other DTCs	â	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: Loss of Coolant

Normal Operation

The engine cooling system is a closed system that provides for coolant expansion and contraction and also changes in pressure as coolant warms and cools with engine operation. Various gaskets, seals, hoses and clamps are used to contain coolant within the cooling system and keep other fluids and contaminants from entering the cooling system.

Coolant loss can be attributed to either external or internal leaks anywhere within the cooling system.

For vehicle/engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

This pinpoint test is intended to diagnose the following:

- Coolant hoses or tubes
- Hose clamps
- Thermostat O-ring seal or gasket
- Coolant pump O-ring seal or gasket
- Thermostat housing
- Heater control valve
- Radiator
- Transmission fluid cooler (in radiator)
- Pressure relief cap
- Coolant pump leaking from weep hole
- Heater core
- Coolant crossover manifold assembly (4.6L [3V])
- Engine gaskets
- Oil cooler
- Coolant expansion tank
- Cylinder block core plugs
- Cylinder head core plugs
- Block heater (if equipped)
- Engine Coolant Temperature (ECT) sensor (4.0L SOHC)

PINPOINT TEST A: LOSS OF COOLANT

⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

Test Step	Result / Action to Take
A1 CARRY OUT INSPECTION AND VERIFICATION	
• Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**Yes** REPAIR as needed. TEST the system for normal operation. **No** GO to A2 .
A2 CHECK THE ENGINE COOLANT LEVEL	
	Yes GO to A3 .

NOTE: Allow the engine to cool before checking the engine coolant level. • Ignition OFF. • Visually inspect the engine coolant level at the coolant expansion tank. • **Is the engine coolant level within specifications?**	**No** ADJUST the engine coolant level as necessary. GO to A3 .
A3 PRESSURE TEST THE ENGINE COOLING SYSTEM	
• Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section. • **Does the engine cooling system leak externally?**	**Yes** REPAIR or INSTALL new components. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK THE PRESSURE RELIEF CAP	
• Carry out the pressure relief cap pressure test. Refer to Component Test, Pressure Relief Cap Pressure Test in this section. • **Is the pressure relief cap OK?**	**Yes** GO to A5 . **No** INSTALL a new pressure relief cap. TEST the system for normal operation.
A5 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK	
• Inspect the engine coolant in the coolant expansion tank for signs of engine oil or transmission fluid. • **Is engine oil or transmission fluid evident in the coolant?**	**Yes** If engine oil is evident, GO to Section 303-00 for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate section in Group 307 for the procedure. TEST the system for normal operation. **No** GO to A6 .
A6 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT	
• Remove the oil level indicators from the engine and the transmission. • **Is coolant evident in the oil or transmission fluid?**	**Yes** If coolant is in the engine oil, GO to Section 303-00 . If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate section in Group 307 for the procedure. **No** GO to A7 .
A7 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES	

• **NOTE:** Use UViewÂ® Combustion Leak Tester part number UVU560000-R or equivalent. • Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases. • **Are combustion gases present?**	**Yes** GO to Section 303-00 for engine diagnosis. **No** The cooling system is operational.

Pinpoint Test B: The Engine Overheats

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. The coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Engine overheating generally occurs when there is a disruption in the ability to control either coolant flow at the correct rate, the inability to transfer heat from the engine through the coolant (including low coolant) or an inability to transfer engine generated heat to the outside air through the radiator.

For engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

- DTC P0217 (Engine Coolant Overtemperature Condition) â Indicates an engine overheat condition was detected by the engine temperature sensor Cylinder Head Temperature (CHT) sensor [4.6L (3V)] or Engine Coolant Temperature (ECT) sensor [4.0L SOHC]).
- DTC P1285 (Cylinder Head Overtemperature Condition) â Indicates an engine overheat condition was sensed by the CHT sensor.
- DTC P1299 (Cylinder Head Overtemperature Protection Active) â Indicates an engine overheat condition was detected by the CHT sensor. A failure mode effects management strategy called fail-safe cooling was activated to cool the engine.

This pinpoint test is intended to diagnose the following:

- Low coolant level
- External engine coolant leak
- Airlock in system
- Pressure relief cap installation
- Restricted airflow through the A/C condenser/radiator
- Internal engine coolant leak
- Coolant condition/concentration
- Accessory drive components
- Non-OEM engine enhancement components

- Cooling fan blade
- Cooling fan clutch
- ECT indicator system (gauge)
- ECT sensor (4.0L SOHC)
- CHT sensor (4.6L [3V])
- Heater core
- Coolant pump
- Coolant flow restriction

PINPOINT TEST B: THE ENGINE OVERHEATS

⚠ WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

Test Step	Result / Action to Take
B1 CARRY OUT INSPECTION AND VERIFICATION	
• Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**Yes** REPAIR as needed. TEST the system for normal operation. **No** GO to B2 .
B2 CHECK FOR DTCs	
• Check for DTC P0217, P1285 or P1299. • **Is DTC P0217, P1285 or P1299 present?**	**Yes** GO to B3 . **No** Actual engine overheating has not been verified. CHECK the ECT gauge operation. REFER to Section 413-01 . If any other DTCs are retrieved, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
B3 CHECK FOR AN AIRFLOW OBSTRUCTION	
• Check the radiator or A/C condenser for an external obstruction such as leaves or cardboard. • **Is an obstruction present?**	**Yes** REMOVE the obstruction. TEST the system for normal operation. **No** GO to B4 .
B4 CHECK THE ENGINE COOLANT LEVEL	
NOTE: Allow the engine to cool before checking the coolant level. • Ignition OFF.	**Yes** GO to B5 . **No** ADJUST the engine coolant level as necessary. GO

• Visually check the engine coolant level in the coolant expansion tank. • **Is the engine coolant level within specification?**	to B5 .
B5 PRESSURE TEST THE ENGINE COOLING SYSTEM	
• Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section. • **Does the engine cooling system leak externally?**	**Yes** REPAIR or INSTALL new components. TEST the system for normal operation. **No** GO to B6 .
B6 CHECK THE PRESSURE RELIEF CAP	
• Carry out the pressure relief cap pressure test. Refer to Component Test, Pressure Relief Cap Pressure Test in this section. • **Is the pressure relief cap OK?**	**Yes** GO to B7 . **No** INSTALL a new pressure relief cap. TEST the system for normal operation.
B7 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK	
• Inspect the engine coolant in the coolant expansion tank for signs of engine oil or transmission fluid. • **Is engine oil or transmission fluid evident in the coolant?**	**Yes** If engine oil is evident, GO to Section 303-00 for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate section in Group 307 for the procedure. TEST the system for normal operation. **No** GO to B8 .
B8 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT	
• Remove the oil level indicators from the engine and the transmission. • **Is coolant evident in the oil or transmission fluid?**	**Yes** If coolant is in the engine oil, GO to Section 303-00 . If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate section in Group 307 for the procedure. **No** GO to B9 .
B9 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES	
• **NOTE:** Use UViewÂ® Combustion Leak Tester part number UVU560000-R or equivalent. • Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.	**Yes** GO to Section 303-00 for engine diagnosis. **No** GO to B10 .

• **Are combustion gases present?**	
B10 CHECK COOLANT CONDITION	
• Check the coolant for dirt, rust or contamination and check the coolant concentration. • **Is the coolant condition OK?**	**Yes** GO to B11 . **No** FLUSH the engine cooling system. REFER to Cooling System Flushing in this section. TEST the system for normal operation.
B11 CHECK THE COOLING FAN OPERATION	
• Ignition OFF. • Check the cooling fan operation. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is the cooling fan operation OK?**	**Yes** GO to B12 . **No** INSTALL a new fan clutch. TEST the system for normal operation.
B12 CHECK THE COOLANT PUMP OPERATION	
• Start the engine. • Allow the engine to run for 10 minutes. Place the climate control function selector in the MAX HEAT position. Feel the heater outlet hose. • **Is the heater outlet hose hot?**	**Yes** GO to B13 . **No** INSTALL a new coolant pump. TEST the system for normal operation.
B13 CHECK THE THERMOSTAT OPERATION	
• Start the engine. • Allow the engine to run for 10 minutes. Feel the upper radiator hose. • **Is the upper radiator hose hot?**	**Yes** CHECK the Engine Coolant Temperature (ECT) gauge operation. REFER to Section 413-01 . **No** GO to B14 .
B14 VISUALLY INSPECT THE THERMOSTAT	
• Carry out the Thermostat Visual Inspection in the Component Tests portion of this section. • **Is the thermostat damaged?**	**Yes** INSTALL a new thermostat. TEST the system for normal operation. **No** INSTALL a new thermostat. TEST the system for normal operation. If the engine still overheats, INSTALL a new radiator. TEST the system for normal operation.

Pinpoint Test C: The Engine Does Not Reach Normal Operating Temperature

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. The coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Concerns of engine inability to reach normal operating temperature typically occur when the rate of coolant flow through some coolant circuits (radiator, heater core) is more than expected given the conditions or the fan clutch is always engaged. Heat is not allowed to build in the engine because a heat exchanger is removing too much heat, including the radiator, heater core and oil cooler. In addition, perceived concerns that the engine does not reach normal operating temperature can be related to a low coolant level or trapped air which does not allow for hot coolant to be available at the heater core, an inoperative climate control system, or for concerns perceived or related to an incorrect engine temperature gauge indication.

For engine specific information, refer to Engine Cooling in the Description and Operation portion of this section.

- DTC P0125 (Insufficient Coolant Temp for Closed Loop Fuel Control) â Indicates the Engine Coolant Temperature (ECT) sensor (4.0L SOHC) or the Cylinder Head Temperature (CHT) sensor (4.6L [3V]) has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting the engine.
- DTC P0128 (Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)) â Indicates the thermostat monitor has not achieved the required engine operating temperature within a specified amount of time after starting the engine.

This pinpoint test is intended to diagnose the following:

- Low coolant level
- Thermostat
- Engine Coolant Temperature (ECT) indicator system (gauge)
- Engine cooling fan

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

⚠ WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

Test Step	Result / Action to Take
C1 CARRY OUT INSPECTION AND VERIFICATION	
	Yes REPAIR as needed. TEST the system for normal operation.

• Carry out the Inspection and Verification procedure in this section. • **Were any concerns found?**	**No** GO to C2 .
C2 CHECK FOR DTC P0125 or P0128	
• Check for DTC P0125 or P0128. • **Is DTC P0125 or P0128 present?**	**Yes** GO to C3 . **No** The cooling system is operational. If an inoperative engine coolant temperature gauge is suspected, CHECK the engine coolant temperature gauge operation. REFER to Section 413-01 . If an inoperative climate control system is suspected, CHECK the climate control system operation. REFER to Section 412-00 . If any other DTCs are retrieved, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
C3 CHECK THE COOLING FAN OPERATION	
• Check the cooling fan clutch operation. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is the cooling fan clutch OK?**	**Yes** GO to C4 . **No** INSTALL a new cooling fan clutch. TEST the system for normal operation.
C4 CHECK THE COOLANT LEVEL	
• **NOTE:** Allow the engine to cool before checking the coolant level. • Visually check the engine coolant level in the coolant expansion tank. • **Is the engine coolant level within specification?**	**Yes** INSTALL a new thermostat. TEST the system for normal operation. **No** GO to Pinpoint Test A to diagnose a coolant leak.

Component Tests

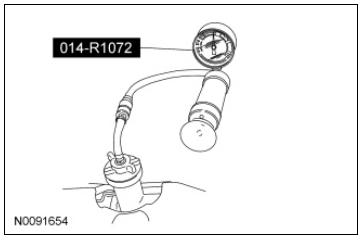
Coolant System Pressure Test

⚠ WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system

is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

1. Turn the engine OFF.

2. Remove the pressure relief cap. Top off the radiator as needed.



3. Fit the Radiator/Heater Core Pressure Tester from the Pressure Test Kit to the radiator fill neck using the correct adapter.

4. ***NOTICE:*** **Do not pressurize the cooling system beyond the maximum pressure listed in the specification table in this section or cooling system components may be damaged.**

   NOTE: If the plunger of the Pressure Test Kit is depressed too fast, an incorrect pressure reading will result.

   Pump the cooling system to the maximum allowed pressure and hold for 2 minutes. If the pressure drops within this time, inspect for leaks and repair as necessary.

5. If no leaks are found and the pressure drops, the leak may be internal to the radiator transmission cooler. Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.

6. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. Refer to Section 303-00 to diagnose the engine.

Cap

1. Inspect the pressure relief cap and seals for damage or deterioration. Install a new pressure relief cap if necessary.

2. Fit the pressure relief cap to the Pressure Test Kit using the correct adapter.

3. **NOTE:** If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.

   Slowly pump the Pressure Test Kit until the pressure gauge stops increasing and note the highest pressure reading. Release the pressure and repeat the test. Install a new pressure relief cap if the pressure is not within specification. Refer to the Specifications.

Thermostat

A new thermostat should be installed only after the following tests and checks have been carried out:

- Pinpoint Test A, B or C
- Thermostat Visual Inspection

Thermostat Visual Inspection

1. Remove the thermostat.

2. Examine the thermostat for signs of damage including:
    - Valve not fully seated (light visible through the valve)
    - Foreign material lodged in the main valve
    - Bent or broken frame or flange
    - Bent or broken spring
    - Bent or broken valve or valve stem
    - Wax leaking from wax reservoir or a bulge in the reservoir
    - Any other damage or distortion

3. **NOTE:** If no damage is found during the inspection, do not attempt to open the thermostat using hot water or other heat sources. This method is not an accurate means to test the function of the thermostat and may damage the thermostat.

   If damage is found during the inspection, remove any foreign material or broken pieces and install a new thermostat.

4. If no damage is found during the inspection, continue troubleshooting the system concern. Go to the Symptom Chart for further instructions.

Radiator Leak Test, Removed From Vehicle

NOTICE: **Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.**

NOTE: Always install plugs in the oil cooler fittings before leak testing or cleaning any radiator.

NOTE: Clean the radiator before leak testing to avoid contamination of tank.

1. Leak test the radiator in clean water with pressurized air to the maximum pressure listed in specifications.

Cooling System Draining, Filling and Bleeding

Special Tool(s)

 ST2818-A	RADIATOR REFILLER 078-00592

Material

Item	Specification
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada)	WSS-M97B51-A1

Draining

⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

NOTICE: **The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated, it must be recycled or disposed of correctly. The use of contaminated coolant may damage the cooling system.**

NOTICE: **All vehicles are filled with Motorcraft® Premium Gold Engine Coolant. Do not mix coolant types. Mixing coolant types may degrade the coolant's corrosion protection.**

NOTE: If cooling system stop leak pellets are used, Motorcraft® Premium Gold Engine Coolant may darken from yellow to golden tan.

NOTE: Less than 80 percent of the coolant capacity can be recovered with the engine in the vehicle. Dirty, rusty or contaminated coolant requires replacement.

1. Make sure the engine is cool.
2. Wrap a thick cloth around the radiator cap. Slowly turn the cap counterclockwise (left) until the pressure begins to release.
3. Step back while the pressure releases.
4. When you are sure all the pressure has been released, use the cloth to turn and remove the cap.
5. Place a suitable container below the radiator draincock. Drain the coolant.
    - Tighten the radiator draincock when finished.

Filling and Bleeding with RADIATOR REFILLER

NOTICE: **All air must be removed from the cooling system. Failure to remove all the air from the cooling system may result in engine damage.**

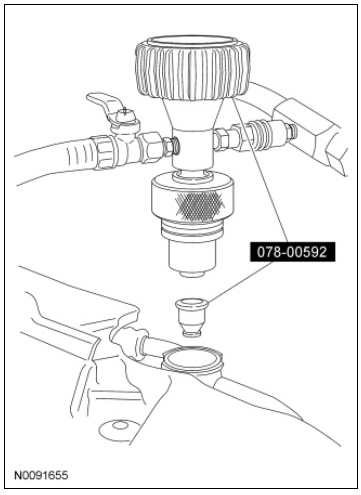
NOTICE: **Turn the radiator cap clockwise until it stops (approximately 135 degrees). Failure to tighten the radiator cap may result in engine damage.**

NOTE: Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level.

To maintain the integrity of the coolant and the cooling system:

- Add Motorcraft® Premium Gold Engine Coolant. Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.
- Do not add orange-colored Motorcraft® Specialty Orange Engine Coolant. Mixing coolants may degrade the coolant's corrosion protection.
- Do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Do not mix with recycled coolant. Use of such coolants may harm the engine and cooling system components.

1. Connect the RADIATOR REFILLER body and the appropriate rubber adapter to the radiator.



2. Follow the RADIATOR REFILLER manufacturer's instructions to fill and bleed the cooling system.
    - Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
        - ♦ Maximum coolant concentration is 60/40 for cold weather areas.
        - ♦ Minimum coolant concentration is 40/60 for warm weather areas.

Filling and Bleeding without RADIATOR REFILLER

NOTICE: **All air must be removed from the cooling system. Failure to remove all the air from the cooling system may result in engine damage.**

NOTICE: **Turn the radiator cap clockwise until it stops (approximately 135 degrees). Failure to tighten the radiator cap may result in engine damage.**

NOTE: Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level.

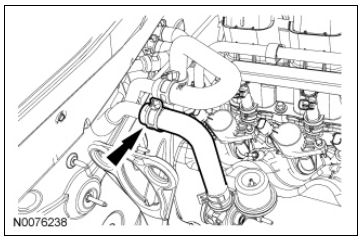
To maintain the integrity of the coolant and the cooling system:

- Add Motorcraft® Premium Gold Engine Coolant. Always fill the cooling system with the same type of coolant that was drained from the system. Do not mix coolant types.
- Do not add orange-colored Motorcraft® Specialty Orange Engine Coolant. Mixing coolants may degrade the coolant's corrosion protection.
- Do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Do not mix with recycled coolant. Use of such coolants may harm the engine and cooling system components.

4.6L (3V) engine

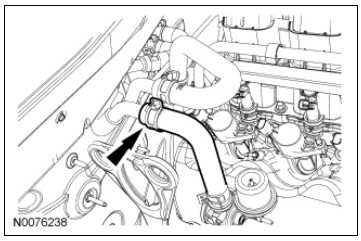
1. Remove the thermostat. For additional information, refer to Thermostat - 4.6L (3V) in this section.

2. Disconnect the heater hose and insert the end of the heater hose into a suitable container.



3. Fill the engine through the thermostat housing until coolant flows from the heater hose.
    - Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
        - ♦ Maximum coolant concentration is 60/40 for cold weather areas.
        - ♦ Minimum coolant concentration is 40/60 for warm weather areas.

4. Connect the heater hose.



5. Install the thermostat. For additional information, refer to Thermostat - 4.6L (3V) in this section.

All engines

6. Fill the radiator through the radiator filler neck until the coolant level is at the bottom of the filler neck.
    - Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
        - ♦ Maximum coolant concentration is 60/40 for cold weather areas.
        - ♦ Minimum coolant concentration is 40/60 for warm weather areas.

7. Install the radiator cap.

8. Fill the coolant expansion tank until the coolant reaches the COLD FILL mark.

9. Select the maximum heater temperature and blower motor speed settings. Position the control to discharge air from the A/C vents.

10. ***NOTICE:*** **If the air discharge remains cool and the engine coolant temperature gauge does not move, the engine coolant level is low in the engine and must be filled. Stop the engine, allow it to cool and fill the cooling system. Failure to follow this instruction may result in damage to the engine.**

    Run the engine until it reaches normal operating temperature.

11. Turn the engine off and allow the engine to cool.

12. Add more coolant mixture to the coolant expansion tank until the coolant level is at the COLD FILL mark.

13. Start the engine and allow it to idle. While the engine is idling, feel for hot air from the A/C vents.
    - Hot air should discharge from the A/C vents. The engine coolant temperature gauge should maintain a stabilized reading in the middle of the NORMAL range and the upper radiator hose should feel hot to the touch.

14. Check the engine coolant level in the coolant expansion tank and fill it as necessary.

15. Repeat previous 5 steps as necessary.

Cooling System Flushing

Material

Item	Specification
Motorcraft® Premium Cooling System Flush VC-1	ESR-M14P7-A

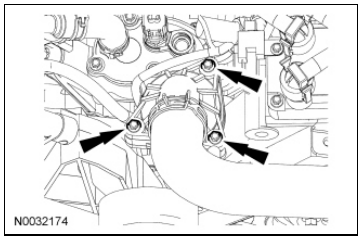
All vehicles

1. ⚠ **WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

   Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Vehicles equipped with a 4.0L SOHC engine

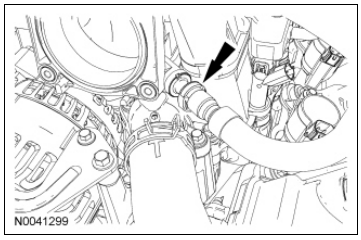
2. Remove the bolts, thermostat housing cover and thermostat. Install the thermostat housing cover and bolts without the thermostat.
   - Tighten to 10 Nm (89 lb-in).



Vehicles equipped with a 4.6L (3V) engine

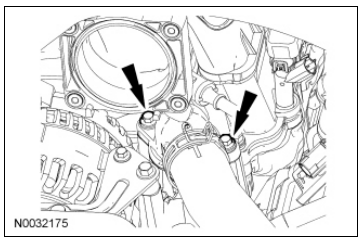
3. Remove the Throttle Body (TB). For additional information, refer to Section 303-04B .

4. Disconnect the fuel vapor hose.



5. Remove the bolts, thermostat housing cover and thermostat. Install the thermostat housing cover, the O-ring seal and the bolts without the thermostat.

- Tighten to 10 Nm (89 lb-in).



All vehicles

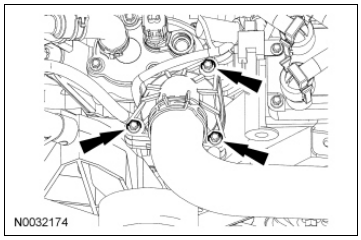
6. Using a suitable cooling system flushing tool, flush the engine and radiator.
   - Use cooling system flush.

Vehicles equipped with a 4.0L SOHC engine

7. **NOTE:** Prior to installing the thermostat, inspect the thermostat housing cover O-ring seal and install a new O-ring seal if necessary.

   Install the thermostat, O-ring seal, thermostat housing cover and bolts.

   - Tighten to 10 Nm (89 lb-in).

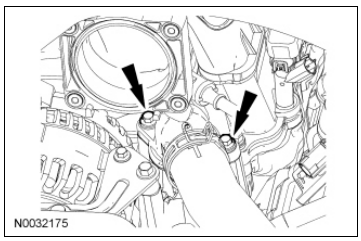


Vehicles equipped with a 4.6L (3V) engine

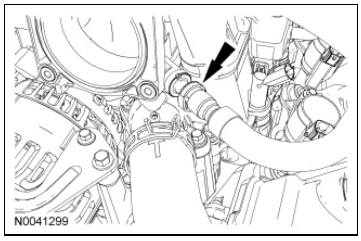
8. **NOTE:** Prior to installing the thermostat, inspect the thermostat housing cover O-ring seal and install a new O-ring seal if necessary.

   Install the thermostat, O-ring seal, thermostat housing cover and bolts.

   - Tighten to 10 Nm (89 lb-in).



9. Connect the fuel vapor hose.



10. Install the TB . For additional information, refer to Section 303-04B .

All vehicles

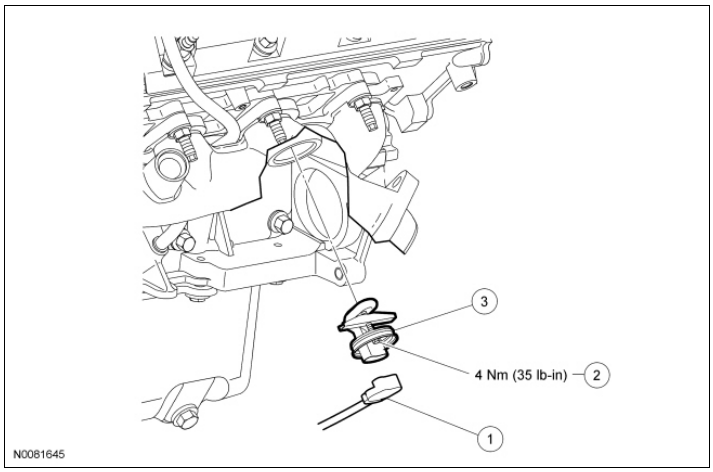
11. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Block Heater

Material

Item	Specification
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada)	WSS-M97B51-A1

Removal and Installation



Item	Part Number	Description
1	6B019	Block heater power cable
2	6A051	Block heater retaining screw
3	6A051	Block heater

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
3. Disconnect the block heater power cable.
4. **NOTE:** Do not loosen the block heater retaining screw more than necessary for removal.

   Loosen the screw and remove the block heater.

   - To install, tighten to 4 Nm (35 lb-in).
5. Clean and inspect the engine block mating surface. Lubricate the block heater seal and the cylinder block hole with clean engine coolant.

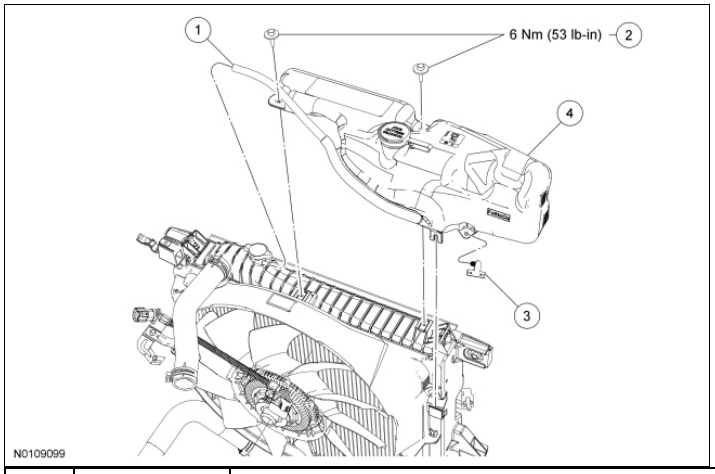
6. ***NOTICE:*** **Make sure the power cable is routed and secured away from rotating or hot components or the cable may be damaged.**

To install, reverse the removal procedure.

Coolant Expansion Tank

Material

Item	Specification
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada)	WSS-M97B51-A1



Item	Part Number	Description
1	8N029	Coolant overflow hose
2	W713417	Coolant expansion tank bolts
3	13A506	Mass Air Flow (MAF) sensor wiring harness retainer (4.6L [3V] engine only) (part of 12B637)
4	8C045	Coolant expansion tank

NOTICE: **Allow the engine to cool before removing the coolant expansion tank. The radiator draws coolant from the coolant expansion tank as the engine cools. If the coolant expansion tank is removed before the engine cools, the radiator will draw air into the system, resulting in possible engine damage.**

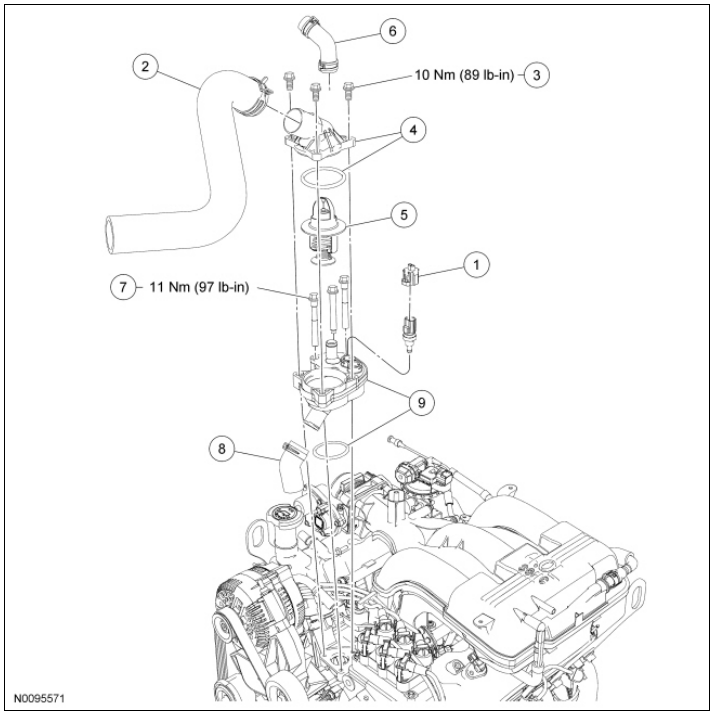
1. Disconnect the coolant overflow hose.

2. If equipped, detach the Mass Air Flow (MAF) sensor wiring harness retainer.

3. Remove the bolts and the coolant expansion tank.
   - To install, tighten to 6 Nm (53 lb-in).

4. To install, reverse the removal procedure.
   - Fill the coolant expansion tank with a 50/50 mixture of coolant and clean, drinkable water.

Thermostat and Thermostat Housing - Exploded View, 4.0L SOHC



Item	Part Number	Description
1	14A464	Engine Coolant Temperature (ECT) sensor electrical connector
2	8260	Upper radiator hose
3	W500015	Thermostat housing cover bolt (3 required)
4	8A586	Thermostat housing cover with O-ring seal
5	8575	Thermostat
6	18472	Heater hose
7	W702527	Thermostat housing bolt (3 required)
8	8548	Bypass hose
9	8A586	Thermostat housing with O-ring seal

1. For additional information, refer to the procedures in this section.

Thermostat - 4.0L SOHC

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Release the clamp and disconnect the upper radiator hose from the thermostat housing cover.

3. Remove the bolts and the thermostat housing cover.
   - To install, tighten to 10 Nm (89 lb-in).

4. Remove the thermostat.

5. **NOTE:** Inspect the thermostat housing cover O-ring seal. Install a new O-ring seal if necessary.

   To install, reverse the removal procedure.

Thermostat Housing - 4.0L SOHC

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Disconnect the Engine Coolant Temperature (ECT) sensor electrical connector.

3. Release the clamp and disconnect the upper radiator hose.

4. Release the clamp and disconnect the heater hose.

5. Release the bypass hose clamp and position it down the hose.

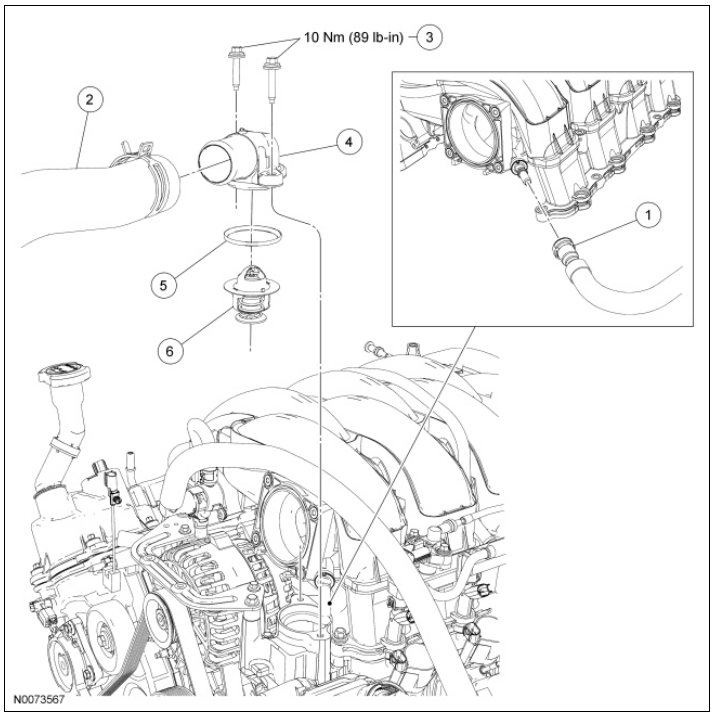
6. Remove the bolts and the thermostat housing.
   - To install, tighten to 11 Nm (97 lb-in).

7. Inspect the thermostat housing O-ring seal. Install a new O-ring seal if necessary.

8. To install, reverse the removal procedure.

Thermostat - 4.6L (3V)

Removal and Installation



Item	Part Number	Description
1	9D289	Fuel vapor tube
2	8260	Upper radiator hose
3	W503279	Thermostat housing bolt (2 required)
4	8594	Thermostat housing cover
5	N806807	Thermostat O-ring seal
6	8575	Thermostat

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.
2. Remove the Throttle Body (TB). For additional information, refer to Section 303-04B .
3. Disconnect the fuel vapor tube.
4. Remove the bolts and position the thermostat housing cover aside.
5. Remove the O-ring seal and the thermostat.

Installation

1. Install the thermostat with the spring facing down.

2. **NOTE:** Inspect the thermostat housing cover O-ring seal. Install a new O-ring seal, if necessary.

   Install the O-ring seal.

3. Position the thermostat housing cover and the bolts.
   - Tighten to 10 Nm (89 lb-in).

4. Connect the fuel vapor hose.

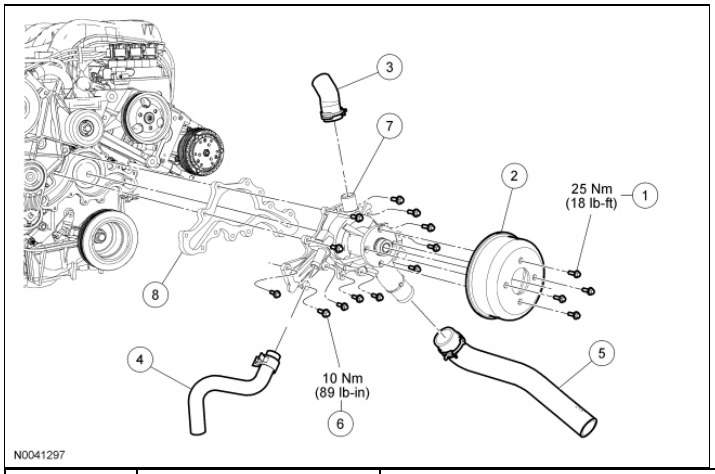
5. Install the TB . For additional information, refer to Section 303-04B .

6. Fill and bleed the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Coolant Pump - 4.0L SOHC

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-



Item	Part Number	Description
1	N605784	Coolant pump pulley bolt (4 required)
2	8509	Coolant pump pulley
3	8548	Coolant pump bypass hose
4	-	Heater hose (part of 6N867)
5	8286	Lower radiator hose
6	500014	Coolant pump bolt (12 required)
7	8501	Coolant pump
8	8507	Coolant pump gasket

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the cooling fan. For additional information, refer to Cooling Fan in this section.

3. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

4. Remove the bolts and the coolant pump pulley.
   - To install, tighten to 25 Nm (18 lb-ft).

5. Release the clamp and disconnect the coolant pump bypass hose.

6. Release the clamp and disconnect the heater hose.

7. Release the clamp and disconnect the lower radiator hose.

8. Remove the bolts, the coolant pump and the gasket.
    - To install, tighten to 10 Nm (89 lb-in).

9. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the old gasket.**

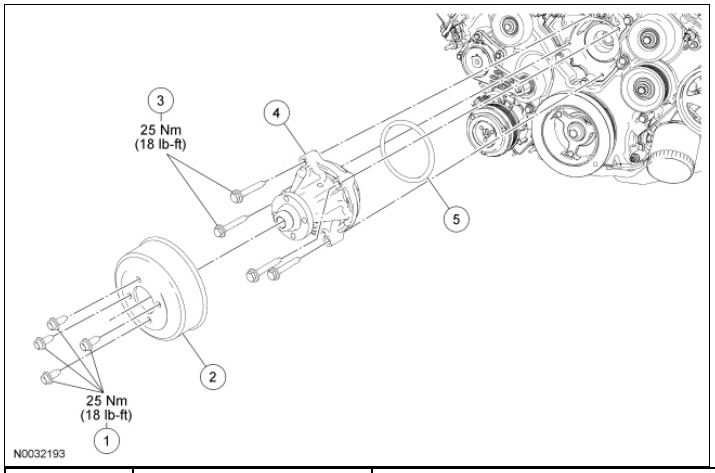
   Clean the mating surfaces with a plastic scraper and metal surface prep. Follow the directions on the packaging.

10. To install, reverse the removal procedure.
    - Install a new coolant pump gasket.

Coolant Pump - 4.6L (3V)

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Premium Gold Engine Coolant VC-7-B (US); CVC-7-B (Canada)	WSS-M97B51-A1



Item	Part Number	Description
1	N806282	Coolant pump pulley bolts (4 required)
2	8A528	Coolant pump pulley
3	N806177	Coolant pump bolts (4 required)
4	8501	Coolant pump
5	391108	Coolant pump O-ring seal

Removal and Installation

1. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the cooling fan. For additional information, refer to Cooling Fan in this section.

3. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

4. Remove the bolts and the coolant pump pulley.
   - To install, tighten to 25 Nm (18 lb-ft).

5. Remove the bolts and the coolant pump.
   - To install, tighten to 25 Nm (18 lb-ft).

6. Remove and discard the coolant pump O-ring.

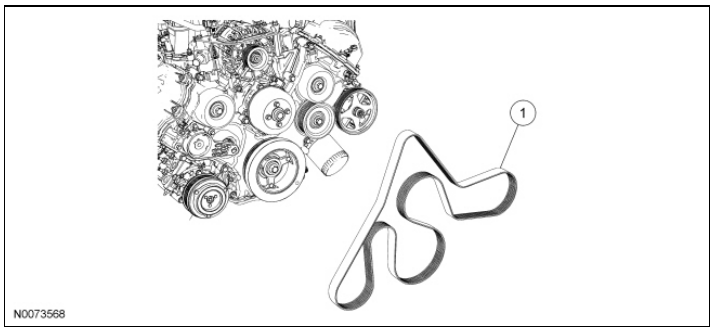
7. ***NOTICE:*** **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of the old O-ring.**

   If necessary, clean the mating surfaces with a plastic scraper and metal surface prep. Follow the directions on the packaging.

8. To install, reverse the removal procedure.
   - Install a new coolant pump O-ring. Lubricate the O-ring with clean engine coolant.

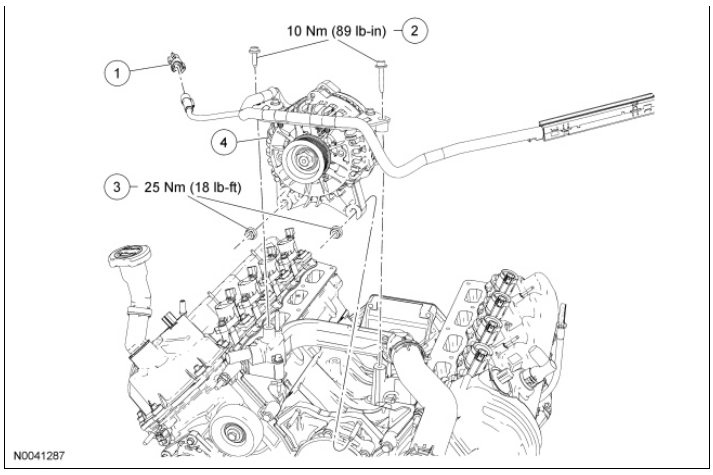
Coolant Crossover Manifold Assembly

Accessory Drive Belt



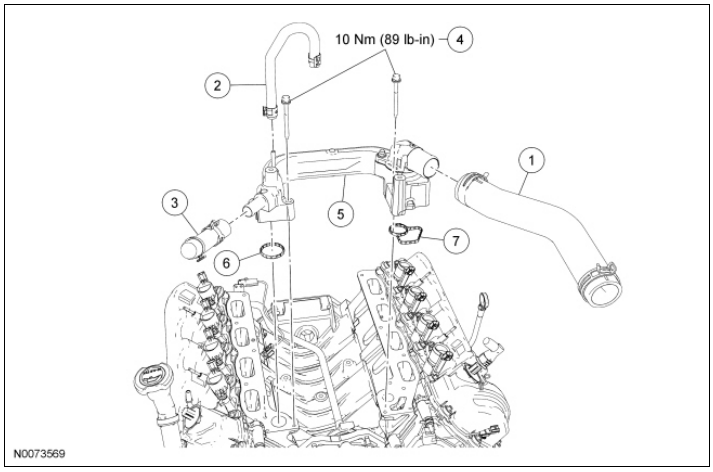
Item	Part Number	Description
1	8620	Accessory drive belt

Generator



Item	Part Number	Description
1	14489	Electrical connector (part of 12B637)
2	N807309	Generator bracket bolts (2 required)
3	N804178	Generator nuts (2 required)
4	10300	Generator

Coolant Crossover Manifold Assembly



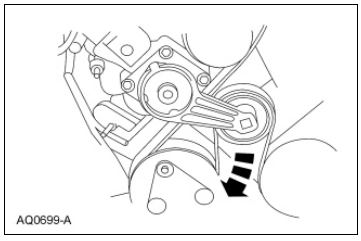
Item	Part Number	Description
1	8260	Upper radiator hose
2	18465	PCV heater hose
3	18C266	Heater hose
4	W710925	Coolant crossover manifold assembly bolts (2 required)
5	8C368	Coolant crossover manifold assembly
6	8C387	RH coolant crossover manifold assembly gasket
7	8C388	LH coolant crossover manifold assembly gasket

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

2. Remove the intake manifold. For additional information, refer to Section 303-01B .

3. Rotate the accessory drive belt tensioner clockwise and detach the belt from the generator pulley.



4. Disconnect the electrical connector.

5. Loosen the generator nuts.
   - To install, tighten to 25 Nm (18 lb-ft).

6. Remove the generator bracket-to-coolant crossover bolts, and position the generator, bracket and wiring harness aside as an assembly.
   - To install, tighten to 10 Nm (89 lb-in).

7. Disconnect the PCV heater hose from the coolant crossover manifold assembly.

8. Disconnect the heater hose from the coolant crossover manifold assembly.

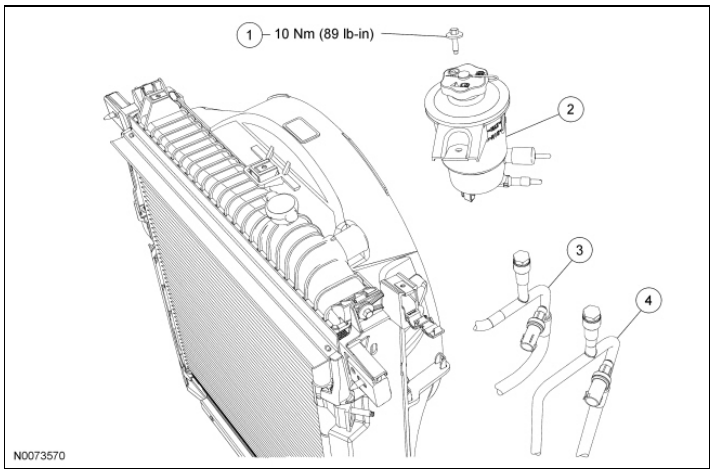
9. Disconnect the upper radiator hose from the coolant crossover manifold assembly.

10. Remove the bolts, the coolant crossover manifold assembly and the gaskets. Discard the gaskets.
    - To install, tighten to 10 Nm (89 lb-in).

11. To install, reverse the removal procedure.
    - Install new gaskets.

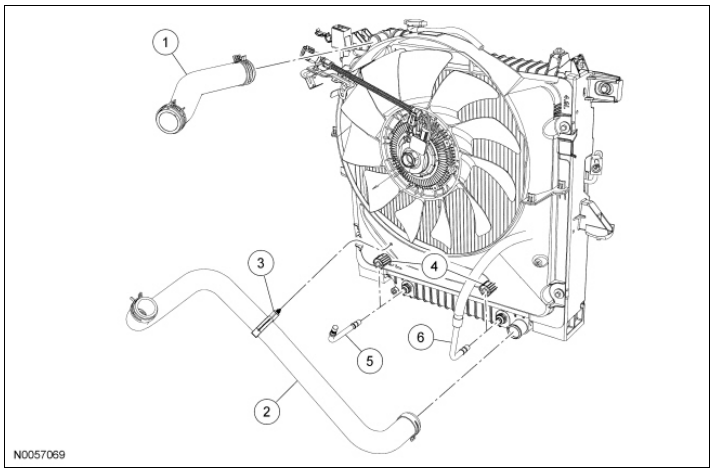
Radiator and Cooling Fan - Exploded View

Power Steering Fluid Reservoir and A/C Tubes



Item	Part Number	Description
1	N503924	Power steering fluid reservoir bolt
2	3R700	Power steering fluid reservoir
3	19972	A/C tube - 4.6L (3V)
4	19972	A/C tube - 4.0L SOHC

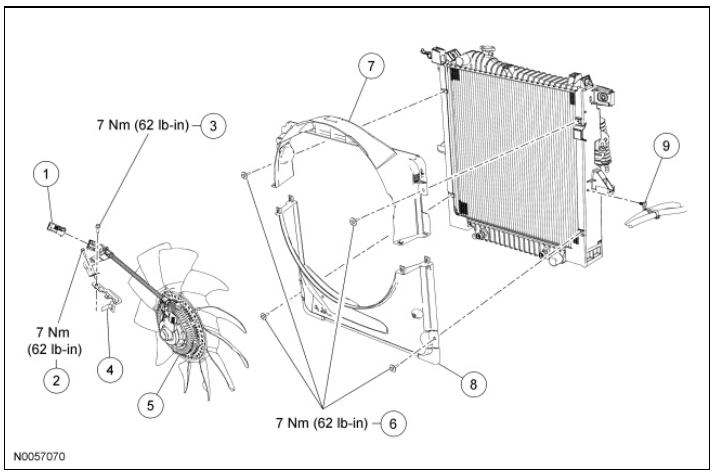
Radiator Hoses and Transmission Fluid Tubes



Item	Part Number	Description
1	8260	Upper radiator hose
2	8286	Lower radiator hose
3	8W287	Lower radiator hose retainer

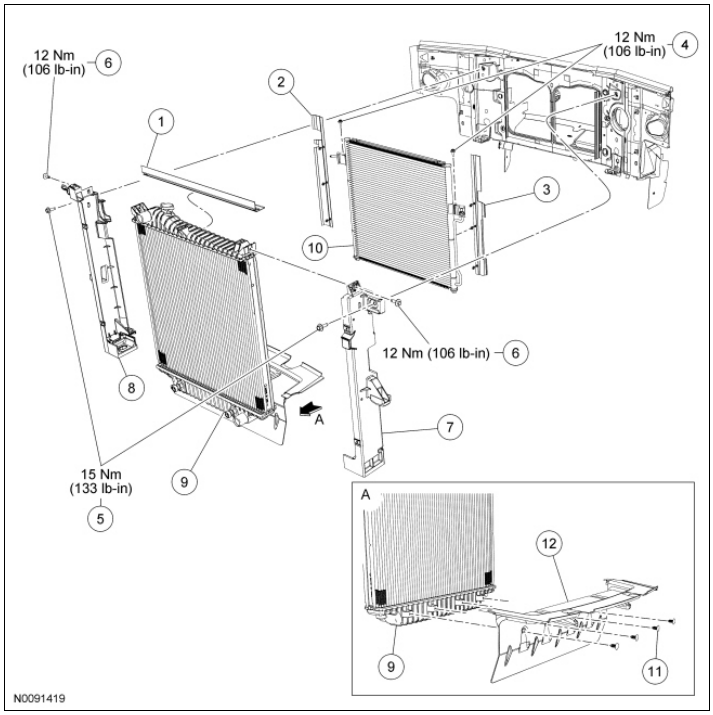
4	7J081	Transmission fluid cooler tube latch assemblies (2 required)
5	7H420	Transmission-to-cooler tube
6	7890	Transmission fluid cooler hose

Cooling Fan and Shroud



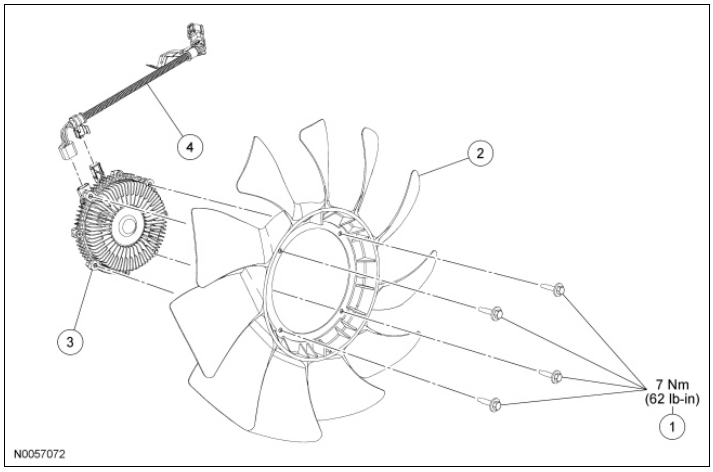
Item	Part Number	Description
1	14A624	Fan clutch electrical connector
2	W500214	Fan clutch wiring harness bracket bolt - 4.0L SOHC
3	W500214	Fan clutch wiring harness bracket bolt - 4.6L (3V)
4	14W163	Fan clutch wiring harness retaining bracket - 4.6L (3V) only
5	8A616	Fan clutch
6	W709027	Fan shroud bolts (4 required)
7	8K618	Upper fan shroud
8	8K619	Lower fan shroud
9	7N291	Transmission fluid cooler tube retainer

Radiator, Support Brackets and Seals



Item	Part Number	Description
1	19T558	Radiator top seal
2	19T557	LH A/C condenser seal
3	19T556	RH A/C condenser seal
4	W711343	Radiator support bracket-to-A/C condenser bolts
5	W707665	Radiator support bracket-to-radiator support bolts (2 required)
6	W503932	Radiator support bracket-to-radiator bolts (2 required)
7	8B265	RH radiator support bracket
8	8B266	LH radiator support bracket
9	8005	Radiator
10	19710	A/C condenser
11	W705589	Pushpin (4 required)
12	8B384	Radiator lower air deflector

Cooling Fan and Electronic Fan Clutch



Item	Part Number	Description
1	W505425	Fan-to-electronic fan clutch bolts (4 required)
2	8600	Fan
3	8A616	Electronic fan clutch
4	8C290	Electronic fan clutch wiring assembly

1. For additional information, refer to the procedures in this section.

Radiator

Special Tool(s)

 ST2935A	Disconnect Tool, Transmission Cooler Line 307-569
 ST2133-A	Holding Wrench, Fan Pulley 303-239 (T84T-6312-C)
 ST2175-A	Wrench, Fan Clutch Nut 303-240 (T84T-6312-D)

Removal and Installation

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the cooling system. For additional information, refer to Cooling System Draining, Filling and Bleeding in this section.

Vehicles equipped with a 4.6L (3V) engine

3. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .

All vehicles

4. Remove the coolant expansion tank. For additional information, refer to Coolant Expansion Tank in this section.

5. Remove the bolt and position the power steering fluid reservoir aside.
    - To install, tighten to 10 Nm (89 lb-in).

6. Release the clamp and disconnect the upper radiator hose.

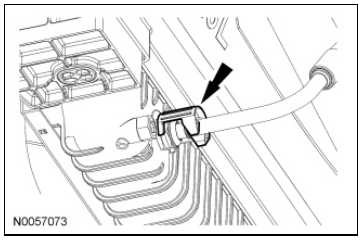
7. Release the clamp and disconnect the lower radiator hose.

8. Detach the lower radiator hose retainer from the lower fan shroud.

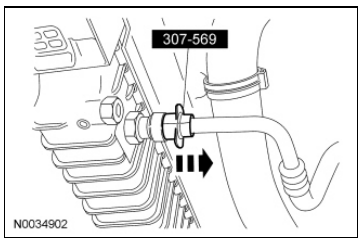
9. Detach the transmission cooler hose retainer from the RH radiator support bracket.

10. Remove the 4 lower radiator air deflector pushpins and position the air deflector aside.

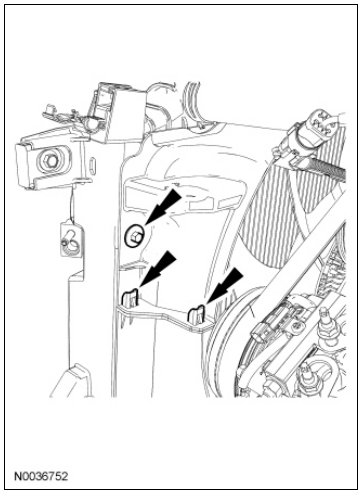
11. Remove the 2 latch assemblies from the transmission cooler tubes.



12. Using the Transmission Cooler Line Disconnect Tool, disconnect the 2 transmission cooler tubes.



13. Remove the 2 upper fan shroud bolts, then unclip the upper fan shroud from the lower fan shroud and remove the upper fan shroud.
    - To install, tighten to 7 Nm (62 lb-in).



14. Disconnect the fan clutch electrical connector.

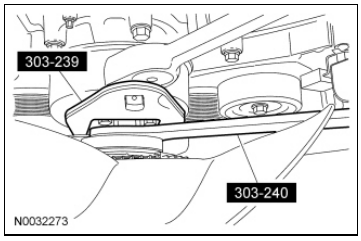
15. Remove the fan clutch wiring harness bracket bolt.
    - To install, tighten to 7 Nm (62 lb-in).

16. ***NOTICE:*** **Do not side load the cooling fan clutch coil or the cooling fan clutch coil may be damaged.**

    NOTE: 4.6L (3V) engine shown, 4.0L SOHC engine similar.

    Using the Fan Pulley Holding Wrench and the Fan Clutch Nut Wrench, remove the cooling fan.

    - To install, tighten to 55 Nm (41 lb-ft).



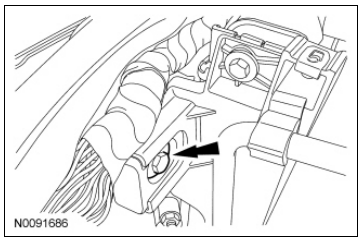
17. Remove the 2 bolts and the lower fan shroud.

18. Detach the A/C tube from the retainer on the radiator support bracket.

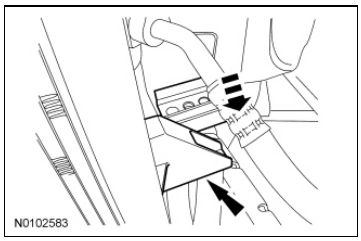
19. **NOTE:** LH shown RH similar.

    Remove the 2 radiator support bracket-to-radiator support bolts.

    - To install, tighten to 15 Nm (133 lb-in).



20. Lift the radiator and A/C condenser assembly off the frame supports and move the assembly toward the front of the engine.



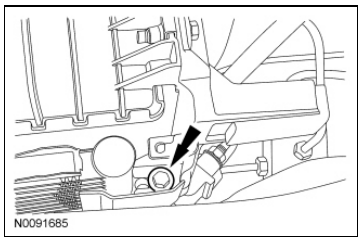
21. Remove the radiator top seal.

22. **NOTE:** Do not remove the A/C condenser seals.

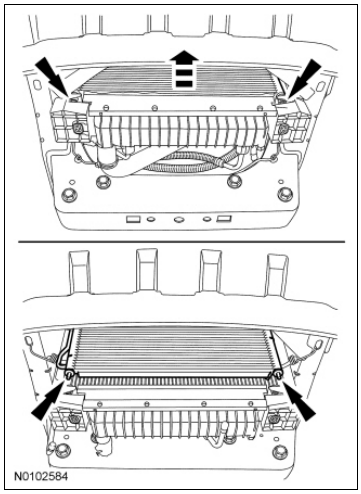
    NOTE: LH shown RH similar.

    Deflect the A/C condenser seals and remove the 2 A/C condenser-to-radiator support bracket bolts.

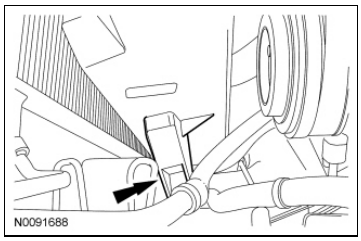
    - To install, tighten to 12 Nm (106 lb-in).



23. Lift the A/C condenser off the supports and move the A/C condenser toward the front of the vehicle.



24. Remove the radiator and the radiator support brackets as an assembly.
    - Move the LH radiator support bracket past the ABS module before removing the radiator from the vehicle.



25. Remove the 4 bolts and separate the 2 radiator support brackets and the radiator.
    - To install, tighten to 12 Nm (106 lb-in).

26. To install, reverse the removal procedure.

Cooling Fan

Special Tool(s)

 ST2133-A	Holding Wrench, Fan Pulley 303-239 (T84T-6312-C)
 ST2175-A	Wrench, Fan Clutch Nut 303-240 (T84T-63112-D)

Removal and Installation

Vehicle equipped with a 4.6L (3V)

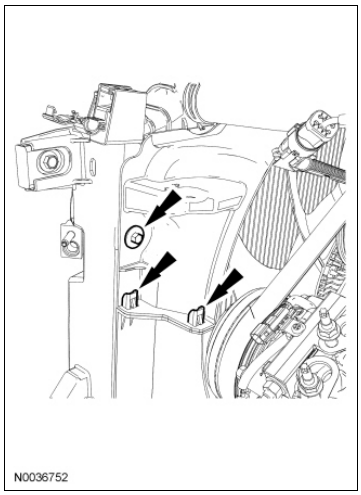
1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .

All vehicles

2. Remove the coolant expansion tank. For additional information, refer to Coolant Expansion Tank in this section.

3. Remove the bolt and position the power steering fluid reservoir aside.
   - To install, tighten to 10 Nm (89 lb-in).

4. Remove the 2 bolts, then unclip the upper fan shroud from the lower fan shroud and remove the upper fan shroud.
   - To install, tighten to 7 Nm (62 lb-in).



5. Disconnect the fan clutch electrical connector.

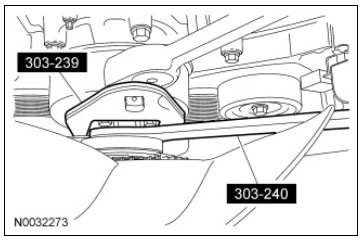
6. Remove the fan clutch wiring harness bracket bolt.
   - To install, tighten to 7 Nm (62 lb-in).

7. ***NOTICE:*** **Do not side load the cooling fan clutch coil or the cooling fan clutch coil may be damaged.**

   NOTE: 4.6L (3V) engine shown, 4.0L SOHC engine similar.

   Using the Fan Pulley Holding Wrench and the Fan Clutch Nut Wrench, remove the cooling fan.

   - To install, tighten to 55 Nm (41 lb-ft).



8. Remove the 4 bolts and separate the fan from the fan clutch.
   - To install, tighten to 7 Nm (62 lb-in).
9. If necessary, unclip and disconnect the fan clutch wiring harness.
10. To install, reverse the removal procedure.

Cooling Fan Shroud

Special Tool(s)

 ST2133-A	Holding Wrench, Fan Pulley 303-239 (T84T-6312-C)
 ST2175-A	Wrench, Fan Clutch Nut 303-240 (T84T-63112-D

Removal and Installation

Vehicles equipped with a 4.6L (3V) engine

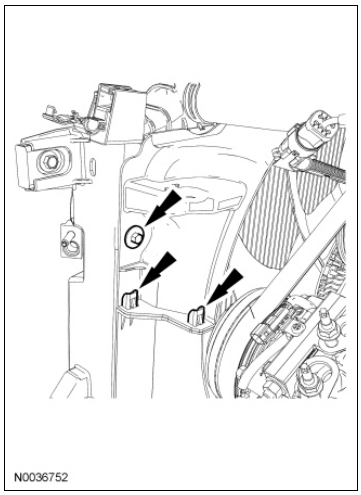
1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .

All vehicles

2. Remove the coolant expansion tank. For additional information, refer to Coolant Expansion Tank in this section.

3. Remove the bolt and position the power steering fluid reservoir aside.
   - To install, tighten to 10 Nm (89 lb-in).

4. Remove the 2 bolts, then unclip the upper fan shroud from the lower fan shroud and remove the upper fan shroud.
   - To install, tighten to 7 Nm (62 lb-in).



5. Disconnect the fan clutch electrical connector.

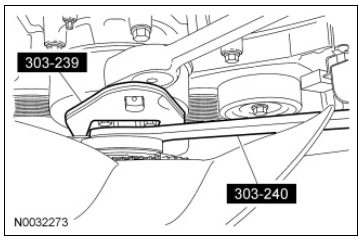
6. Remove the fan clutch wiring harness bracket bolt.
   - To install, tighten to 7 Nm (62 lb-in).

7. ***NOTICE:*** **Do not side load the cooling fan clutch coil or the cooling fan clutch coil may be damaged.**

   NOTE: 4.6L (3V) engine shown, 4.0L SOHC engine similar.

   Using the Fan Pulley Holding Wrench and the Fan Clutch Nut Wrench, remove the cooling fan.

   - To install, tighten to 55 Nm (41 lb-ft).



8. Remove the 2 bolts and the lower fan shroud.
   - To install, tighten to 7 Nm (62 lb-in).

9. To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A	-

Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel Pump Driver Module (FPDM) bolts	10	-	89
Fuel rail bolts	23	17	-
Fuel supply tube bolts	6	-	53
Fuel supply tube bracket bolt	8	-	71
Fuel temperature and pressure sensor bolts	6	-	53
Throttle Body (TB) bolts	9	-	80
Wiring harness bracket nut	9	-	80

Fuel Charging and Controls

The fuel charging and control system consists of the:

- Throttle Body (TB)
- Fuel supply tube
- Fuel rails
- Fuel injectors
- Fuel pressure and temperature sensor

The fuel charging and controls system is:

- a Sequential Multi-Port Fuel Injection (SFI).
- pulse-width modulated.
- Mass Air Flow (MAF) controlled.

Throttle Body (TB)

The TB :

- controls air supply to the intake manifold by electronically positioning the throttle plate.
- is not adjustable.

Fuel Supply Tube

The fuel supply tube:

- supplies fuel to the 2 fuel rails.

Fuel Rails

The fuel rails:

- deliver fuel to the individual fuel injectors.

Fuel Injectors

The fuel injectors:

- are electrically operated by the PCM.
- atomize the fuel as the fuel is delivered.
- are deposit-resistant and self-cleaning.
- each have an internal solenoid which opens a needle valve to inject fuel into the cylinder heads.

Fuel Pressure and Temperature Sensor

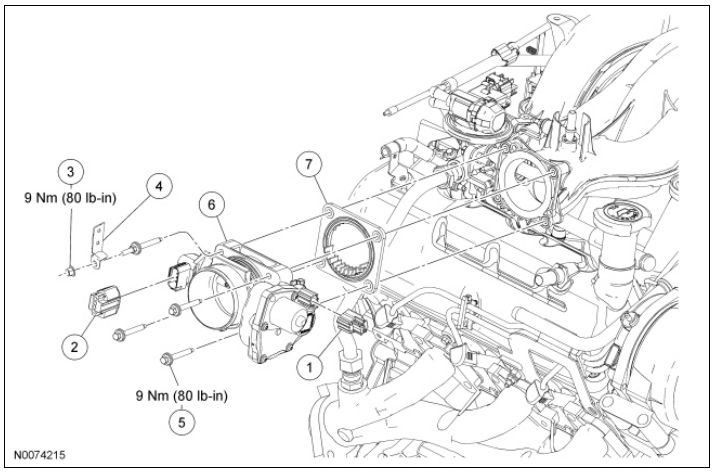
The fuel pressure and temperature sensor:

- supplies the PCM with signals indicating fuel pressure and fuel temperature.

Fuel Charging and Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Throttle Body



Item	Part Number	Description
1	14A464	Throttle Body (TB) electrical connector
2	14A464	Throttle Position (TP) sensor electrical connector
3	-	Wiring harness bracket nut
4	-	Wiring harness bracket (part of 12B637)
5	W704380	TB bolt (4 required)
6	9E926	TB
7	9E936	TB gasket

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the Air Cleaner (ACL) outlet tube. For additional information, refer to Section 303-12 .

2. Disconnect the Throttle Body (TB) electrical connector.

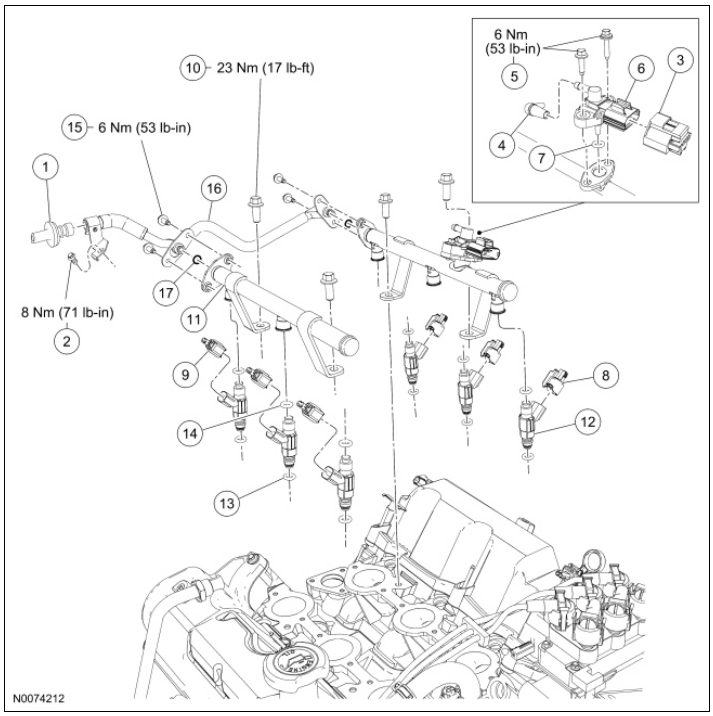
3. Disconnect the Throttle Position (TP) sensor electrical connector.

4. Remove the nut and position the wiring harness bracket aside.
   - To install, tighten to 9 Nm (80 lb-in).

5. Remove the 4 bolts, the TB and the gasket. Discard the gasket.
   - To install, tighten to 9 Nm (80 lb-in).

6. To install, reverse the removal procedure.
   - Install a new TB gasket.

Fuel Rail and Fuel Injector - Exploded View



Item	Part Number	Description
1	9J338	Fuel tube spring lock coupling
2	W500204	Fuel supply tube bracket bolt
3	14A464	Fuel pressure and temperature sensor electrical connector
4	-	Fuel pressure and temperature sensor vacuum hose
5	W709515	Fuel rail pressure and temperature sensor bolts (2 required)
6	9G756	Fuel rail pressure and temperature sensor
7	-	Fuel rail pressure and temperature sensor O-ring seal (part of 9G756)
8	14A464	Fuel injector electrical connector (LH side) (3 required)
9	14A464	Fuel injector electrical connector (RH side) (3 required)
10	W500023-S	Fuel rail bolt (4 required)
11	9D280	Fuel rail
12	9F593	Fuel injector (6 required)
13	9229	Fuel injector-to-cylinder head O-ring seal (6 required)
14	9229	Fuel injector-to-fuel rail O-ring seal (6 required)

15	W711782	Fuel supply tube bolt (4 required)
16	9E964	Fuel supply tube
17	9229	Fuel supply tube O-ring seal (2 required)

1. For additional information, refer to the procedures in this section.

Fuel Rail

Material

Item	Specification
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTICE: **If used as a leverage device, the fuel rail may be damaged. Care must be taken when working around the fuel rail.**

NOTE: During the repair or replacement of fuel-related components, cap, tape or otherwise appropriately protect all liquid and vapor fuel openings to prevent the ingress of dirt or other contamination. Remove all caps, tape and other protective materials prior to installation.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the spring lock coupling. For additional information, refer to Section 310-00 .
4. Remove the intake manifold. For additional information, refer to Section 303-01A .
5. Remove the fuel supply tube bracket bolt.
   - To install, tighten to 8 Nm (71 lb-in).
6. Disconnect the 6 fuel injector electrical connectors.
7. Disconnect the fuel pressure and temperature sensor electrical and vacuum connectors.

8. Remove the 4 bolts and the fuel rail and injectors as an assembly.
    - To install, tighten to 23 Nm (17 lb-ft).

9. Remove the fuel injectors. Remove and discard the O-ring seals.

10. ***NOTICE:*** **O-ring seals are made of special fuel-resistant material. Fuel will damage ordinary O-ring seals and may cause the fuel system to leak.**

    NOTICE: **Do not reuse O-ring seals. The removal and installation process may damage the used O-ring seals, and cause the fuel system to leak.**

    NOTE: Install new fuel injector O-ring seals and lubricate them with clean engine oil.

    To install, reverse the removal procedure.

Fuel Injectors

Removal and Installation

1. The fuel injectors are serviced with the fuel rail. For additional information, refer to Fuel Rail and Fuel Injector - Exploded View and Fuel Rail in this section.

Fuel Rail Supply Tube

Material

Item	Specification
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTE: During the repair or replacement of fuel-related components, cap, tape or otherwise appropriately protect all liquid and vapor fuel openings to prevent the ingress of dirt or other contamination. Remove all caps, tape and other protective materials prior to installation.

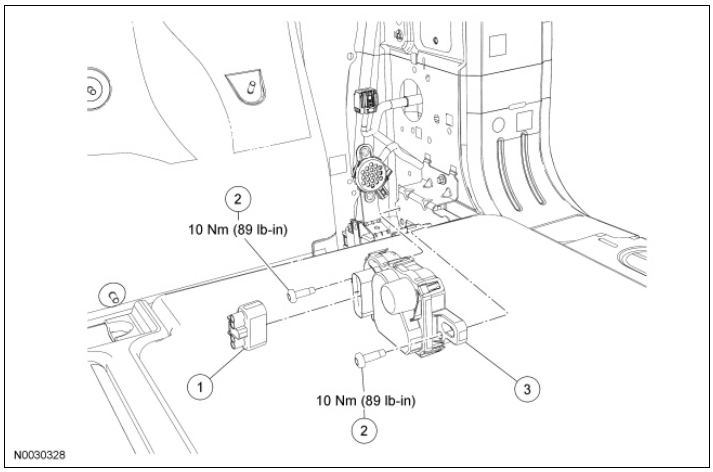
1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the intake manifold. For additional information, refer to Section 303-01A .
4. Disconnect the fuel rail supply tube spring lock coupling. For additional information, refer to Section 310-00 .
5. Remove the fuel rail supply tube bracket bolt.
   - To install, tighten to 8 Nm (71 lb-in).
6. Remove the 4 bolts and the fuel rail supply tube.
   - To install, tighten to 6 Nm (53 lb-in).
7. ***NOTICE:*** **O-ring seals are made of special fuel-resistant material. Fuel will damage ordinary O-ring seals and may cause the fuel system to leak.**

NOTICE: **Do not reuse O-ring seals. The removal and installation process may damage the used O-ring seals, and cause the fuel system to leak.**

Remove and discard the fuel rail supply tube O-ring seals.

8. To install, reverse the removal procedure.
    - Lubricate the new O-ring seals with clean engine oil prior to installation.

Fuel Pump Driver Module (FPDM) - Explorer, Mountaineer



Item	Part Number	Description
1	14A464	Fuel Pump Driver Module (FPDM) electrical connector
2	W504755	FPDM bolts (2 required)
3	9D370	FPDM

Removal and Installation

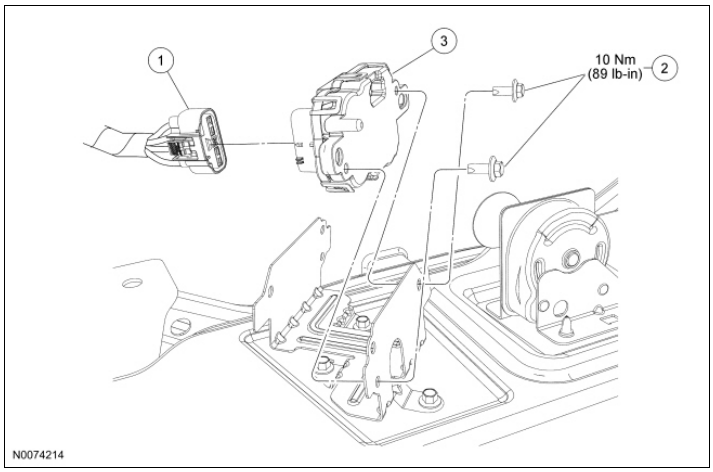
1. Remove the RH rear quarter trim panel. For additional information, refer to Section 501-05 .

2. Disconnect the Fuel Pump Driver Module (FPDM) electrical connector.

3. Remove the 2 bolts and the FPDM .
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.

Fuel Pump Driver Module (FPDM) - Explorer Sport Trac



Item	Part Number	Description
1	14A464	Fuel Pump Driver Module (FPDM) electrical connector
2	W504755	FPDM bolts (2 required)
3	9D370	FPDM

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the Fuel Pump Driver Module (FPDM) electrical connector.

3. Remove the 2 bolts and the FPDM .
   - To install, tighten to 10 Nm (89 lb-in).

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

Torque Specifications

Description	Nm	lb-in
Fuel Pump Driver Module (FPDM) bolts	10	89
Fuel rail bolts	10	89
Throttle Body (TB) bolts	10	89

Fuel Charging and Controls

Sequential Multi-Port Fuel Injection (SFI)

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

The fuel charging and controls system consists of the following:

- Throttle Body (TB)
- Fuel injectors
- Fuel rail
- Fuel rail pressure and temperature sensor
- Fuel Pump Driver Module (FPDM)

The fuel charging and controls system is:

- a Sequential Multi-Port Fuel Injection (SFI) system.
- pulse-width modulated.
- Mass Air Flow (MAF) controlled.

Fuel is metered into each intake port in a sequential firing order. Fuel injectors pulse to follow engine firing order, in accordance with engine demand on a tuned intake manifold.

The PCM controls the fuel injection system. Injector pulse width is varied to control the amount of fuel flow. Varying fuel pump output controls fuel pressure. The PCM commands the fuel pump driver module, which directly controls the fuel pump. The TB is electronically controlled by the engine management system. Throttle plate angle is changed electronically in response to throttle pedal movements initiated by the driver.

Throttle Body (TB)

The TB :

- controls air supply to the intake manifold by electronically positioning the throttle plate.
- is not adjustable.

Refer to Throttle Body in this section.

Fuel Injectors

The fuel injectors:

- are electronically operated by the PCM.
- atomize the fuel as the fuel is delivered.
- each have an internal solenoid that opens a needle valve, which injects fuel into the intake port in the cylinder head.

- are deposit resistant.

For removal and installation, refer to Fuel Rail and Fuel Injector - Exploded View and Fuel Rail in this section.

Fuel Rail

NOTICE: **The fuel injectors and the fuel rail must be handled with extreme care to prevent damage to sealing areas and sensitive fuel-metering orifices.**

The fuel rail:

- receives fuel from the fuel supply tube.
- delivers fuel to the fuel injectors.

For removal and installation, refer to Fuel Rail and Fuel Injector - Exploded View and Fuel Rail in this section.

Fuel Rail Pressure and Temperature Sensor

The fuel rail pressure and temperature sensor:

- measures the pressure and temperature of the fuel rail and sends these signals to the PCM.
- uses intake manifold vacuum as a pressure reference.

For removal and installation, refer to Section 303-14 .

Fuel Pump Driver Module (FPDM)

The FPDM :

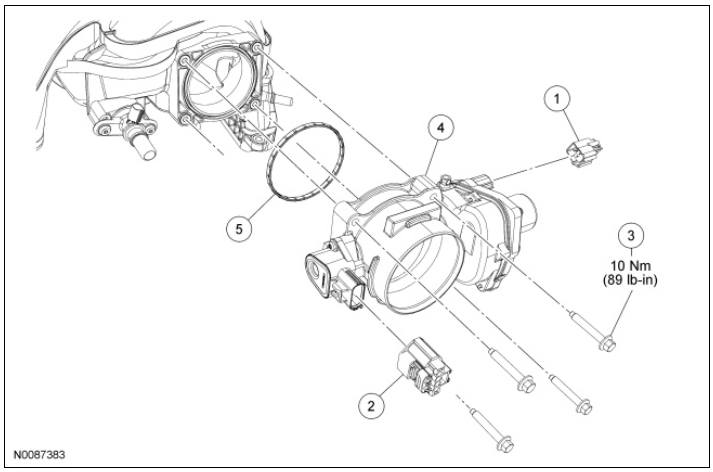
- receives signals from the PCM.
- duty cycles the fuel pump.

For removal and installation, refer to Fuel Pump Driver Module (FPDM) - Explorer, Mountaineer or Fuel Pump Driver Module (FPDM) - Explorer Sport Trac in this section.

Fuel Charging and Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Throttle Body



Item	Part Number	Description
1	14A464	Electronic throttle control electrical connector (part of 12B637)
2	14A464	Throttle Position (TP) sensor electrical connector (part of 12B637)
3	N806154	Throttle Body (TB) bolt (4 required)
4	9F991	TB
5	9E936	TB gasket

Removal and Installation

1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .

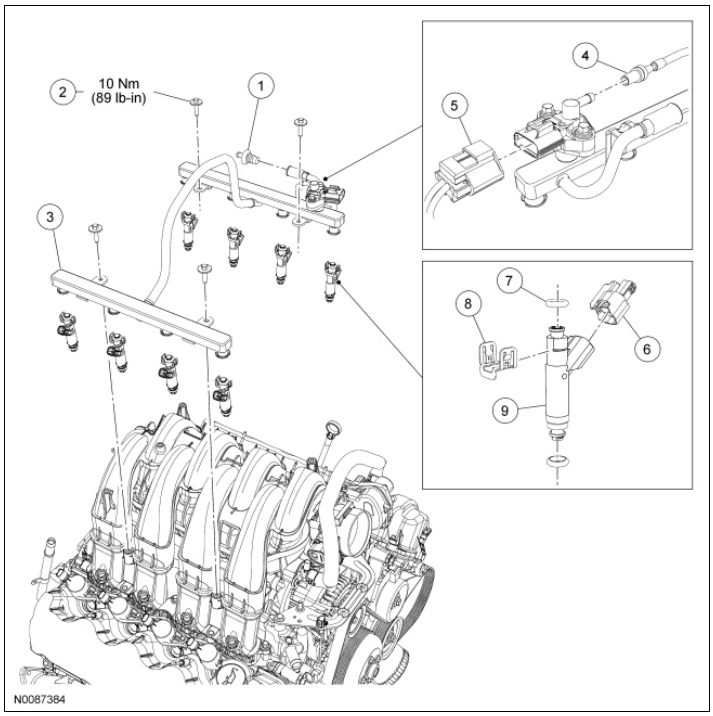
2. Disconnect the electronic throttle control electrical connector.

3. Disconnect the Throttle Position (TP) sensor electrical connector.

4. Remove the 4 bolts, the Throttle Body (TB) and the TB gasket. Discard the gasket.
   - To install, tighten to 10 Nm (89 lb-in).

5. To install, reverse the removal procedure.

Fuel Rail and Fuel Injector - Exploded View



Item	Part Number	Description
1	9J274	Fuel supply tube spring lock coupling
2	N705800	Fuel rail bolt (4 required)
3	9F792	Fuel rail
4	9E498	Vacuum hose
5	14A464	Fuel rail pressure and temperature sensor electrical connector (part of 12B637)
6	14A464	Fuel injector electrical connector (8 required) (part of 12B637)
7	9229	O-ring seal (16 required)
8	9C995	Fuel injector retaining clip (8 required)
9	9F593	Fuel injector

1. For additional information, refer to the procedures in this section.

Fuel Rail

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTE: During the repair or installation of new fuel-related components, cap, tape or otherwise appropriately protect all liquid and vapor fuel openings to prevent the ingress of dirt or other contamination. Remove caps, tape and other protective materials prior to installation.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the fuel supply tube spring lock coupling. For additional information, refer to Section 310-00 .
4. Disconnect the fuel rail pressure and temperature sensor electrical connector and vacuum hose.
5. Disconnect the 8 fuel injector electrical connectors.
6. Remove the 4 fuel rail bolts.
   - To install, tighten to 10 Nm (89 lb-in).
7. Remove the fuel rail and fuel injectors as an assembly from the intake manifold.
8. **NOTE:** The fuel injector clip can be reused if it is not damaged during removal. If the clip is reused, the 2 sides of the clip should be squeezed back into shape by placing it between index finger and

thumb.

Remove the retaining clips and fuel injectors from the fuel rail.

9. ***NOTICE:*** **O-ring seals are made of special fuel-resistant material. Fuel will damage ordinary O-ring seals and may cause the fuel system to leak.**

   NOTICE: **Do not reuse O-ring seals. The removal and installation process may damage the used O-ring seals, and cause the fuel system to leak.**

   Remove and discard the fuel injector O-ring seals.

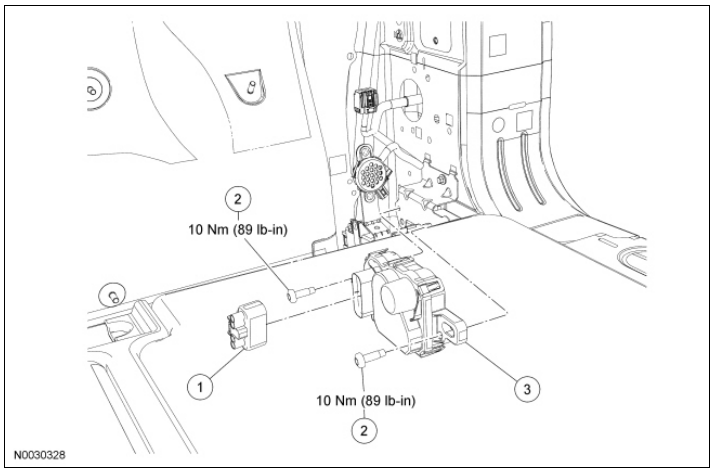
10. To install, reverse the removal procedure.
    - Lubricate the new upper and lower fuel injector O-ring seals with clean engine oil prior to installation.

Fuel Injectors

Removal and Installation

1. The fuel injectors are serviced with the fuel rail. For additional information, refer to Fuel Rail and Fuel Injector - Exploded View and Fuel Rail in this section.

Fuel Pump Driver Module (FPDM) - Explorer, Mountaineer



Item	Part Number	Description
1	14A464	Fuel Pump Driver Module (FPDM) electrical connector
2	W504755	FPDM bolts (2 required)
3	9D370	FPDM

Removal and Installation

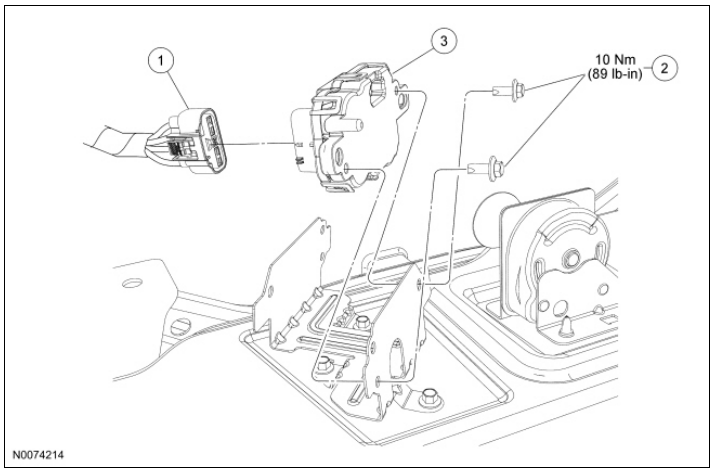
1. Remove the RH rear quarter trim panel. For additional information, refer to Section 501-05 .

2. Disconnect the Fuel Pump Driver Module (FPDM) electrical connector.

3. Remove the 2 bolts and the FPDM .
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.

Fuel Pump Driver Module (FPDM) - Explorer Sport Trac



Item	Part Number	Description
1	14A464	Fuel Pump Driver Module (FPDM) electrical connector
2	W504755	FPDM bolts (2 required)
3	9D370	FPDM

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the Fuel Pump Driver Module (FPDM) electrical connector.

3. Remove the 2 bolts and the FPDM .
   - To install, tighten to 10 Nm (89 lb-in).

General Specifications

Item	Specification
Accessory drive belt	6 ribs

Torque Specifications

Description	Nm	lb-ft
Accessory drive belt idler pulley bolt, 4.0L SOHC	47	35
Accessory drive belt idler pulley bolt, 4.6L (3V)	25	18
Accessory drive belt tensioner bolt, 4.0L SOHC	47	35
Accessory drive belt tensioner bolt, 4.6L (3V)	25	18

Accessory Drive

The accessory drive consists of the following:

- Drive belt
- Idler pulley(s)
- Belt tensioner
- Crankshaft pulley
- A/C clutch pulley
- Generator pulley
- Coolant pump pulley
- Power steering pump pulley

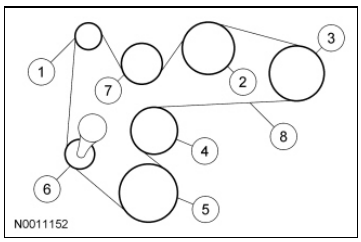
The accessory drive:

- has a single serpentine drive.
- has one idler pulley on the 4.0L SOHC engine.
- has 2 idler pulleys on the 4.6L (3V) engine.
- has automatic tensioning.
- is not adjustable.

The accessory drive system provides power to operate components which power other systems. These could include components such as the generator, power steering pump and A/C compressor. Each of these components is equipped with a pulley which is driven by the accessory drive belt. The accessory drive belt is driven by the engine crankshaft pulley. One or more idler pulleys may be provided to facilitate belt routing and alignment. The automatic belt tensioner maintains correct belt tension and compensates for component wear and changes in system load. System load changes can be caused by the A/C compressor clutch engaging or disengaging, or demand changes on other systems powered by the accessory drive belt. To maintain correct operation of this system, it is critical that the correct length drive belt be installed. The pulleys must also be correctly aligned and kept clean.

Accessory Drive Belt Routing

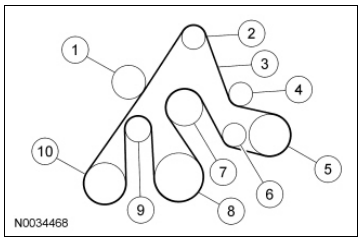
Front End Accessory Drive (FEAD) - 4.0L SOHC



Item	Part Number	Description
1	10300	Generator pulley
2	3A733	Power steering pump pulley
3	19D629	A/C compressor pulley

4	8509	Coolant pump pulley
5	6B321	Crankshaft damper
6	6B209	Drive belt tensioner pulley
7	6C348	Belt idler pulley
8	8620	Drive belt

Front End Accessory Drive (FEAD) - 4.6L (3V)



Item	Part Number	Description
1	19A216	Belt idler pulley
2	10300	Generator pulley
3	8620	Drive belt
4	19A216	Belt idler pulley
5	3A733	Power steering pump pulley
6	6C348	Belt idler pulley
7	8509	Coolant pump pulley
8	6316	Crankshaft pulley
9	6B209	Drive belt tensioner pulley
10	19D629	A/C compressor pulley

Accessory Drive

Inspection and Verification

NOTICE: **Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.**

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

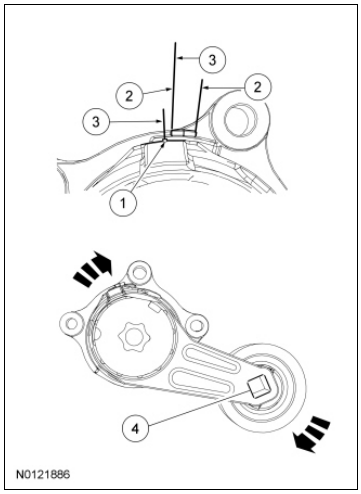
Visual Inspection Chart

Mechanical
• Drive belt cracking/chunking/wear • Belt/pulley contamination • Incorrect accessory drive belt • Incorrectly routed accessory drive belt • Pulley misalignment or excessive pulley runout • Loose or mislocated hardware • Incorrectly routed power steering tubes (rubbing) • Loose accessory drive belt • Damaged pulleys • Tensioner arm misalignment

Belt Tensioner With Belt Length Indicator

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops.

NOTE: 6.2L engine accessory drive belt tensioner shown, other accessory drive belt tensioners similar.



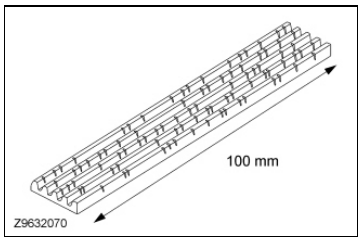
Item	Description
1	Belt length indicator
2	Acceptable belt installation and wear range
3	Belt replacement range
4	Belt tension relief point

3. Check that the belt length indicator, if equipped, on the belt tensioner is in the acceptable belt installation and wear range. If the indicator is in the belt replacement range, either an incorrect belt is installed or the belt is worn beyond the service limit. Install a new belt as necessary.

4. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, A/C slugging noise, power steering cavitations at low temperatures, Variable Camshaft Timing (VCT) tick or generator whine.

5. If a concern is found, correct the condition before proceeding to the next step.

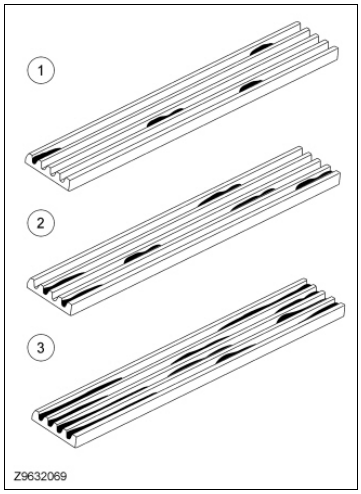
V-Ribbed Serpentine Drive Belt With Cracks Across Ribs



6. Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 in) can be considered acceptable. If cracks exceed this standard, install a new belt.

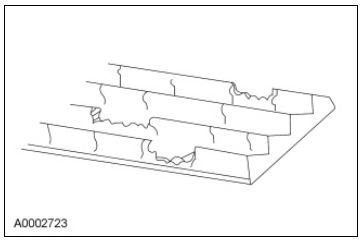
V-Ribbed Serpentine Belt With Piling

NOTE: Piling is an excessive buildup in the V-grooves of the belt.



7. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.
    1. Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.
    2. Longer deposit areas building up to 50% of the rib height. This is not considered a durability concern, but it can result in excessive noise. If noise is apparent, install a new belt.
    3. Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.

V-Ribbed Serpentine Belt With Chunks of Rib Missing



8. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt.

9. If the concern is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Component Tests

Drive Belt - Noise/Flutter

NOTICE: **Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.**

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start up and shut down or during very rapid engine acceleration and decelerations, such as:

- Wide Open Throttle (WOT) 1-2 and 2-3 shifts or 2-3 and 3-4 back-out shifts on automatic transmissions.
- WOT 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertias required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur:

- if the A/C discharge pressure goes above specifications:
  - ♦ the A/C system is overcharged.
  - ♦ the A/C condenser core airflow is blocked.
  - ♦ the A/C anti-slugging strategy executes after a long hot heat soak.
- if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.
- if any of the accessories or idler pulley(s) are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.
- if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.
- if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.
- **NOTE:** The accessory drive belt tensioner arm should rotate freely without binding.

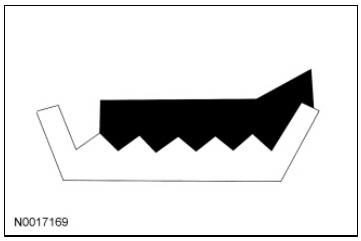
  Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

Drive Belt - Incorrect Installation

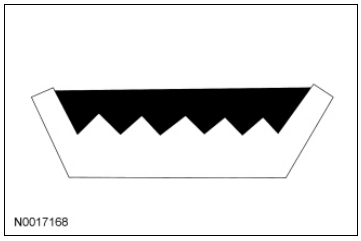
NOTICE: **Incorrect accessory drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the pulleys.**

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.

Incorrect Installation



Correct Installation



With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following:

- Visually check the accessory drive belt tensioner for damage and wear, especially the mounting pad surface and arm alignment. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. If the tensioner arm is worn, the arm will be out of alignment. Either of these conditions will result in chirp and squeal noises.
- With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.
- Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.
- Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to specification. Recheck the accessory drive belt tracking.

Belt Tensioner - Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind.

1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under Accessory Drive in the Description and Operation portion of this section.

2. **NOTE:** The accessory drive belt tensioner spring is very strong and requires substantial force to release.

   Release the tension on the belt and detach the accessory drive belt from the tensioner. Carry out the following tests:

   - Move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.

- Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition.
- Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks.

3. If the accessory drive belt tensioner does not meet the criteria in the previous step, install a new tensioner. If the accessory drive belt tensioner meets the criteria in the previous step, proceed to testing the tensioner dynamically.

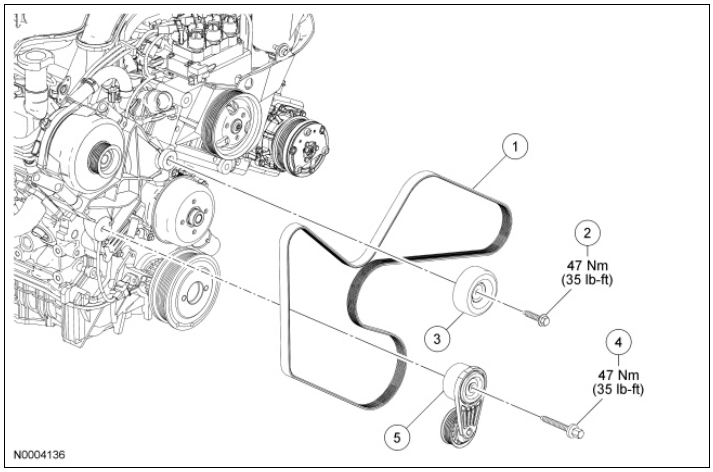
4. If the tensioner is saturated with oil and grease internally, install a new tensioner.

Belt Tensioner - Dynamics

The accessory drive belt tensioner can be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the A/C clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without A/C clutch cycling or engine acceleration, check belt rideout. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check rideout condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

Front End Accessory Drive (FEAD) - Exploded View, 4.0L SOHC



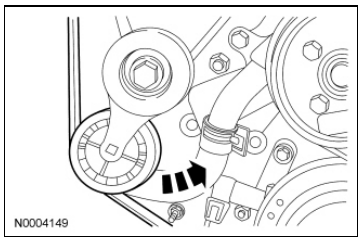
Item	Part Number	Description
1	8620	Accessory drive belt
2	-	Accessory drive belt idler pulley bolt
3	6C348	Accessory drive belt idler pulley
4	W500326-S437	Accessory drive belt tensioner bolt
5	6B209	Accessory drive belt tensioner

1. For additional information, refer to the procedures in this section.

Accessory Drive Belt - 4.0L SOHC

Removal and Installation

1. Rotate the accessory drive belt tensioner counterclockwise and remove the drive belt.

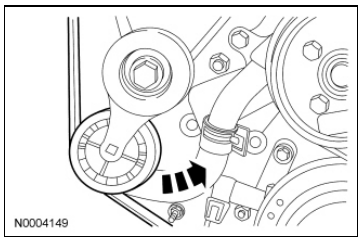


2. To install, reverse the removal procedure.
    - For correct belt routing, refer to Accessory Drive , Accessory Drive Belt Routing, Front End Accessory Drive (FEAD) - 4.0L SOHC in the Description and Operation portion of this section.

Accessory Drive Belt Idler Pulley - 4.0L SOHC

Removal and Installation

1. Rotate the accessory drive belt tensioner counterclockwise and remove the drive belt.



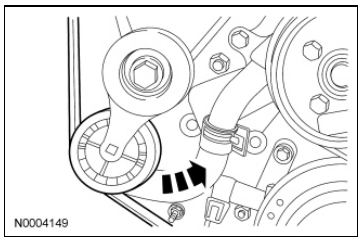
2. Remove the bolt and the accessory drive belt idler pulley.
   - To install, tighten to 47 Nm (35 lb-ft).

3. To install, reverse the removal procedure.
   - For correct belt routing, refer to Accessory Drive , Accessory Drive Belt Routing, Front End Accessory Drive (FEAD) - 4.0L SOHC in the Description and Operation portion of this section.

Accessory Drive Belt Tensioner - 4.0L SOHC

Removal and Installation

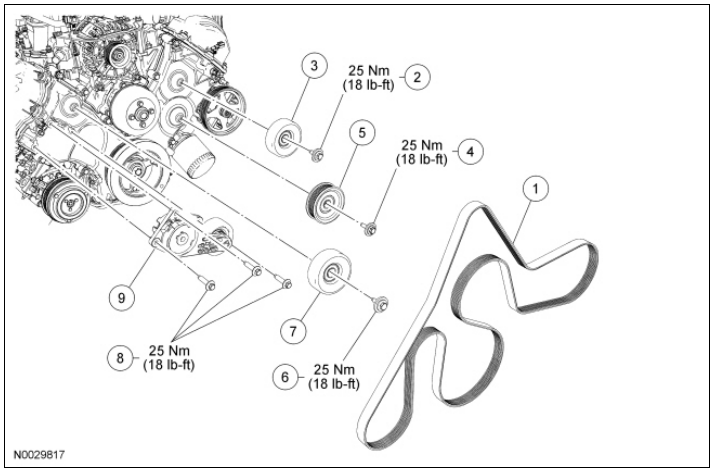
1. Rotate the accessory drive belt tensioner counterclockwise and remove the drive belt.



2. Remove the bolt and the accessory drive belt tensioner.
   - To install, tighten the bolt to 47 Nm (35 lb-ft).

3. To install, reverse the removal procedure.
   - For correct belt routing, refer to Accessory Drive , Accessory Drive Belt Routing, Front End Accessory Drive (FEAD) - 4.0L SOHC in the Description and Operation portion of this section.

Front End Accessory Drive (FEAD) - Exploded View, 4.6L (3V)



Item	Part Number	Description
1	8620	Accessory drive belt
2	N808102	Accessory drive belt idler pulley bolt
3	19A216	Accessory drive belt idler pulley
4	W707288	Accessory drive belt idler pulley bolt
5	6C348	Accessory drive belt idler pulley
6	N808102	Accessory drive belt idler pulley bolt
7	19A216	Accessory drive belt idler pulley
8	N808920	Accessory drive belt tensioner bolts (3 required)
9	6B209	Accessory drive belt tensioner

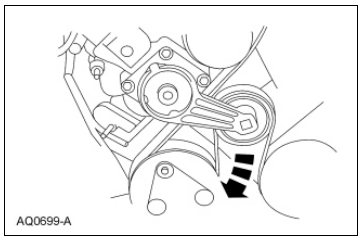
1. For additional information, refer to the procedures in this section.

Accessory Drive Belt - 4.6L (3V)

Removal and Installation

1. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

2. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.



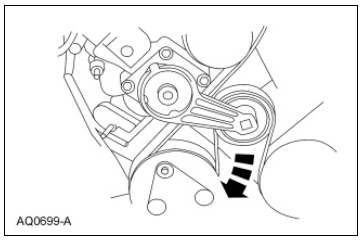
3. To install, reverse the removal procedure.
   - For correct belt routing, refer to Accessory Drive , Accessory Drive Belt Routing, Front End Accessory Drive (FEAD) - 4.6L (3V) in the Description and Operation portion of this section.

Accessory Drive Belt Idler Pulley - 4.6L (3V)

Removal and Installation

1. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

2. Rotate the accessory drive belt tensioner clockwise and remove the drive belt.



3. **NOTE:** The 4.6L (3V) has 3 idler pulleys, an upper RH, an upper LH and a lower LH.

   Remove the bolt and the accessory drive belt idler pulley.

   - To install, tighten to 25 Nm (18 lb-ft).

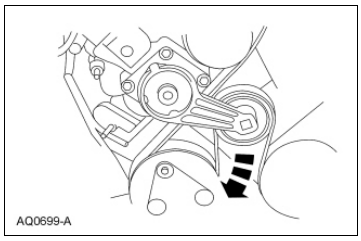
4. To install, reverse the removal procedure.
   - For correct belt routing, refer to Accessory Drive , Accessory Drive Belt Routing, Front End Accessory Drive (FEAD) - 4.6L (3V) in the Description and Operation portion of this section.

Accessory Drive Belt Tensioner - 4.6L (3V)

Removal and Installation

1. Remove the air cleaner outlet pipe. For additional information, refer to Section 303-12 .

2. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.



3. Remove the bolts and the accessory drive belt tensioner.
   - To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.
   - For correct belt routing, refer to Accessory Drive , Accessory Drive Belt Routing, Front End Accessory Drive (FEAD) - 4.6L (3V) in the Description and Operation portion of this section.

General Specifications

Item	Specification
Normal engine cranking speed	140-220 rpm
Starter motor no load current draw	60-80 amps
Starter motor normal load current draw	130-220 amps
Starter motor maximum load current draw	800 amps
Starter motor minimum stall torque (at 5 volts)	14.7 Nm (10.8 lb-ft)
Starter circuit maximum voltage drop (engine at normal operating temperature)	0.5 volt

Torque Specifications

Description	Nm	lb-ft	lb-in
Ground cable nut - 4.0L SOHC	20	-	177
Starter motor bolts and stud bolts	25	18	-
Starter solenoid B-terminal nut	12	-	106
Starter solenoid S-terminal nut	6	-	53

Starting System

The starting system consists of the following:

- Starter motor
- Starter solenoid
- Starter drive
- Starter relay
- Ignition switch
- Digital Transmission Range (TR) sensor
- Battery
- PCM
- Start diode (part of the One-Touch Integrated Start (OTIS) system)

The function of the starting system is to crank the engine at a speed fast enough to permit the engine to start.

When the ignition switch is turned to the START position, current flows to the starter relay. On 4.0L SOHC engines, the current first goes through the TR sensor, and the PCM provides a ground for the starter relay. On 4.6L (3V) engines, if the transmission sends a signal to the PCM indicating a PARK or NEUTRAL position, the PCM will ground the starter relay. When the starter relay is energized, current flows to the starter solenoid.

When the starter solenoid is energized, a magnetic field is created in the starter solenoid windings. The iron plunger core is drawn into the starter solenoid coil, and a drive lever and pin connected to the starter drive engages the drive pinion gear to the flexplate ring gear. When the plunger is pulled all the way in, the contact disc closes the circuit between the battery and the motor feed terminals. This sends current to the motor and the drive pinion gear cranks the flexplate to start the engine. When current flows to the starter motor, the starter solenoid pull-in coil is bypassed, and the hold-in coil keeps the drive pinion gear engaged with the flexplate.

One-Touch Integrated Start (OTIS)

The vehicle is equipped with OTIS , a computer-assisted cranking system. This feature assists in starting the engine. If the ignition key is turned to the START position and released when the engine begins cranking, the engine may continue cranking for up to 10 seconds or until the vehicle starts.

Once the ignition is turned to the START position and the vehicle is in NEUTRAL or PARK, the PCM reads starter motor request from the ignition switch and gains control of the starter engagement. The customer is no longer in the loop after the initial crank request, and the customer may release the key to the RUN position. The PCM will disengage the starter motor based on the following events:

- The engine is started (rpm threshold)
- A set time has been exceeded (calibrated)
- The ignition key has been turned to the OFF position

Starting System

Special Tool(s)

 ST2574-A	Flex Probe Kit 105-R025D or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The starting system is electronically controlled by the Passive Anti-Theft System (PATS). PATS is controlled by the instrument cluster. PATS recognizes the correct electronically coded ignition key and the instrument cluster will send a message to the PCM to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid with the key in the START position, thereby allowing the starter motor to activate.

Inspection and Verification

⚠ WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

NOTE: When working on the starter system, make sure the anti-theft system is deactivated, if equipped.

1. Verify the customer concern by operating the starting system.
2. Remove the accessory drive belt. Refer to Section 303-05 . Verify the crankshaft and each of the components driven by the accessory drive belt rotate and are not seized or damaged.
3. Visually inspect for obvious signs of mechanical and electrical damage. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
	• Battery

• Starter motor • Brackets	• Failed fuse 11 (30A) • Damaged wiring harness • Loose or corroded connections • Starter relay • Anti-theft system

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

6. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory DTCs.

9. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.

10. If the DTCs retrieved are related to the concern, go to PCM DTC Chart in this section For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

PCM DTC Chart

PCM DTC Chart

DTC	Description	Action
P0512	Starter Request Circuit - Circuit has Power With the Ignition in the OFF Position	CARRY OUT the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. If necessary, INSTALL a new ignition switch. If the ignition switch passed the component test, REPAIR circuit CDC35 (BU/WH) for a short to power.
P0705	TR Sensor Circuit Failure	Refer to the appropriate section in Group 307 for the procedure.

P0706	TR Sensor Circuit Failure	Refer to the appropriate section in Group 307 for the procedure.
P0708	TR Sensor Circuit Failure	Refer to the appropriate section in Group 307 for the procedure.
P0709	TR Sensor Circuit Failure	Refer to the appropriate section in Group 307 for the procedure.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank/The Relay Does/Does Not Click

Refer to Wiring Diagrams Cell 20 , Starting System for schematic and connector information.

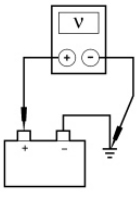
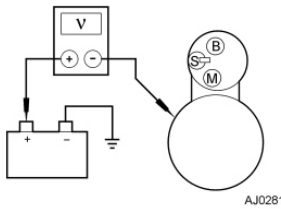
Under normal operation, constant power is supplied to the starter motor relay from Battery Junction Box (BJB) fuse 11 (30A). When the ignition switch is turned in the START position and held, power flows to the start diode through circuit CDC35 (BU/WH). Power then flows to the digital Transmission Range (TR) sensor (4.0L SOHC engines only) and to the starter motor relay through circuit CDC38 (WH/VT). On vehicles equipped with a 4.6L 3V engine, the PCM will receive a voltage signal from the transmission when the vehicle is in Park or Neutral through circuit CET40 (GN/OG). A ground is supplied through circuit CDC12 (YE) from the PCM, causing the starter motor relay coil to energize and the relay contacts to close. This allows power to be supplied from the starter motor relay contacts which then flows through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid engages the starter drive into the ring gear and closes the solenoid contacts, allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine.

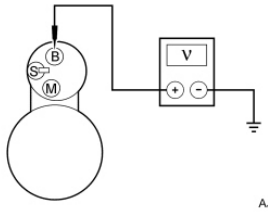
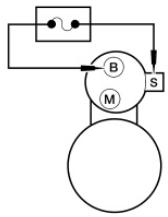
This pinpoint test is intended to diagnose the following:

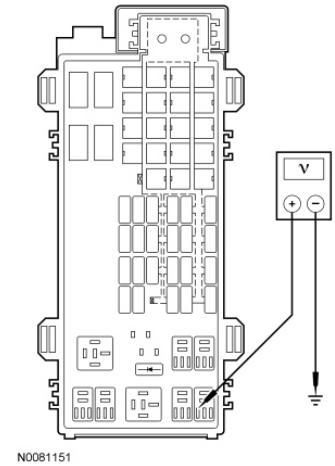
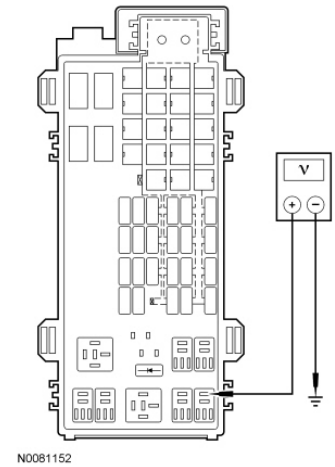
- Battery
- Starter motor
- Passive Anti-Theft System (PATS)
- Starter relay
- Ignition switch
- Digital TR sensor (4.0L SOHC only)
- Circuitry
- PCM
- Start diode
- Park/Neutral switch signal (integral to the mechatronics unit - 4.6L 3V only)

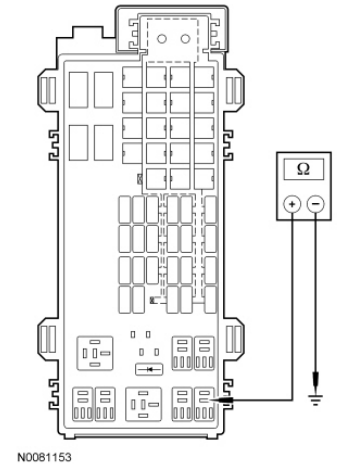
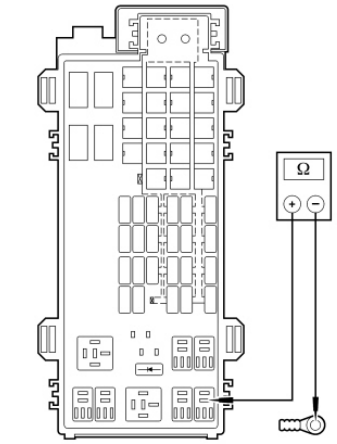
PINPOINT TEST A: THE ENGINE DOES NOT CRANK/THE RELAY DOES/DOES NOT CLICK

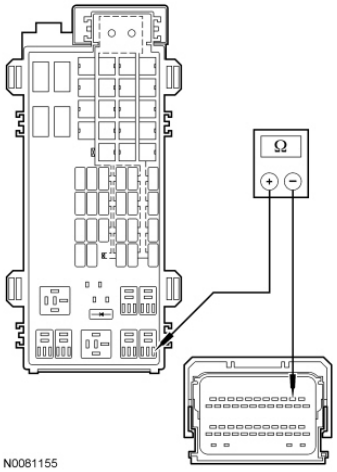
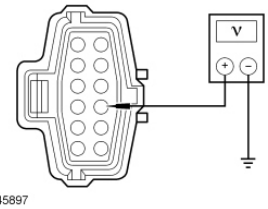
Test Step	Result / Action to Take
A1 CHECK THE BATTERY	
• Check the battery condition and charge. Refer to Section 414-00 . • **Is the battery OK?**	**Yes** GO to A2 . **No**

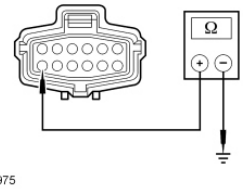
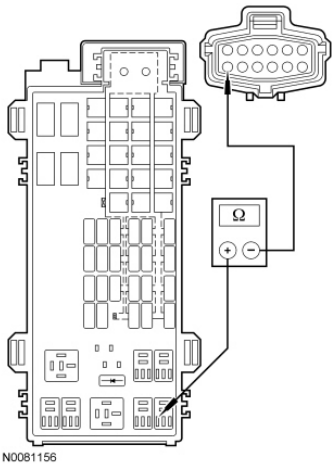
	CHARGE or INSTALL a new battery as required. TEST the system for normal operation.
A2 CHECK THE PCM FOR DTCs	
• Check for PCM DTCs. • **Were any PCM DTCs retrieved?**	**Yes** If PCM DTC P1260 is retrieved, REFER to Section 419-01 . All other PCM DTCs, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to A3 .
A3 CHECK THE BATTERY GROUND CABLE	
• Measure the voltage between the positive battery post and the battery ground cable connection at the cylinder block.  AJ0280-A • **Is the voltage reading greater than 10 volts?**	**Yes** GO to A4 . **No** INSTALL a new battery ground cable. TEST the system for normal operation.
A4 CHECK THE STARTER MOTOR GROUND	
• Measure the voltage between the positive battery post and the starter motor case.  AJ0281-A • **Is the voltage reading greater than 10 volts?**	**Yes** GO to A5 . **No** CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.
A5 CHECK THE POWER SUPPLY TO THE STARTER MOTOR	
• Ignition OFF. • Measure the voltage at the starter motor B-terminal.	**Yes** GO to A6 . **No** CLEAN, TIGHTEN or INSTALL a new positive battery cable. TEST the system for normal operation.

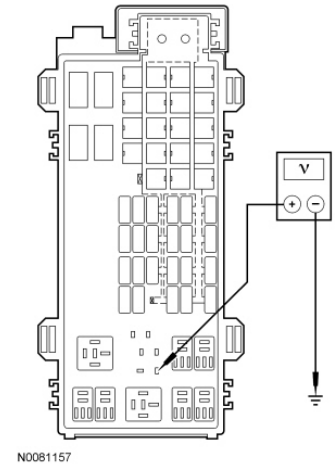
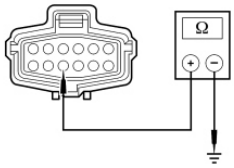
 AJ0278-A • **Is the voltage reading greater than 10 volts?**	
A6 CHECK THE STARTER MOTOR	
• Connect one end of a fused jumper wire to the B-terminal of the starter motor and momentarily connect the other end to the starter solenoid S-terminal.  N0076529 • **Does the starter motor engage and the engine crank?**	**Yes** GO to A7 . **No** INSTALL a new starter motor. REFER to Starter Motor - 4.0L SOHC or Starter Motor - 4.6L (3V) in this section. TEST the system for normal operation.
A7 CHECK THE START INPUT TO THE STARTER MOTOR	
• Disconnect: Starter S-Connector. • Measure the voltage at the starter motor solenoid S-connector with the key in the START position. • **Is the voltage reading greater than 10 volts?**	**Yes** CLEAN the starter solenoid S-terminal and connector. CHECK the wiring and the starter motor for a loose or intermittent connection. TEST the system for normal operation. **No** GO to A8 .
A8 CHECK THE START INPUT TO THE STARTER RELAY	
• Disconnect: Starter Relay. • Measure the voltage at starter relay pin 1, circuit CDC38 (WH/VT) with the key in the START position.	**Yes** GO to A9 . **No** If the vehicle is equipped with a 4.0L SOHC engine, GO to A14 . If the vehicle is equipped with a 4.6L (3V) engine, GO to A24 .

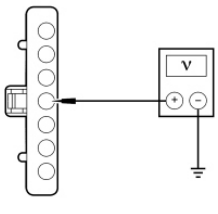
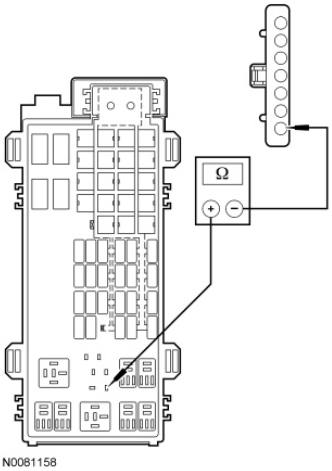
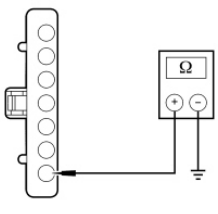
 N0081151 • **Is the voltage reading greater than 10 volts?**	
A9 CHECK THE BATTERY SUPPLY TO THE STARTER RELAY	
• Ignition OFF. • Measure the voltage at starter relay pin 3, circuit SBB11 (BU/RD).  N0081152 • **Is the voltage reading greater than 10 volts?**	**Yes** GO to A10 . **No** REPAIR circuit SBB11 (BU/RD) for an open. TEST the system for normal operation.
A10 CHECK CIRCUIT CDC25 (BN/GN) FOR A SHORT TO GROUND	
• Disconnect: Starter S-Connector. • Measure the resistance between starter relay pin 5, circuit CDC25 (BN/GN) and ground.	**Yes** REPAIR circuit CDC25 (BN/GN) for a short to ground. TEST the system for normal operation. **No** GO to A11 .

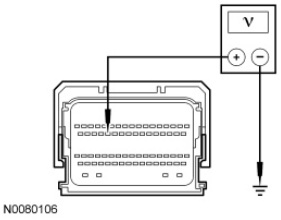
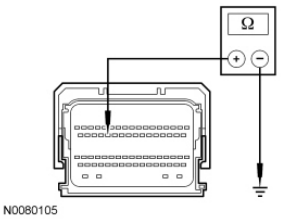
 N0081153 • **Is the resistance reading less than 10,000 ohms?**	
A11 CHECK CIRCUIT CDC25 (BN/GN) FOR AN OPEN	
• Measure the resistance of circuit CDC25 (BN/GN) between starter relay pin 5 and the starter S-connector.  N0081154 • **Is the resistance reading less than 5 ohms?**	**Yes** GO to A12 . **No** REPAIR circuit CDC25 (BN/GN) for an open. TEST the system for normal operation.
A12 CHECK CIRCUIT CDC12 (YE) FOR AN OPEN	
• Disconnect: PCM C175B. • Measure the resistance between starter relay pin 2, circuit CDC12 (YE) and PCM C175B pin 2, circuit CDC12 (YE).	**Yes** GO to A13 . **No** REPAIR circuit CDC12 (YE) for an open. TEST the system for normal operation.

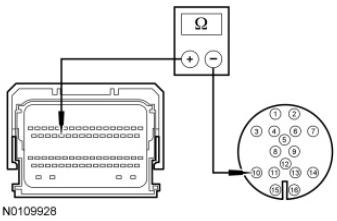
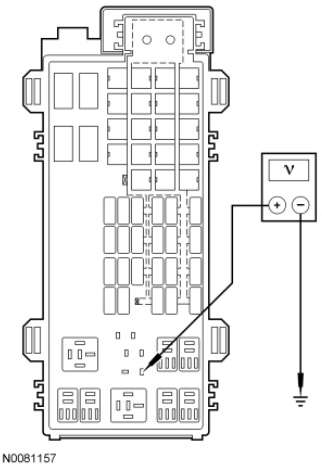
 • **Is the resistance less than 5 ohms?**	
A13 CHECK THE STARTER RELAY	
• Carry out the Starter Mini ISO Relay Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the starter relay good?**	**Yes** DIAGNOSE the PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** INSTALL a new starter relay. TEST the system for normal operation.
A14 CHECK THE START INPUT TO THE DIGITAL TR SENSOR - 4.0L SOHC	
• Disconnect: TR Sensor C167. • Measure the voltage at the digital TR sensor C167-10, circuit CDC38 (WH/VT) with the key in the START position.  • **Is the voltage reading greater than 10 volts?**	**Yes** GO to A15 . **No** GO to A18 .
A15 CHECK CIRCUIT CDC38 (WH/VT) FOR A SHORT TO GROUND - 4.0L SOHC	
• Measure the resistance between digital TR sensor C167-12, circuit CDC38 (WH/VT) and ground.	**Yes** REPAIR circuit CDC38 (WH/VT) for a short to ground. TEST the system for normal operation. **No** GO to A16 .

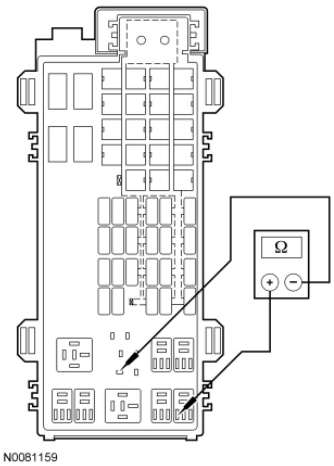
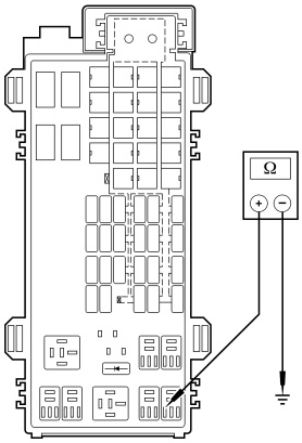
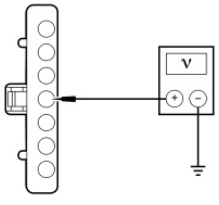
 N0073975 • **Is the resistance reading less than 10,000 ohms?**	
A16 CHECK CIRCUIT CDC38 (WH/VT) FOR AN OPEN - 4.0L SOHC	
• Measure the resistance between starter relay pin 1, circuit CDC38 (WH/VT) and digital TR sensor C167-12, circuit CDC38 (WH/VT).  N0081156 • **Is the resistance less than 5 ohms?**	**Yes** GO to A17 . **No** REPAIR circuit CDC38 (WH/VT) for an open. TEST the system for normal operation.
A17 CHECK DIGITAL TR SENSOR ADJUSTMENT - 4.0L SOHC	
• Carry out the digital TR sensor adjustment. Refer to Section 307-01A . • **Is the digital TR sensor adjusted correctly?**	**Yes** INSTALL a new digital TR sensor. TEST the system for normal operation. **No** ADJUST the digital TR sensor as necessary. TEST the system for normal operation.
A18 CHECK FOR BATTERY POWER AT THE START DIODE - 4.0L SOHC	
• Disconnect: Start Diode. • Measure the voltage at the input side of the start diode circuit CDC35 (BU/WH).	**Yes** GO to A19 . **No** GO to A21 .

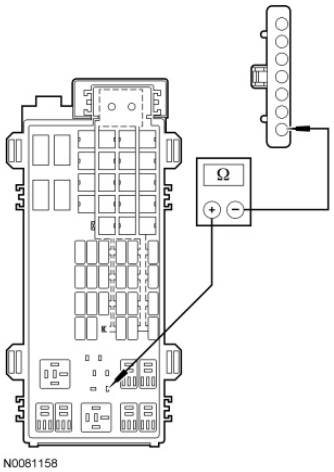
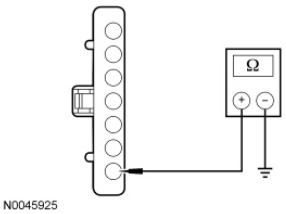
 N0081157 • **Is the voltage reading greater than 10 volts?**	
A19 CHECK CIRCUIT CDC38 (WH/VT) FOR AN OPEN - 4.0L SOHC	
• Measure the resistance between start diode output side, circuit CDC38 and digital TR sensor C167-10, circuit CDC38 (WH/VT). • **Is the resistance less than 5 ohms?**	**Yes** GO to A20 . **No** REPAIR circuit CDC38 (WH/VT). TEST the system for normal operation.
A20 CHECK CIRCUIT CDC38 FOR A SHORT TO GROUND - 4.0L SOHC	
• Measure the resistance between digital TR sensor C167-10, circuit CDC38 (WH/VT) and ground.  N0073988 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new start diode. TEST the system for normal operation. **No** REPAIR circuit CDC38 (WH/VT) for a short to ground. TEST the system for normal operation.
A21 CHECK FOR BATTERY POWER AT THE IGNITION SWITCH - 4.0L SOHC	
• Disconnect: Ignition Switch C250. • Measure the voltage at ignition switch C250 pin 4, circuit SBP08 (VT/RD).	**Yes** GO to A22 . **No** REPAIR circuit SBP08 (VT/RD). TEST the system for normal operation.

 N0045923 • **Is the voltage reading greater than 10 volts?**	
A22 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN - 4.0L SOHC	
• Check the resistance between ignition switch C250 pin 7, circuit CDC35 (BU/WH) and start diode input side, circuit CDC35 (BU/WH).  N0081158 • **Is the resistance reading less than 5 ohms?**	**Yes** GO to A23 . **No** REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.
A23 CHECK CIRCUIT CDC35 (BU/WH) FOR A SHORT TO GROUND - 4.0L SOHC	
• Measure the resistance between ignition switch C250 pin 7, circuit CDC35 (BU/WH) and ground.  N0045925 • **Is the resistance reading greater than 10,000 ohms?**	**Yes** INSTALL a new ignition switch. TEST the system for normal operation **No** REPAIR circuit CDC35 (BU/WH) for a short to ground. TEST the system for normal operation.
A24 CHECK FOR VOLTAGE ON CIRCUIT CET40 (GN/OG) AT PCM CONNECTOR - 4.6L (3V)	

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.** • Ignition OFF. • Disconnect: PCM C175T. • Ignition ON. • Measure the voltage between PCM C175T-19, circuit CET40 (GN/OG), harness side and ground while moving the selector lever from PARK to NEUTRAL.  N0080106 • **Is the voltage greater than 10 volts with the selector lever in PARK and NEUTRAL?**	**Yes** GO to A27 . **No** GO to A25 .
A25 CHECK CIRCUIT CET40 (GN/OG) FOR A SHORT TO GROUND - 4.6L (3V)	
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.** • Measure the resistance between C175B-30, circuit CET40 (GN/OG), harness side and ground.  N0080105 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A26 . **No** REPAIR circuit CET40 (GN/OG). TEST the system for normal operation.
A26 CHECK CIRCUIT CET40 (GN/OG) FOR AN OPEN - 4.6L (3V)	
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.** • Ignition OFF. • Disconnect: PCM C1575. • Measure the resistance between PCM C175T-19, circuit CET40 (GN/OG), harness side and transmission C1575-10, circuit CET40 (GN/OG), harness side.	**Yes** Replace the transmission mechatronics unit. REFER to Section 307-01B . TEST the system for normal operation. **No** REPAIR circuit CET40 (GN/OG). TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	
A27 CHECK FOR BATTERY POWER AT THE START DIODE - 4.6L (3V)	
• Measure the voltage at the start diode input side, circuit CDC35 (BU/WH).  • **Is the voltage 10 volts or greater?**	**Yes** GO to A28 . **No** GO to A30 .
A28 CHECK CIRCUIT CDC38 (WH/VT) FOR AN OPEN - 4.6L (3V)	
• Measure the resistance between starter relay pin 1, circuit CDC38 (WH/VT) and start diode output side circuit CDC38 (WH/VT).	**Yes** GO to A29 . **No** REPAIR circuit CDC38 (WH/VT) for an open. TEST the system for normal operation.

 N0081159 • **Is the resistance less than 5 ohms?**	
A29 CHECK CIRCUIT CDC38 (WH/VT) FOR A SHORT TO GROUND - 4.6L (3V)	
• Measure the resistance between starter relay pin 1, circuit CDC38 (WH/VT) and ground.  N0081160 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new start diode. TEST the system for normal operation. **No** REPAIR circuit CDC38 (WH/VT) for a short to ground. TEST the system for normal operation.
A30 CHECK FOR BATTERY POWER AT THE IGNITION SWITCH - 4.6L (3V)	
• Disconnect: Ignition Switch C250. • Measure the voltage at ignition switch C250 pin 4, circuit SBP08 (VT/RD).  N0045923	**Yes** GO to A31 . **No** REPAIR circuit SBP08 (VT/RD). TEST the system for normal operation.

• **Is the voltage reading greater than 10 volts?**	
A31 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN - 4.6L (3V)	
• Measure the resistance between ignition switch C250 pin 7, circuit CDC35 (BU/WH) and start diode input side, circuit CDC35 (BU/WH)  • **Is the resistance less than 5 ohms?**	**Yes** GO to A32 . **No** REPAIR circuit CDC35 (BU/WH) for an open. TEST the system for normal operation.
A32 CHECK CIRCUIT CDC35 (BU/WH) FOR A SHORT TO GROUND - 4.6L (3V)	
• Measure the resistance between ignition switch C250 pin 7, circuit CDC35 (BU/WH) and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new ignition switch. TEST the system for normal operation. **No** REPAIR circuit CDC35 (BU/WH) for a short to ground. TEST the system for normal operation.

Pinpoint Test B: One-Touch Integrated Start (OTIS) Does Not Operate Correctly

Refer to Wiring Diagrams Cell 20 , Starting System for schematic and connector information.

Normal Operation

When the ignition switch is turned in the START position and released, the PCM receives a starter motor request signal through circuit CDC35 (BU/WH). With the vehicle in PARK or NEUTRAL, power flows from the PCM to the starter motor relay through circuit CDC38 (WH/VT). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter motor relay coil to energize and the relay contacts close. This allows power from starter motor relay through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is

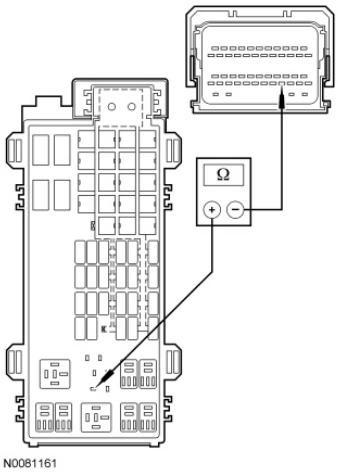
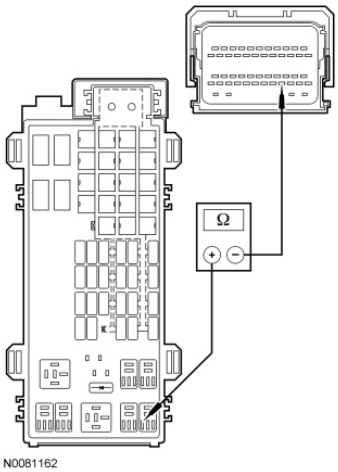
grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and close the solenoid contacts, allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine. The customer is no longer in the loop after the initial crank request, and the customer may release the key to the RUN position. The PCM will disengage the starter motor based on engine running (rpm threshold), a set crank time has been exceeded or the ignition switch has been turned to the OFF position.

This pinpoint test is intended to diagnose the following:

- Circuitry
- PCM

PINPOINT TEST B: ONE-TOUCH INTEGRATED START (OTIS) DOES NOT OPERATE CORRECTLY

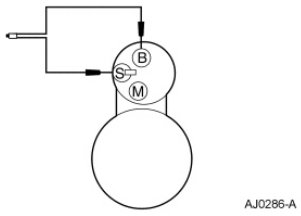
Test Step	Result / Action to Take
B1 CHECK THE STATUS OF OTIS (OTS_STAT) PID	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger/PID. • Monitor the PCM PID OTS_STAT with the ignition switch in the RUN position. • **Is the OTIS PID enabled?**	**Yes** GO to B2 . **No** ENABLE OTIS TEST the system for normal operation. If OTIS will not enable, INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.
B2 CHECK THE KEY POSITION FOR START INDICATED (START_KEY) PID	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger/PID. • Monitor the PCM PID START_KEY with the ignition switch in the START position. • **Does the PID change from OFF to ON?**	**Yes** GO to B4 . **No** GO to B3 .
B3 CHECK CIRCUIT CDC38 (WH/VT)	
• Disconnect: Start Diode. • Disconnect: PCM C175B. • Measure the resistance between the start diode, circuit CDC38 (WH/VT), harness side and PCM C175B-38, circuit CDC38 (WH/VT), harness side.	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** REPAIR circuit CDC38 (WH/VT). TEST the system for normal operation.

 N0081161 • **Is the resistance less than 5 ohms?**	
B4 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger/PID. • Monitor the PCM PID STRT_RLY with the ignition switch in the START position. • **Does the PID change from DISABLED to ENABLED?**	**Yes** GO to B6 . **No** GO to B5 .
B5 CHECK THE CIRCUIT CDC38 (WH/VT) BETWEEN THE STARTER RELAY AND THE PCM	
• Ignition OFF. • Disconnect: PCM C175B. • Disconnect: Smart Junction Box (SJB) C2280B. • Measure the resistance between the starter motor relay pin 1, circuit CDC38 (WH/VT), harness side and PCM C175b-38, circuit CDC38 (WH/VT), harness side.  N0081162 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** REPAIR circuit CDC38 (WH/VT). TEST the system for normal operation.

B6 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger/PID. • Monitor the PCM PID SMC_MON with the ignition switch in the START position. • **Does the PID change from OFF to ON?**	**Yes** REPAIR circuit CDC12 (YE). TEST the system for normal operation. **No** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.

Pinpoint Test C: Unusual Starter Noise

PINPOINT TEST C: UNUSUAL STARTER NOISE

Test Step	Result / Action to Take
C1 CHECK THE STARTER MOUNTING	
• Inspect the starter mounting bolts and brackets for looseness, and the starter housing to confirm a flush, tight fit to the rear cover plate. • **Is the starter motor mounted correctly?**	**Yes** GO to C2 . **No** INSTALL the starter motor correctly. REFER to Starter Motor - 4.0L SOHC or Starter Motor - 4.6L (3V) in this section. TEST the system for normal operation.
C2 CHECK FOR ENGINE NOISE	
• Ignition OFF. • Connect a remote starter switch between the starter solenoid B- and S-terminals.  AJ0286-A • Engage the starter motor and verify that the noise is due to the starter operation. • **Is the noise due to the starter motor engagement?**	**Yes** GO to C3 . **No** REFER to Section 303-00 to continue the diagnosis.
C3 CHECK FOR UNUSUAL WEAR	
• Remove the starter motor. Refer to Starter Motor - 4.0L SOHC or Starter Motor - 4.6L (3V) in this section.	**Yes** INSTALL a flexplate. REFER to Section 303-01A for 4.0L SOHC engines or Section 303-01B for 4.6L (3V) engines. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor.

• Inspect the ring gear for damaged or worn teeth. • **Is the noise due to ring gear tooth damage?**	REFER to Starter Motor - 4.0L SOHC or Starter Motor - 4.6L (3V) in this section. TEST the system for normal operation. **No** INSTALL a new starter motor. REFER to Starter Motor - 4.0L SOHC or Starter Motor - 4.6L (3V) in this section. TEST the system for normal operation.

Component Tests

Starter Motor - Voltage Drop Test

⚠ **WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

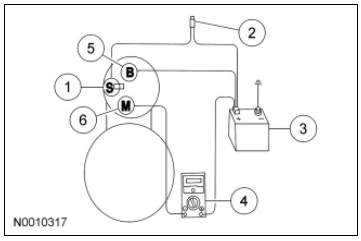
NOTICE: **A protective cap or boot is provided over the battery input terminal on all vehicle lines and must be installed after servicing, or the vehicle may be damaged.**

Always make the Rotunda 73 Digital Multimeter connections at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor - Motor Feed Circuit

1. Make sure the battery is fully charged. Refer to Section 414-00 .
2. Disconnect the Inertia Fuel Shutoff (IFS) switch.
3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.
4. Connect the Rotunda 73 Digital Multimeter positive lead to the battery positive (+) post. Connect negative lead to the starter solenoid M-terminal.

Motor Feed Circuit



Item	Part Number	Description
1	-	S-terminal (part of 11002)
2	-	Remote starter switch
3	10653	Battery
4	-	Rotunda 73 Digital Multimeter

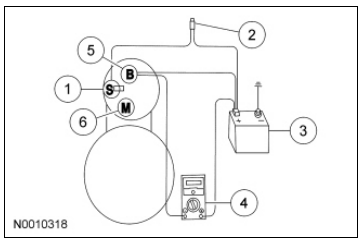
5	-	B-terminal (part of 11002)
6	-	M-terminal (part of 11002)

5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.

6. If the voltage reading is 0.5 volt or less, go to the Starter Motor - Motor Ground Circuit component test in this section.

7. If the voltage reading is greater than 0.5 volt, indicating excessive resistance, move the Rotunda 73 Digital Multimeter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.5 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.

Motor Feed Circuit



Item	Part Number	Description
1	-	S-terminal (part of 11002)
2	-	Remote starter switch
3	10653	Battery
4	-	Rotunda 73 Digital Multimeter
5	-	B-terminal (part of 11002)
6	-	M-terminal (part of 11002)

8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.5 volt when checked at the M-terminal and less than 0.5 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.

9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself.

10. By moving the Rotunda 73 Digital Multimeter negative lead toward the battery and checking each mechanical connection point, the excessive voltage drop can be located. When the high reading disappears, the last mechanical point that was checked is the concern. Repair or install a new connection as required.

Starter Motor - Motor Ground Circuit

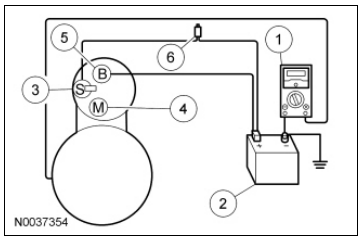
A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Disconnect the IFS switch.

2. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.

3. Connect the Rotunda 73 Digital Multimeter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.

Motor Ground Circuit



Item	Part Number	Description
1	-	Rotunda 73 Digital Multimeter
2	10653	Battery
3	-	S-terminal (part of 11002)
4	-	M-terminal (part of 11002)
5	-	B-terminal (part of 11002)
6	-	Remote starter switch

4. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.

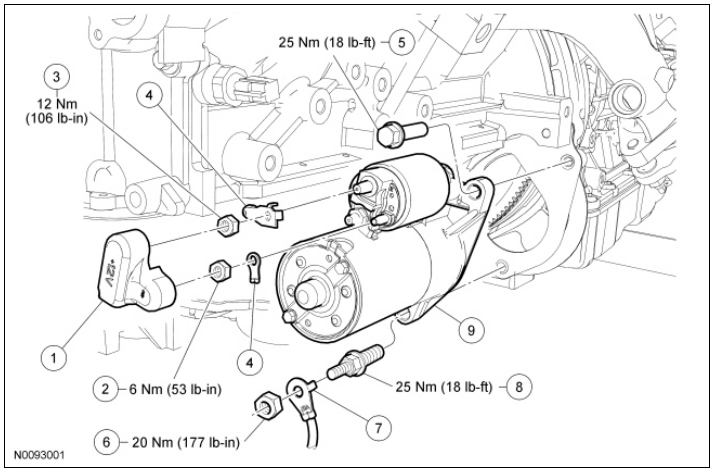
5. If the voltage drop is more than 0.5 volt, clean the negative cable connections at the battery and body connections, and retest.

6. If the voltage drop is greater than 0.5 volt, determine which way the current is flowing in the cable. Connect the Rotunda 73 Digital Multimeter positive lead to the end of the cable nearest battery positive.

7. Connect the multimeter negative lead to the terminal at the other end of the cable.

8. Crank the engine and observe the voltage reading. The voltage reading should be 0.5 volt or lower. If the voltage drop is too high, clean the terminal ends. Retest, and if still high, install a new cable. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.

Starter Motor - 4.0L SOHC



Item	Part Number	Description
1	11N087	Starter motor solenoid terminal cover
2	W705790	Starter motor S-terminal nut
3	-	Starter motor B-terminal nut
4	14A280	Starter motor solenoid cables
5	W500320	Starter motor bolt
6	N802001	Ground cable nut
7	-	Ground cable
8	W710601	Starter motor stud bolt
9	11002	Starter motor

Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the starter motor solenoid terminal cover.

4. Remove the B-terminal nut and disconnect the cable.
   - To install, tighten to 12 Nm (106 lb-in).

5. Remove the S-terminal nut and disconnect the cable.
   - To install, tighten to 6 Nm (53 lb-in).

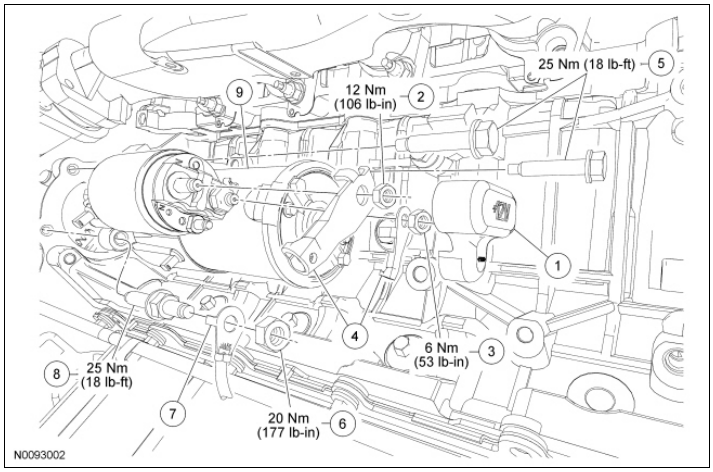
6. Remove the nut and position the ground cable aside.

- To install, tighten to 20 Nm (177 lb-in).

7. Remove the bolt, the stud bolt and the starter.
   - To install, tighten to 25 Nm (18 lb-ft).

8. To install, reverse the removal procedure.
   - Tighten the upper bolt before tightening the lower fastener.

Starter Motor - 4.6L (3V)



Item	Part Number	Description
1	11N078	Starter motor solenoid terminal cover
2	-	B-terminal nut
3	W705790	S-terminal nut
4	14463	Starter motor solenoid cables
5	W704942	Starter motor bolts (2 required)
6	N802001	Ground cable nut
7	-	Ground cable
8	W704941	Starter motor stud bolt
9	11000	Starter motor

Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the starter solenoid terminal cover.

4. Remove the B-terminal nut and disconnect the cable.
   - To install, tighten to 12 Nm (106 lb-in).

5. Remove the S-terminal nut and disconnect the cable.
   - To install, tighten to 6 Nm (53 lb-in).

6. Remove the nut and disconnect the ground cable from the stud bolt.

- To install, tighten to 20 Nm (177 lb-in).

7. Remove the bolts, the stud bolt and the starter.
   - To install, tighten to 25 Nm (18 lb-ft).

8. To install, reverse the removal procedure.
   - Tighten the upper bolt before tightening the lower fasteners.

Material

Item	Specification	Fill Capacity
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

General Specifications

Item	Specification
Base ignition timing	10 degrees Before Top Dead Center (BTDC), Non-adjustable
Firing order	1-4-2-5-3-6
Spark plug gap	1.32-1.42 mm (0.052-0.056 in)
Spark plug type	AGSF24N

Torque Specifications

Description	Nm	lb-in
Ignition coil bolts	6	53
Spark plugs	17	150

Engine Ignition

The ignition system consists of the following:

- Crankshaft Position (CKP) sensor
- Ignition coil
- Spark plug wires
- Spark plugs

The CKP sensor:

- is a variable reluctance sensor.
- is mounted on the engine front cover.
- is triggered by a 36-minus-1 tooth trigger wheel located on the crankshaft damper pulse ring.
- provides ignition timing and crankshaft speed to the PCM.

The ignition coil:

- changes low-voltage pulses from the PCM to high-voltage pulses.
- fires 2 spark plugs simultaneously.
- has 3 transformers.
    - One transformer fires the spark plugs for cylinders 1 and 5
    - One transformer fires the spark plugs for cylinders 2 and 6
    - One transformer fires the spark plugs for cylinders 3 and 4

Spark plug wires:

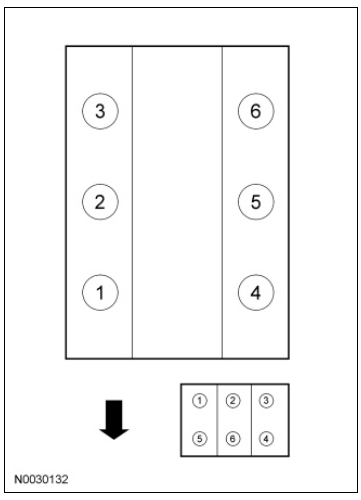
- carry high-voltage pulses from the ignition coil to the spark plugs.

The spark plugs:

- change high-voltage pulses to spark at the gap, which ignites the fuel and air mixture.

The firing order is 1-4-2-5-3-6.

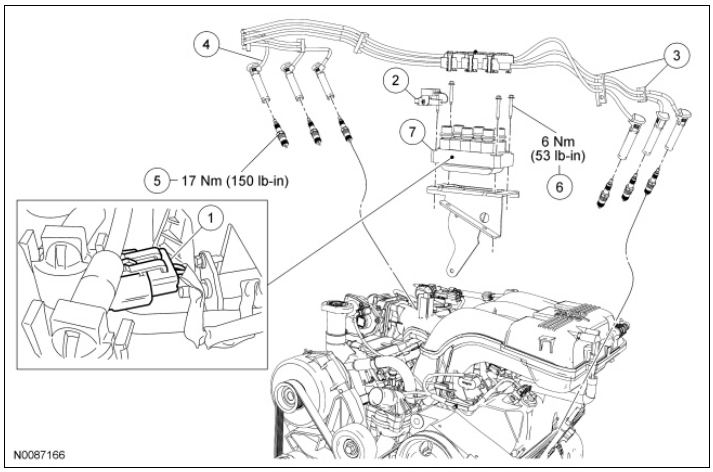
Coil Terminal-to-Cylinder Relationship



Engine Ignition

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Engine Ignition Components - Exploded View



Item	Part Number	Description
1	14A464	Ignition coil electrical connector
2	14489	Radio noise suppressor electrical connector
3	12297	Spark plug wire retainers
4	12286	Spark plug wire (6 required)
5	12405	Spark plug (6 required)
6	W706216-S	Ignition coil bolt (4 required)
7	12029	Ignition coil

1. For additional information, refer to the procedures in this section.

Ignition Coil

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal and Installation

1. Disconnect the ignition coil electrical connector.

2. Disconnect the radio noise suppressor electrical connector.

3. ***NOTICE:*** **It is important to twist the spark plug wire boot while pulling upward to avoid possible damage to the spark plug wire.**

   NOTE: Spark plug wires must be connected to the correct ignition coil terminal. For additional information, refer to the Cylinder-to-Coil Terminal Relationship, Engine Ignition in the Description and Operation portion of this section.

   Squeeze the tabs and twist, while pulling upward to disconnect the 6 spark plug wires from the ignition coil.

4. Remove the 4 bolts and the ignition coil.
   - To install, tighten to 6 Nm (53 lb-in).

5. **NOTE:** Apply silicone dielectric compound to the inside of the ignition coil boots.

   To install, reverse the removal procedure.

Spark Plug Wires

Special Tool(s)

 ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal and Installation

1. ***NOTICE:*** **It is important to twist the spark plug wire boot while pulling upward to avoid possible damage to the spark plug wire.**

   NOTE: Spark plug wires must be connected to the correct ignition coil terminal. For additional information, refer to the Cylinder-to-Coil Terminal Relationship, Engine Ignition in the Description and Operation portion of this section.

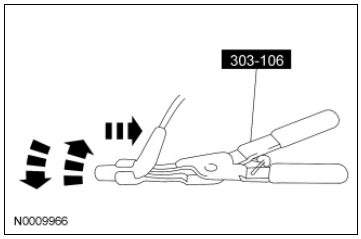
   Squeeze the locking tabs and twist while pulling upward to disconnect the 6 spark plug wires from the ignition coil.

2. Detach the spark plug wires from the spark plug wire retainers.

3. ***NOTICE:*** **It is important to twist the spark plug wire boot while pulling upward to avoid possible damage to the spark plug wire.**

   NOTE: Spark plug wires must be connected to the correct spark plug.

   With a twisting motion, use the Spark Plug Wire Remover to pull the spark plug wires from the spark plugs.



4. **NOTE:** Apply silicone dielectric compound to the inside of the spark plug wire boots.

   To install, reverse the removal procedure.

Spark Plugs

Special Tool(s)

 ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)

Material

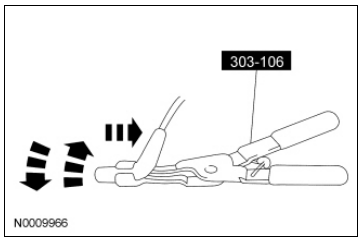
Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal and Installation

1. ***NOTICE:*** **It is important to twist the spark plug wire boot while pulling upward to avoid possible damage to the spark plug wire.**

   NOTE: Spark plug wires must be connected to the correct spark plug. Refer to the Cylinder-to-Coil Terminal Relationship, Engine Ignition in the Description and Operation portion of this section.

   With a twisting motion, use the Spark Plug Wire Remover to pull the spark plug wire from the spark plug.



2. **NOTE:** Use compressed air to remove any foreign material from the spark plug wells before removing the spark plugs.

   Remove the spark plugs.

   - To install, tighten to 17 Nm (150 lb-in).

3. Use a suitable spark plug gap tool to check and adjust the spark plug gap.

4. **NOTE:** Apply silicone dielectric compound to the inside of the spark plug wire boots.

   To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

General Specifications

Item	Specification
Base ignition timing	10 degrees Before Top Dead Center (BTDC)
Firing order	1-3-7-2-6-5-4-8
Spark plug gap	1.05 +/- 0.05 mm (0.039-0.043 in)
Spark plug type	HJFS-24FP

Torque Specifications

Description	Nm	lb-in
Coil-on-plug bolts	6	53
Spark plugs	12	106

Engine Ignition

The electronic ignition system is a coil-on-plug ignition system. The coil-on-plug ignition system consists of the following components:

- Crankshaft Position (CKP) sensor
- Ignition coils
- Spark plugs

The CKP sensor:

- is a variable reluctance sensor.
- is triggered by a 36-minus-1 tooth sensor ring mounted on the crankshaft.
- provides base timing and crankshaft speed (rpm) to the PCM.

The 8 separate ignition coils:

- change low voltage to high voltage pulses based on signals from the PCM.
- produce the high voltage pulses to the spark plugs.
- are connected directly to each spark plug.

The spark plugs:

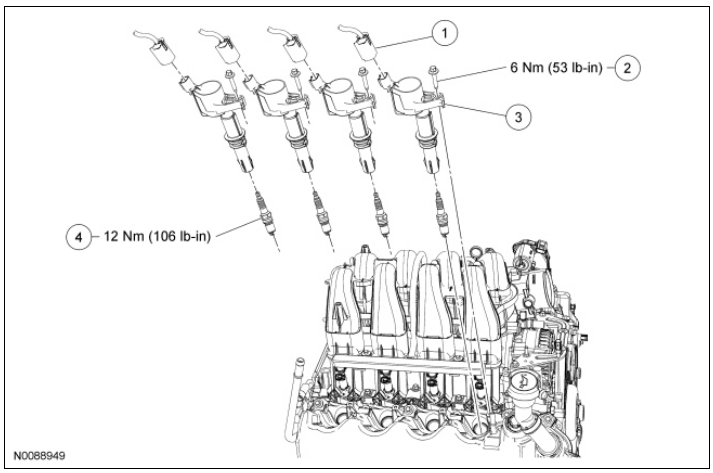
- change high voltage pulses into a spark which ignites the fuel and air mixture.
- originally equipped on the vehicle have a platinum-enhanced active electrode for long life.

Engine Ignition

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

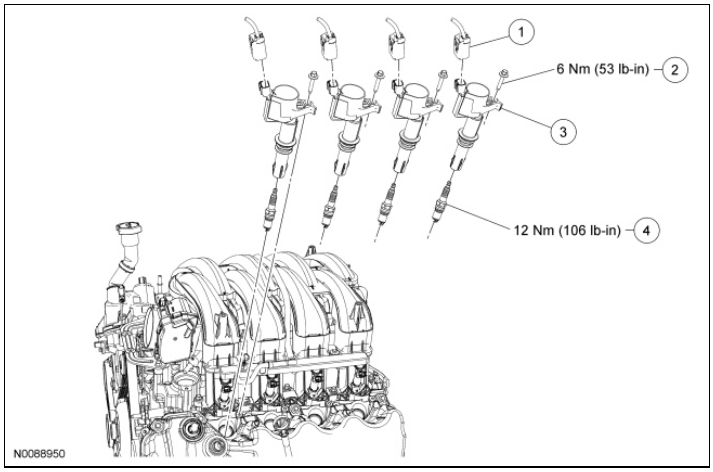
Engine Ignition Components - Exploded View

Ignition Components RH Side



Item	Part Number	Description
1	14A464	Ignition coil-on-plug electrical connector (part of 12B637) (4 required)
2	W706175	Ignition coil-on-plug bolt (4 required)
3	12A366	Ignition coil-on-plug (4 required)
4	12405	Spark plug (4 required)

Ignition Components LH Side



Item	Part Number	Description
1	14A464	Ignition coil-on-plug electrical connector (4 required) (part of 12B637)

2	W706175	Ignition coil-on-plug bolt (4 required)
3	12A366	Ignition coil-on-plug (4 required)
4	12405	Spark plug (4 required)

1. For additional information, refer to the procedures in this section.

Ignition Coil-On-Plug

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Removal and Installation

1. Disconnect the 8 ignition coil electrical connectors.

2. Remove the 8 ignition coil bolts.
   - To install, tighten to 6 Nm (53 lb-in).

3. **NOTE:** When removing the ignition coils, a slight twisting motion will break the seal and ease removal.

   Remove the 8 ignition coils.

4. To install, reverse the removal procedure.
   - Apply a light film of brake caliper grease to the inside of the coil boots before installation.

Spark Plugs

Removal

NOTICE: **The spark plug procedure must be followed exactly or damage to the cylinder head and spark plug will result.**

NOTICE: **Do not remove the spark plugs when the engine is hot or cold soaked. Spark plug thread or cylinder head damage can occur. Make sure the engine is warm (hand touch after cooling down) prior to spark plug removal.**

1. Remove the ignition coil-on-plug. For additional information, refer to Ignition Coil-On-Plug in this section.

2. ***NOTICE:*** **Only use hand tools when removing or installing the spark plugs or damage can occur to the cylinder head or spark plug.**

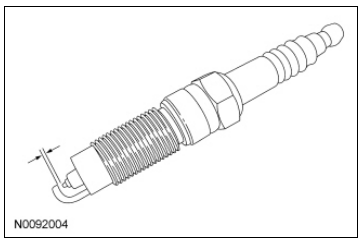
   NOTE: Use compressed air to remove any foreign material from the spark plug well before removing the spark plugs.

   Remove the spark plug.

3. Inspect the spark plug. For additional information, refer to Section 303-00 .

Installation

1. Adjust the spark plug gap as necessary. For the correct spark plug gap specification, refer to Specifications in this section.



2. ***NOTICE:*** **Only use hand tools when removing or installing the spark plugs or damage can occur to the cylinder head or spark plug.**

   Install the spark plug.

   - Tighten to 12 Nm (106 lb-in).

3. Install the ignition coil-on-plug. For additional information, refer to Ignition Coil-On-Plug in this section.

Torque Specifications

Description	Nm	lb-ft
Exhaust manifold-to-EGR system module tube fittings - 4.0L SOHC	40	30
EGR system module bolts - 4.0L SOHC	25	18

Engine Emission Control

NOTICE: **Do not remove any part of the engine emission control system. Operating the engine without the engine emission control system will reduce fuel economy and engine ventilation. This will weaken engine performance and shorten engine life.**

The engine emission control system consists of the following:

- PCV system
- EGR system (4.0L SOHC only)

PCV System

The PCV system consists of the following:

- PCV valve
- Hoses

The PCV system uses intake manifold vacuum to ventilate the crankcase and return the fumes to the intake manifold for combustion.

The PCV valve:

- controls the amount of ventilating air and blow-by gases going to the intake manifold.
- is integral to the LH valve cover on the 4.6L (3V) engine. If a new PCV valve must be installed, a new valve cover must be installed on a 4.6L (3V) engine. Refer to Section 303-01B .

EGR System

The EGR system consists of the following:

- EGR system module which incorporates the following components in one unit:
  - EGR valve
  - EGR system module transducer
  - EGR vacuum regulator solenoid
- Exhaust manifold-to-EGR system module tube

NOTE: Only the 4.0L SOHC engine is equipped with an EGR system. The 4.6L (3V) engine uses a variable camshaft timing system.

The EGR system returns a portion of the exhaust gas to the intake manifold to reduce the combustion temperature. This results in lower Nitrogen Oxides (NOX) formation.

The PCM controls the EGR system module. When the EGR system module valve opens, exhaust gas flows to the intake manifold.

The EGR valve controls the amount of exhaust gas flowing into the intake manifold.

The EGR system module transducer:

- monitors the EGR system module flow rate through the EGR valve.
- sends an EGR system module flow rate signal to the PCM.

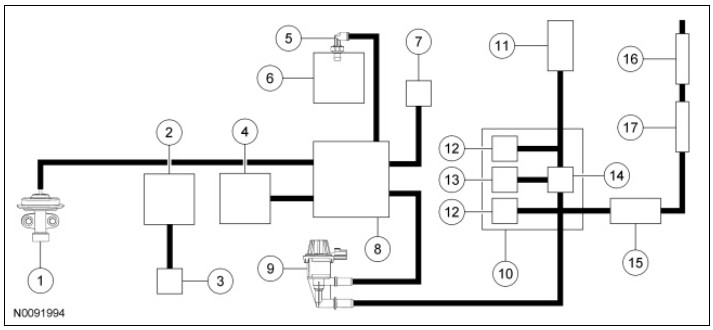
The EGR vacuum regulator solenoid uses input from the PCM to change the EGR system module operation.

The exhaust manifold-to-EGR system module tube:

- connects the exhaust manifold to the EGR valve.

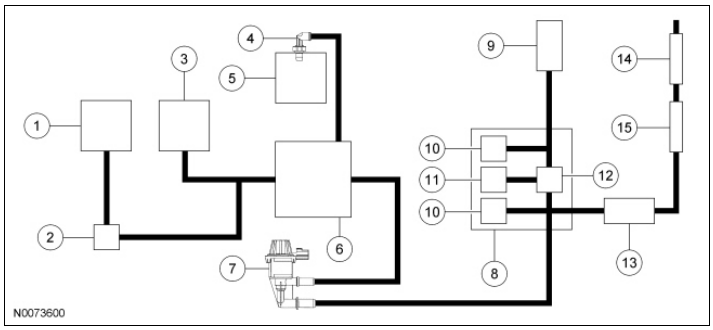
Evaporative Emission (EVAP), EGR and PCV Vacuum Routing

4.0L SOHC Engine



Item	Part Number	Description
1	90475	EGR system module
2	6583	RH valve cover
3	9B659	Air Cleaner (ACL) outlet pipe
4	2002	Brake booster
5	6A666	PCV valve
6	6A513	LH valve cover
7	9G756	Fuel rail pressure and temperature sensor
8	9424	Intake manifold
9	9C915	Evaporative Emission (EVAP) canister purge valve
10	9002	Fuel tank
11	9034	Fuel tank filler pipe
12	-	Fuel tank vent valves
13	9H703	Fuel pump module
14	9C052	Fuel tank pressure sensor
15	9D635	EVAP canister
16	9B328	Dust separator
17	9F945	EVAP canister vent valve

4.6L (3V) Engine

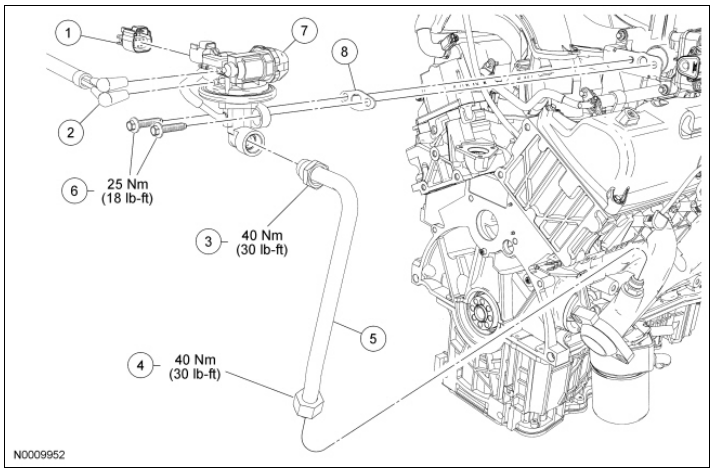


Item	Part Number	Description
1	6583	RH valve cover
2	6B059	Air Cleaner (ACL) outlet pipe
3	2002	Brake booster
4	6A666	PCV valve
5	6A513	LH valve cover
6	9424	Intake manifold
7	9C915	Evaporative Emission (EVAP) canister purge valve
8	9002	Fuel tank
9	9034	Fuel tank filler pipe
10	-	Fuel tank vent valves
11	9H307	Fuel pump module
12	9C052	Fuel tank pressure sensor
13	9D653	EVAP canister
14	9B328	Dust separator
15	9f945	EVAP canister vent valve

Engine Emission Control

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Exhaust Gas Recirculation (EGR) System Components - Exploded View, 4.0L SOHC



Item	Part Number	Description
1	-	EGR system module electrical connector (part of 12B637)
2	9E498	Engine vacuum harness
3	-	EGR system module-to-exhaust manifold tube upper fitting (part of 9E469)
4	-	EGR system module-to-exhaust manifold tube lower fitting (part of 9E469)
5	9E469	EGR system module-to-exhaust manifold tube
6	W506024	EGR system module bolts (2 required)
7	9D475	EGR system module
8	9D476	EGR system module gasket

1. For additional information, refer to the procedures in this section.

Exhaust Gas Recirculation (EGR) System Module - 4.0L SOHC

Removal and Installation

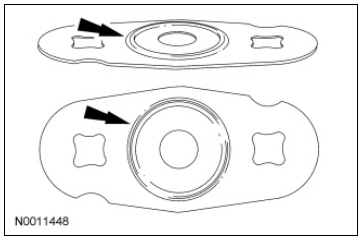
1. Disconnect the EGR system module electrical and vacuum connectors.

2. Disconnect the EGR system module-to-exhaust manifold tube upper fitting.
   - To install, tighten to 40 Nm (30 lb-ft).

3. **NOTE:** When installing the new EGR module gasket, install with the side with the raised circle facing the intake manifold.

   Remove the 2 bolts, the EGR system module and the gasket. Discard the gasket.

   - To install, tighten to 25 Nm (18 lb-ft).



4. **NOTE:** The EGR system module sealing surfaces are soft metals.

   Carefully clean the EGR system module sealing surfaces.

5. To install, reverse the removal procedure.
   - Install a new EGR system module gasket.

Exhaust Gas Recirculation (EGR) System Module Tube - 4.0L SOHC

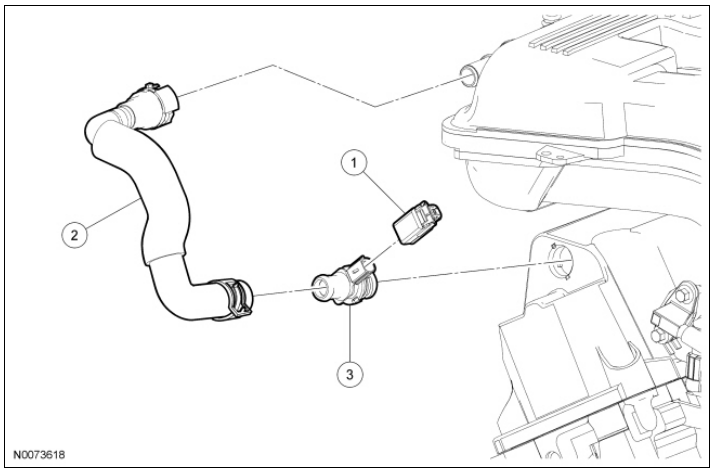
Removal and Installation

1. Disconnect the EGR system module-to-exhaust manifold tube upper fitting.
   - To install, tighten to 40 Nm (30 lb-ft).

2. Disconnect the EGR system module-to-exhaust manifold tube lower fitting and remove the tube.
   - To install, tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure.

Positive Crankcase Ventilation (PCV) Valve - 4.0L SOHC



Item	Part Number	Description
1	14A464	PCV valve electrical connector (part of 12B637)
2	6K817	PCV valve hose
3	6A666	PCV valve

Removal and Installation

1. Disconnect the PCV valve electrical connector.
2. Disconnect the PCV valve hose.
3. **NOTE:** If the PCV valve is removed from the valve cover, a new PCV valve must be installed.

   Rotate the PCV valve counterclockwise and remove it from the valve cover.
4. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Coolant expansion tank bolts	6	53

Intake Air Distribution and Filtering

The air induction system consists of the following:

- Air Cleaner (ACL)
- ACL element
- ACL outlet pipe
- Mass Air Flow (MAF) sensor
- Throttle Body (TB)

The air induction system supplies filtered air to the engine to mix with the fuel for combustion purposes.

The ACL provides a sealed container for the ACL element.

The ACL element is chemically treated, pleated paper which filters the engine intake air.

The ACL outlet pipe connects the ACL to the TB .

The MAF sensor is attached to the ACL and measures the volume of air delivered to the engine. The MAF sensor has an integrated Intake Air Temperature (IAT) sensor which measures the temperature of the incoming air. For information on servicing the MAF sensor, refer to Section 303-14 .

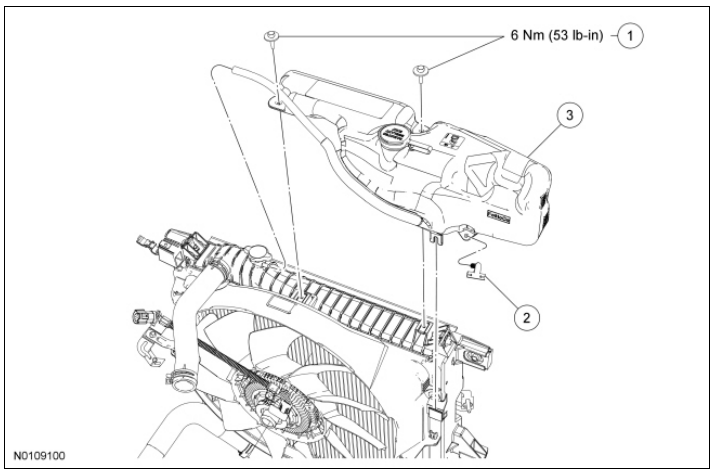
The TB varies the amount of air entering the engine based on driver input to the accelerator pedal. For information on servicing the TB , refer to Section 303-04A (4.0L SOHC engines) or Section 303-04B (4.6L [3V] engines).

Intake Air Distribution and Filtering

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

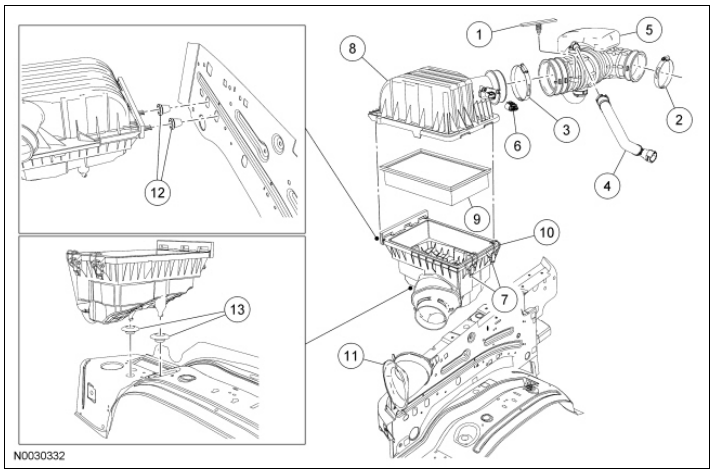
Intake Air System Components - Exploded View

Coolant Expansion Tank



Item	Part Number	Description
1	W713417	Coolant expansion tank bolts (2 required)
2	13A506	Mass Air Flow (MAF) sensor wiring harness retainer (4.6L [3V] engine only) (part of 12B637)
3	8C045	Coolant expansion tank

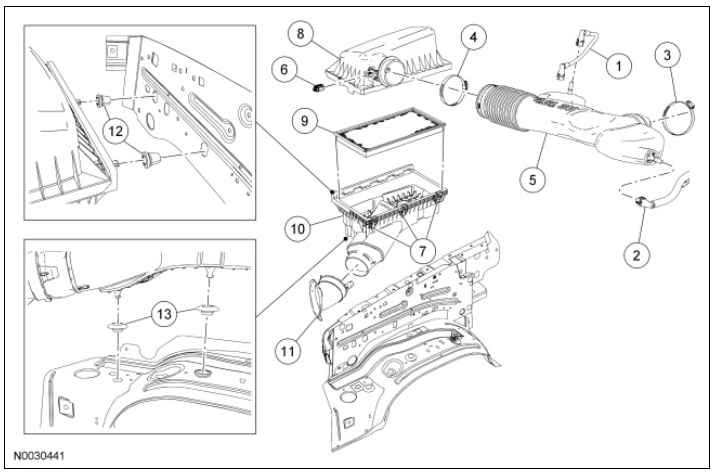
Intake Air System Components (4.0L SOHC)



Item	Part Number	Description
1	13A506	Wiring harness retainer
2	9C632	Air Cleaner (ACL) outlet pipe clamp
3	9C632	ACL outlet pipe clamp
4	6758	Crankcase breather hose

5	9R504	ACL outlet pipe
6	14A464	Mass Air Flow (MAF) sensor electrical connector
7	9628	Retaining clips (2 required) (part of 9A600)
8	9661	ACL cover
9	9601	ACL element
10	9A600	ACL tray
11	9E931	Rubber bell mouth
12	9P686	Grommets (2 required)
13	9P686	Grommets (2 required)

Intake Air System Components - 4.6L (3V)



Item	Part Number	Description
1	6758	Crankcase breather hose
2	9C482	Brake booster vacuum hose
3	9C632	Air Cleaner (ACL) outlet pipe clamp
4	9C632	ACL outlet pipe clamp
5	9B659	ACL outlet pipe
6	14A464	Mass Air Flow (MAF) sensor electrical connector (part of 12B637)
7	9628	ACL cover retaining clips (3 required) (part of 9A612)
8	9661	ACL cover
9	9601	ACL element
10	9A612	ACL tray
11	9E931	Rubber bell mouth
12	9P686	Grommets (2 required)
13	9P686	Grommets (2 required)

1. For additional information, refer to the procedures in this section.

Air Cleaner

Removal

1. Loosen the clamp and disconnect the Air Cleaner (ACL) outlet pipe from the ACL .
2. Disconnect the Mass Air Flow (MAF) sensor electrical connector.
3. **NOTE:** It is not necessary to disconnect the coolant expansion tank hose.

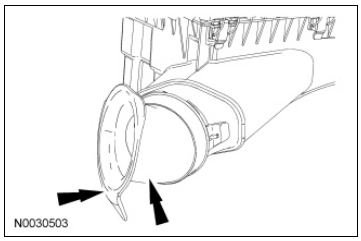
   Remove the 2 bolts and, if equipped with a 4.6L (3V) engine, detach the wiring harness retainer. Position the coolant expansion tank aside.
4. **NOTE:** The grommets that go into the inner fender will come out with the ACL .

   Lift the ACL out of the grommets in the wheel well and out of the inner fender.

Installation

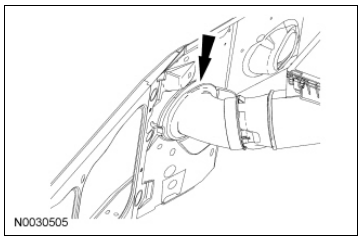
1. ***NOTICE:*** **Use a sponge or shop towel to apply the soap and water solution. Spraying the soap and water solution may damage the Mass Air Flow (MAF) sensor.**

   Apply a soap and water solution to the face and the LH side of the rubber bell mouth.



2. **NOTE:** Make sure the 2 grommets that go into the inner fender are in place on the ACL .

   Push the ACL into the 2 grommets in the wheel well and into the inner fender.
3. Make sure the bell mouth is correctly installed. The face of the rubber bell mouth should be against the inside of the sheet metal. No part of the rubber bell mouth should protrude through the air intake hole in the sheet metal.



4. Position the coolant expansion tank, install the 2 bolts and, if equipped with a 4.6L (3V) engine, attach the wiring harness retainer.
   - Tighten to 6 Nm (53 lb-in).

5. Connect the MAF sensor electrical connector.

6. Connect the ACL outlet pipe to the ACL and tighten the clamp.

Air Cleaner Element

Removal and Installation

NOTE: Do not disconnect the Mass Air Flow (MAF) sensor electrical connector.

Vehicles equipped with a 4.0L (SOHC) engine

1. Detach the wiring harness retainer from the Air Cleaner (ACL) outlet pipe.

Vehicles equipped with a 4.6L (3V) engine

2. Detach the wiring harness retainer from the coolant expansion tank.

All vehicles

3. Loosen the clamp and disconnect the ACL outlet pipe from the ACL .
4. Unclip and remove the ACL cover.
5. Remove the ACL element.
6. **NOTE:** Clean the inside of the ACL tray.

   To install, reverse the removal procedure.

Air Cleaner Outlet Pipe

Removal and Installation

Vehicles equipped with a 4.0L SOHC engine

1. Detach the wiring harness retainer from the Air Cleaner (ACL) outlet pipe.

Vehicles equipped with a 4.6L (3V) engine

2. Disconnect the brake booster vacuum hose from the ACL outlet pipe.

All vehicles

3. Disconnect the crankcase breather hose from the ACL outlet pipe.

4. Loosen the clamps and remove the ACL outlet pipe.

5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-ft	lb-in
Dust separator mounting bolt	9	-	80
Evaporative Emission (EVAP) canister purge valve nuts	25	18	-

Evaporative Emissions

NOTE: The vehicle vacuum routing diagrams are contained in the Description and Operation subsection of the Engine Emission Control section. Refer to Section 303-08 .

The Evaporative Emission (EVAP) system consists of the following components:

- Dust separator (located on the RH frame rail behind the fuel tank)
- EVAP canister (located on the top of the fuel tank)
- EVAP canister purge valve
- Fuel vapor vent valve (located on the RH frame rail behind the fuel tank)
- Fuel Tank Pressure (FTP) sensor (located on the top of the fuel tank)
- Vapor tubes
- Vapor hoses

The EVAP system:

- prevents hydrocarbon emissions from reaching the atmosphere.
- stores fuel vapors in the EVAP canister that are generated during vehicle operation or hot soak, until they can be consumed by the engine during normal engine operation.
- routes the stored fuel vapors to the engine during engine operation.
- is controlled by the PCM which, using various sensor inputs, calculates the desired amount of purge flow. The PCM regulates the purge flow, induced by the application of intake manifold vacuum, by varying the duty cycle applied to the EVAP canister purge valve.

The fuel vapors are routed:

- from the fuel tank through the fill limit vent valve and fuel vapor vent valve. The fuel vapor vent valves are part of the fuel tank assembly and cannot be serviced separately.
- to the EVAP canisters through a vapor line.
- to the engine when the EVAP canister purge valve is opened by the PCM.

The FTP sensor:

- monitors the pressure levels in the fuel tank.
- communicates the pressure reading to the PCM during the On-Board Diagnostic (OBD) II leak test.

The EVAP canister:

- is located on top of the fuel tank.
- contains activated carbon.
- stores fuel vapors.

Fuel tank filler cap (Explorer Sport Trac) and the Easy Fuel ™ fuel tank filler pipe (Explorer/Mountaineer):

- relieves system vacuum below 3.8 kPa (15.26 in H_2O).

The canister vent solenoid:

- is normally open.

- seals the EVAP system for the inspection and maintenance (I/M 240) test and OBD II leak and pressure tests.

The EVAP canister purge valve:

- is normally closed.
- regulates the purging of the EVAP canister.
- is electronically controlled by the PCM.

The dust separator:

- prevents suspended dust and dirt particles from entering the evaporative emission system.
- is serviced as a separate item.

The EVAP system monitor:

- is a self-test strategy within the PCM which tests the integrity of the EVAP system.
- monitors the EVAP system for leaks.
- monitors electronic EVAP components for irrationally high or low voltages.
- monitors for correct EVAP system operation.
- uses negative leak test methods to test and activate the EVAP system.
- has an engine malfunction light that will be displayed by the message center if the EVAP system fails the test.

The engine ON EVAP leak-check monitor:

- is executed by the individual components of the enhanced EVAP system. Intake manifold vacuum is utilized to reach a target vacuum on the EVAP system. The FTP sensor is used by the engine ON EVAP leak-check monitor to determine if the target vacuum necessary to carry out the leak-check on the EVAP system has been reached. Once target vacuum on the EVAP system is achieved, the change in EVAP system vacuum over a calibrated period of time determines if a leak exists.

The Engine Off Natural Vacuum (EONV) EVAP leak-check monitor is executed:

- once the engine ON EVAP leak-check monitor is completed and the key is turned OFF. The EONV EVAP leak-check monitor determines if a leak is present when the naturally occurring change in the fuel tank pressure or vacuum does not exceed a calibrated limit during a calibrated amount of time. A separate, low-power consuming microprocessor in the PCM manages the EONV leak-check. The engine OFF EVAP leak-check monitor is executed by the individual components of the enhanced EVAP system.

Evaporative Emissions

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Evaporative Emission System Leak Test

Special Tool(s)

 ST2817-A	VACUTEC Smoke Machine Fuel Evaporative Emission System Tester 218-0002 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Phase 1 - Leak Verification

1. Run the EVAP Test with the scan tool.
2. **NOTE:** Some small leaks may not be detected using the EVAP Test. If the system has passed the test but a leak is still suspected, then proceed to Phase 2.

   If the Evaporative Emission (EVAP) system failed the EVAP Test, then proceed to Phase 2.

Phase 2 - System Leak Check

NOTE: Some vehicles utilize a conventional fuel tank filler pipe cap and filler pipe assembly, and some vehicles utilize an Easy Fuel ™ (capless) fuel tank filler pipe assembly.

All vehicles

1. Disconnect the upper vapor tube-to- EVAP canister purge valve quick connect coupling. For additional information, refer to Section 310-00 .
2. Connect the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to the upper EVAP canister purge valve fitting. For additional information, refer to the manufacturer's instructions.
3. **NOTE:** The battery ground cable was previously disconnected in the vapor tube quick connect coupling procedure.

   Connect the battery ground cable. For additional information, refer to Section 414-01 .
4. **NOTE:** In the scan tool, the EVAP canister purge valve is referred to as the EVAP vapor management valve.

   Open the EVAP canister purge valve with the scan tool.
5. Close the canister vent solenoid with the scan tool.

Vehicles equipped with a fuel tank filler pipe cap

6. Carefully turn the fuel tank filler pipe cap counterclockwise until the thread disengages and position aside.

Vehicles equipped with a capless fuel tank filler pipe assembly

7. **NOTE:** The supplemental refueling adapter is located in the jack storage compartment.

   Install the supplemental refueling adapter into the Easy Fuel ™ (capless) fuel tank filler pipe assembly.

All vehicles

8. **NOTE:** If smoke does not exit the fuel tank filler pipe neck area after the system is pressurized, open the canister vent solenoid with the scan tool to allow the air to purge. Once smoke is seen at the canister vent solenoid, close the canister vent solenoid with the scan tool.

   Introduce smoke from the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester into the EVAP system and verify that smoke is exiting the fuel tank filler pipe neck area. For additional information, refer to the manufacturer's instructions.

Vehicles equipped with a fuel tank filler pipe cap

9. Install the fuel tank filler cap once smoke is observed exiting the fuel tank filler pipe neck area.

Vehicles equipped with a capless fuel tank filler pipe assembly

10. Remove the supplemental refueling adapter once smoke is observed exiting the fuel tank filler pipe neck area.

All vehicles

11. Continue to enter smoke into the system for 60 seconds to obtain pressure.

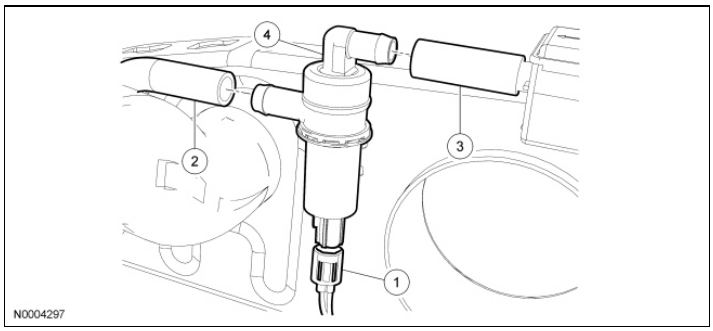
12. Press and release the remote start button in intervals of 15 seconds ON and 15 seconds OFF while checking for exiting smoke.

13. Use the halogen light provided with the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to follow the EVAP system path and look for smoke exiting at the source of the leak(s).

14. Repair any leaks as necessary.

15. Repeat the leak test until the system passes.

Fuel Vapor Vent Valve



Item	Part Number	Description
1	-	Evaporative Emission (EVAP) canister fuel vapor vent valve electrical connector (part of 14407)
2	9K318	Fuel vapor hose
3	9S321	Fuel vapor hose
4	9F945	Fuel vapor vent valve

Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTE: Use only water-based lubricants on the vapor hoses.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

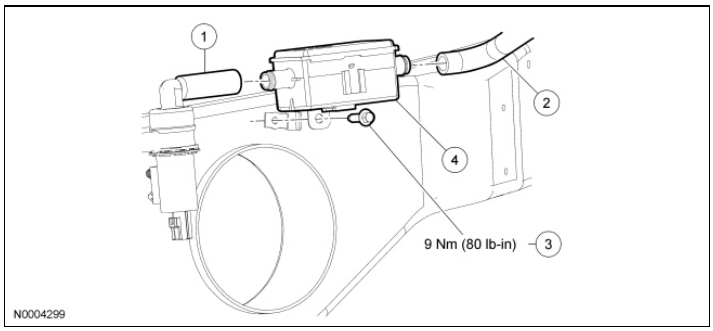
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Disconnect the fuel vapor vent valve electrical connector.

4. Disconnect the fuel vapor hoses from the fuel vapor vent valve and remove the fuel vapor vent valve.

5. To install, reverse the removal procedure.
   - Lubricate the vapor hoses with a water-based lubricant to ease installation.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Dust Separator



Item	Part Number	Description
1	9S321	Fuel vapor hose
2	-	Fuel filler pipe vapor hose (part of 9034)
3	W506414	Bolt
4	9B328	Dust separator

Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTE: Use only water-based lubricants on the vapor hoses.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

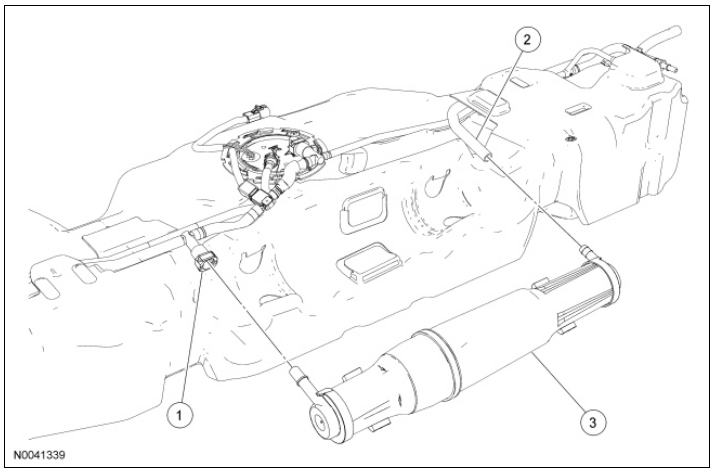
3. Disconnect the fuel vapor hose from the dust separator.

4. Disconnect the fuel filler pipe vapor hose from the dust separator.

5. Remove the bolt and the dust separator.
   - To install, tighten to 9 Nm (80 lb-in).

6. To install, reverse the removal procedure.
   - Lubricate the vapor hoses with a water-based lubricant to ease installation.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Evaporative Emission Canister



Item	Part Number	Description
1	-	Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling (part of 9E616)
2	9K318	Vapor hose
3	9D653	Evaporative Emission (EVAP) canister

Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

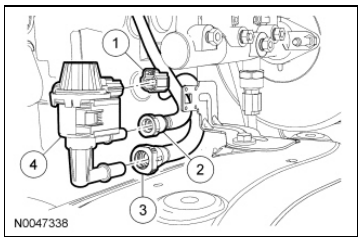
NOTE: Use only water-based lubricants on the vapor hoses.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Remove the fuel tank. For additional information, refer to Section 310-01 .
4. Detach the Evaporative Emission (EVAP) canister from the fuel tank to gain access to the quick connect coupling.
5. Disconnect the Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling from the EVAP canister. For additional information, refer to Section 310-00 .
6. Disconnect the vapor hose from the EVAP canister.

7. Remove the EVAP canister.

8. To install, reverse the removal procedure.
    - Lubricate the vapor hoses with a water-based lubricant to ease installation.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Evaporative Emission Canister Purge Valve



Item	Part Number	Description
1	-	Evaporative Emission (EVAP) canister purge valve electrical connector (part of 14A464)
2	-	Vapor tube quick connect coupling (part of 9D289)
3	-	Vapor tube quick connect coupling (part of 9J338)
4	9G641	EVAP canister purge valve

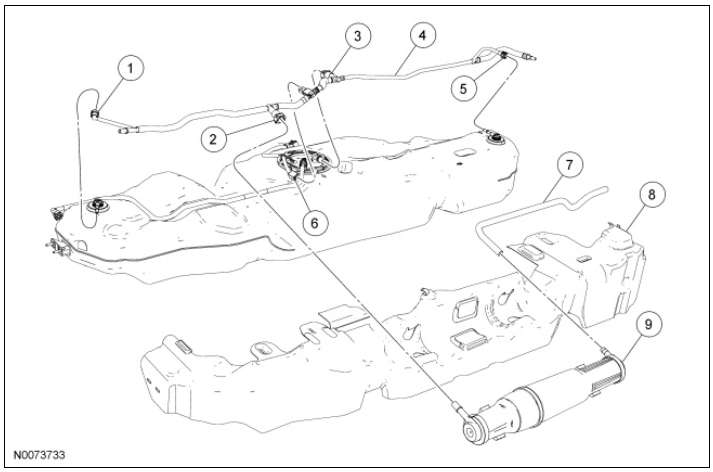
Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.
4. Disconnect the 2 vapor tube quick connect couplings from the EVAP canister purge valve. For additional information, refer to Section 310-00 .
5. Detach the EVAP canister purge valve from the bracket and remove.
6. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Fuel Tank Pressure Sensor



Item	Part Number	Description
1	-	Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling (part of 9E616)
2	-	FTP sensor and vapor tube assembly quick connect coupling (part of 9E616)
3	-	FTP sensor and vapor tube assembly quick connect coupling (part of 9E616)
4	9E616	FTP sensor and vapor tube assembly
5	-	FTP sensor and vapor tube assembly quick connect coupling (part of 9E616)
6	14A464	FTP sensor electrical connector
7	9K318	Vapor hose
8	9A032	Fuel tank shield
9	9D653	Evaporative Emission (EVAP) canister

Removal and Installation

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the Evaporative Emission (EVAP) canister. For additional information, refer to Evaporative Emission Canister in this section.

2. Remove the fuel tank shield from the fuel tank.

3. Disconnect the Fuel Tank Pressure (FTP) sensor electrical connector.

4. Disconnect the 3 FTP sensor and vapor tube assembly quick connect couplings from the Fuel Pump (FP) module and the vapor vent valves. For additional information, refer to Section 310-00 .

5. Remove the FTP sensor and vapor tube assembly.

6. To install, reverse the removal procedure.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to Evaporative Emission System Leak Test in this section.

Material

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A	-
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-	-

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor bolts, 4.6L (3V)	25	18	-
A/C tube bracket nut	7	-	62
Camshaft Position (CMP) sensor bolt, 4.0L SOHC	6	-	53
CMP sensor bolt, 4.6L (3V)	10	-	89
Catalyst Monitor Sensor (CMS)	41	30	-
Charge Motion Control Valve (CMCV) bolts	10	-	89
Crankshaft Position (CKP) sensor bolt	10	-	89
Cylinder Head Temperature (CHT) sensor, 4.6L (3V)	10	-	89
Fuel rail temperature and pressure sensor bolts	6	-	53
Heated Oxygen Sensor (HO2S)	41	30	-
Knock Sensor (KS) bolt	20	-	177
Mass Air Flow (MAF) bolts	2	-	18
Oil pan drain plug	26	19	-
PCM bolts	10	-	89
Throttle Position (TP) sensor screws	3	-	27
Variable Camshaft Timing (VCT) oil control solenoid bolt	5	-	44

Electronic Engine Controls

The electronic engine controls consist of the following:

- PCM
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor (4.0L SOHC)
- Cylinder Head Temperature (CHT) sensor (4.6L [3V])
- Camshaft Position (CMP) sensor
- Crankshaft Position (CKP) sensor
- Mass Air Flow (MAF) sensor
- Heated Oxygen Sensor (HO2S)
- Catalyst Monitor Sensor (CMS)
- Knock Sensor (KS).
- Charge Motion Control Valve (CMCV) (4.6L [3V])
- Variable Camshaft Timing (VCT) oil control solenoid (4.6L [3V])

The PCM:

- accepts input from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range.
- outputs a command to the fuel injectors to meter the appropriate quantity of fuel.
- switches the PCV valve heat ON and OFF.

The TP sensor:

- sends the PCM a signal indicating the throttle plate angle.
- is the main input to the PCM from the driver.

The ECT sensor (4.0L SOHC):

- sends the PCM a signal indicating engine temperature.
- voltage decreases as coolant temperature increases.

The CHT sensor (4.6L [3V]):

- is mounted to the wall of the cylinder head and is not connected to any coolant passages.

The CMP sensor:

- sends the PCM a signal indicating camshaft position used for fuel synchronization.

The CKP sensor:

- sends the PCM a signal indicating crankshaft position.
- is essential for calculating spark timing.

The MAF sensor:

- uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool.

The HO2S :

- creates a voltage signal dependent on exhaust oxygen content.
- provides feedback information to the PCM used to calculate fuel delivery.

The CMS :

- monitors oxygen content after it flows through the catalytic converter.
- provides a voltage to the PCM used to calculate catalytic converter integrity.

The KS :

- is used to detect engine detonation.
- sends a voltage signal to the PCM.
- is able to provide a signal which retards the ignition timing, as necessary.

The 4.6L (3V) air induction system improves engine performance by using the CMCV assemblies as follows:

- The intake manifold has 2 runners per cylinder, feeding each of the intake ports in the cylinder heads.
- The CMCV assemblies are located between the intake manifold and the cylinder heads, providing 2 air passages for each cylinder.
- One air passage is always open and the other passage switches from closed to open by means of a valve plate.
- The valve plates are opened and closed by the CMCV electric actuator, which is controlled by the PCM.

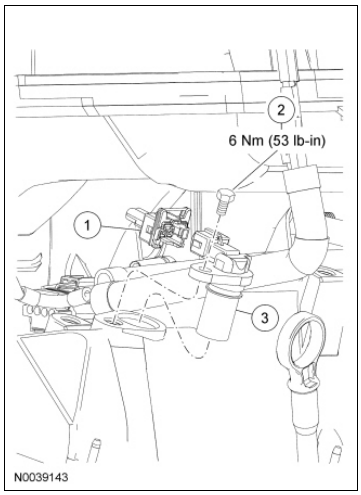
The VCT oil control solenoid:

- is an electrically controlled hydraulic valve that directs engine oil to the variable camshaft. Once the PCM transmits a signal, the solenoid moves a valve spool, directing oil into the camshaft phaser cavity. This action changes valve timing by either inducing an advance or retard condition. The camshaft is thereby repositioned in relation to crankshaft timing and allows for optimum engine performance and lower emissions.

Electronic Engine Controls

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Camshaft Position (CMP) Sensor - 4.0L SOHC



Item	Part Number	Description
1	14A464	Camshaft Position (CMP) sensor electrical connector
2	W500204	CMP sensor bolt
3	6B288	CMP sensor

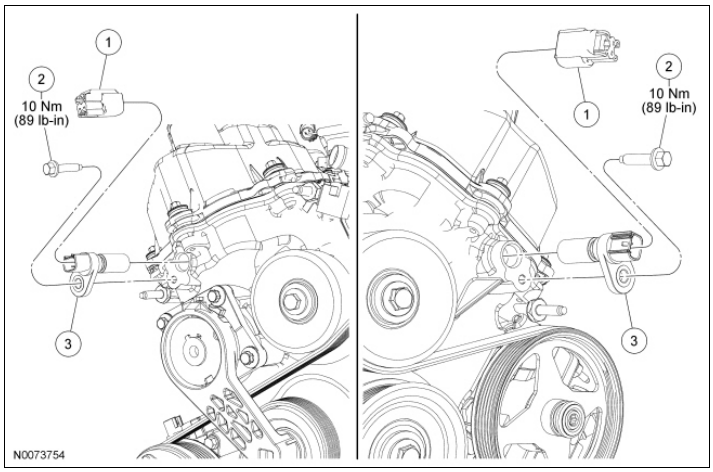
Removal and Installation

1. Disconnect the Camshaft Position (CMP) sensor electrical connector.

2. Remove the bolt and the CMP sensor.
   - To install, tighten to 6 Nm (53 lb-in).

3. To install, reverse the removal procedure.

Camshaft Position (CMP) Sensor - 4.6L (3V)



Item	Part Number	Description
1	14A464	Camshaft Position (CMP) electrical connector (part of 12B637)
2	N806155	CMP sensor bolt (2 required)
3	6B288	CMP sensor (2 required)

Removal and Installation

RH side

1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .

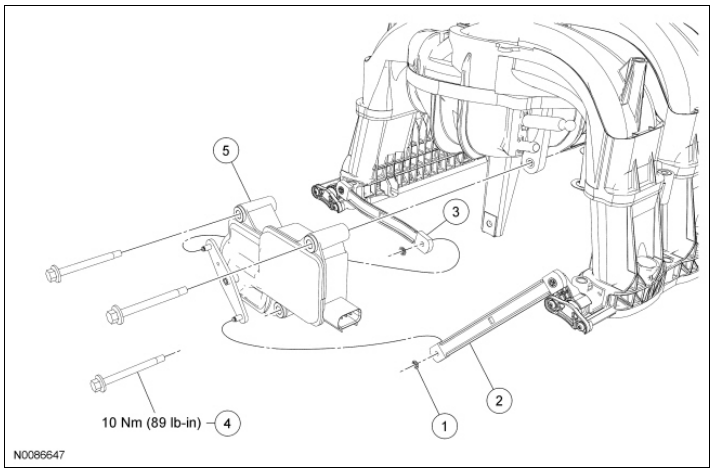
Both sides

2. Disconnect the Camshaft Position (CMP) sensor electrical connector.

3. Remove the bolt and the CMP sensor.
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.

Charge Motion Control Valve (CMCV) - 4.6L (3V)



Item	Part Number	Description
1	9424	E-clip (2 required)
2	9G770	RH Charge Motion Control Valve (CMCV) linkage
3	9G771	LH CMCV linkage
4	W506104	CMCV bolt (3 required)
5	9G730	CMCV

Removal

1. Remove the intake manifold. For additional information, refer to Section 303-01B .
2. **NOTE:** Do not disconnect the linkages at the intake manifold unless a new intake manifold is being installed.

   Remove and discard the 2 E-clips and disconnect the Charge Motion Control Valve (CMCV) linkages from the CMCV .
3. Remove the 3 bolts and the CMCV .
4. **NOTE:** A bent shaft or damaged components will require a new intake manifold.

   Rotate each CMCV shaft by hand to verify that they do not stick or bind.

Installation

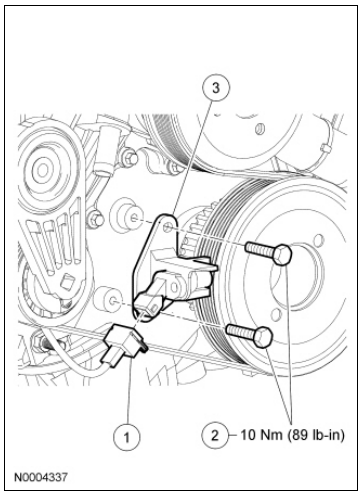
1. Position the CMCV and loosely install the 3 bolts.
   - Do not tighten the bolts at this time.
2. Rotate each CMCV shaft so that the plates are in the closed position.
3. Connect the CMCV linkages to the CMCV and install 2 new E-clips.
4. Tighten the 3 CMCV bolts.

- Tighten to 10 Nm (89 lb-in).

5. Install the intake manifold. For additional information, refer to Section 303-01B .

6. Carry out the Key ON Engine OFF (KOEO) self-test. For additional information, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Crankshaft Position (CKP) Sensor - 4.0L SOHC



Item	Part Number	Description
1	14A464	Crankshaft Position (CKP) sensor electrical connector
2	W500213	CKP sensor bolts (2 required)
3	6C315	CKP sensor

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

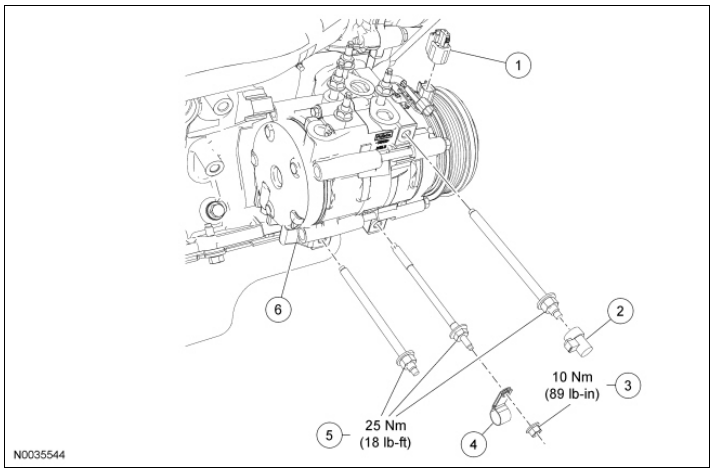
2. Disconnect the Crankshaft Position (CKP) sensor electrical connector.

3. Remove the 2 bolts and the CKP sensor.
   - To install, tighten to 10 Nm (89 lb-in).

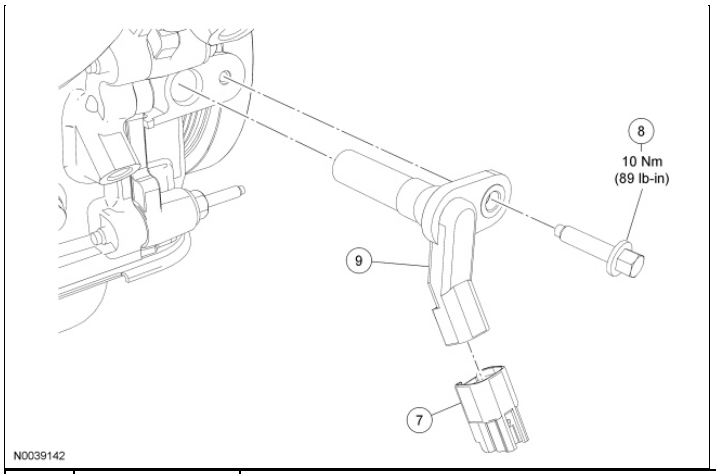
4. **NOTE:** Be sure the sensor wiring is routed away from the battery cable.

   To install, reverse the removal procedure.

Crankshaft Position (CKP) Sensor - 4.6L (3V)



Item	Part Number	Description
1	14A464	A/C compressor clutch electrical connector (part of 14A280)
2	14A163	Battery cable retainer (part of 14A280)
3	W520111	A/C tube bracket nut
4	19N704	A/C tube bracket
5	W707821	A/C compressor stud bolts (3 required)
6	19703	A/C compressor



Item	Part Number	Description
7	14A464	Crankshaft Position (CKP) sensor electrical connector (part of 12B637)
8	N806155	CKP sensor bolt
9	6C315	CKP sensor

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the accessory drive belt. For additional information, refer to Section 303-05 .

3. Disconnect the A/C compressor coil electrical connector.

4. Detach the battery cable retainer from the A/C compressor stud bolts.

5. Remove the nut and detach the A/C tube bracket.
   - To install, tighten to 10 Nm (89 lb-in).

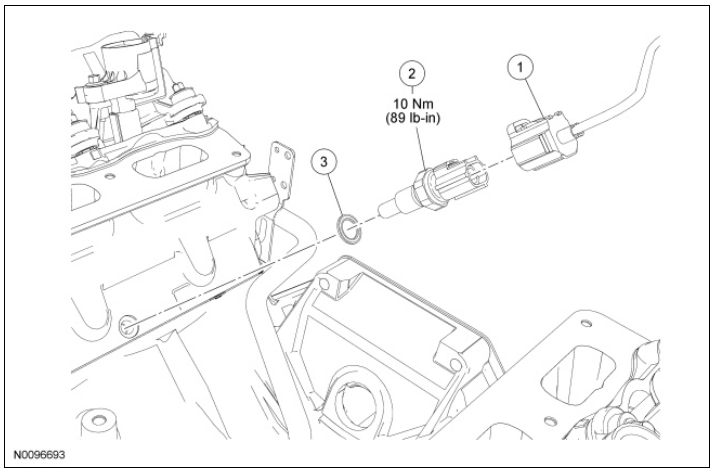
6. Remove the stud bolts and position the A/C compressor aside.
   - To install, tighten to 25 Nm (18 lb-ft).

7. Disconnect the Crankshaft Position (CKP) sensor electrical connector.

8. Remove the bolt and the CKP sensor.
   - To install, tighten to 10 Nm (89 lb-in).

9. To install, reverse the removal procedure.

Cylinder Head Temperature (CHT) Sensor - 4.6L (3V)



Item	Part Number	Description
1	030305	Cylinder Head Temperature (CHT) sensor electrical connector
2	6G004	CHT sensor
3	12A676	CHT sensor O-ring seal

Removal and Installation

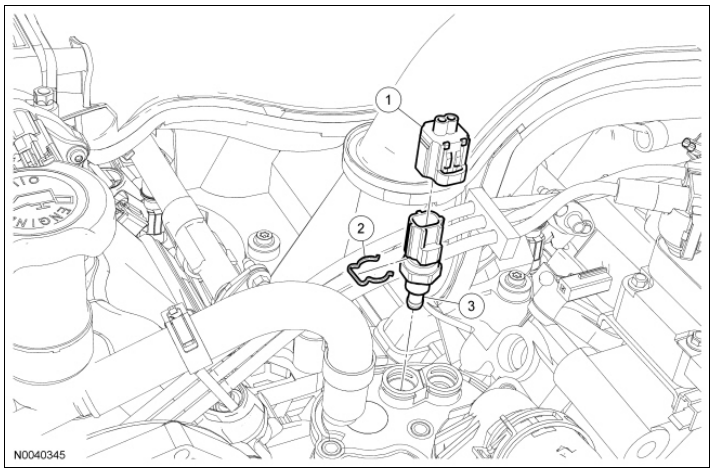
1. Remove the intake manifold. For additional information, refer to Section 303-01B .

2. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.

3. Remove and discard the CHT sensor.
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.
   - Do not reuse the CHT sensor. Install a new sensor.

Engine Coolant Temperature (ECT) Sensor - 4.0L SOHC



Item	Part Number	Description
1	14A464	Engine Coolant Temperature (ECT) sensor electrical connector
2	-	Retaining clip
3	12A648	ECT sensor

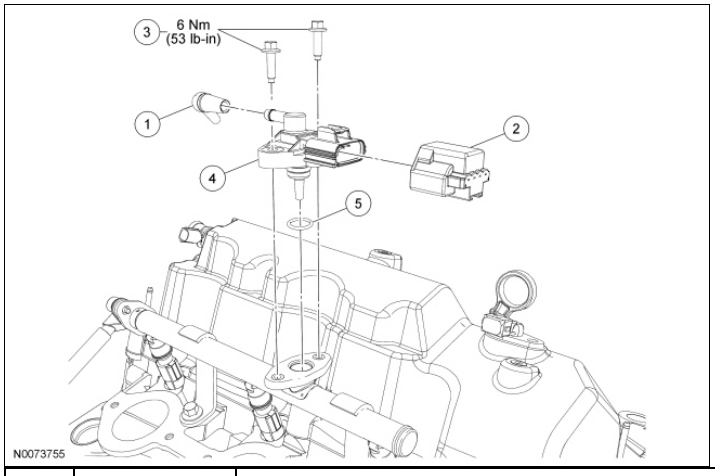
Removal and Installation

1. Drain the cooling system. For additional information, refer to Section 303-03 .
2. Disconnect the Engine Coolant Temperature (ECT) sensor electrical connector.
3. Remove the clip and the ECT sensor.
4. To install, reverse the removal procedure.

Fuel Rail Pressure and Temperature Sensor - 4.0L SOHC

Material

Item	Specification
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A



Item	Part Number	Description
1	9E499	Fuel rail pressure and temperature sensor vacuum hose connector
2	14A464	Fuel rail pressure and temperature sensor electrical connector (part of 12B637)
3	W709515	Fuel rail pressure and temperature sensor bolts (2 required)
4	9G756	Fuel rail pressure and temperature sensor
5	-	Fuel rail pressure and temperature sensor O-ring seal

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ **WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 412-01 .
3. Remove the intake manifold. For additional information, refer to Section 303-01A .
4. Disconnect the fuel rail pressure and temperature sensor vacuum and electrical connectors.
5. Remove the 2 bolts and the fuel rail pressure and temperature sensor.
   - To install, tighten to 6 Nm (53 lb-in).
6. Remove and discard the O-ring seal.
7. ***NOTICE:*** **Use an O-ring seal made of special fuel resistant material. Fuel will damage ordinary O-ring seals and may cause the fuel system to leak.**

   NOTICE: **Do not reuse the O-ring seal. The removal and installation process may damage the used O-ring seals and cause the fuel system to leak.**

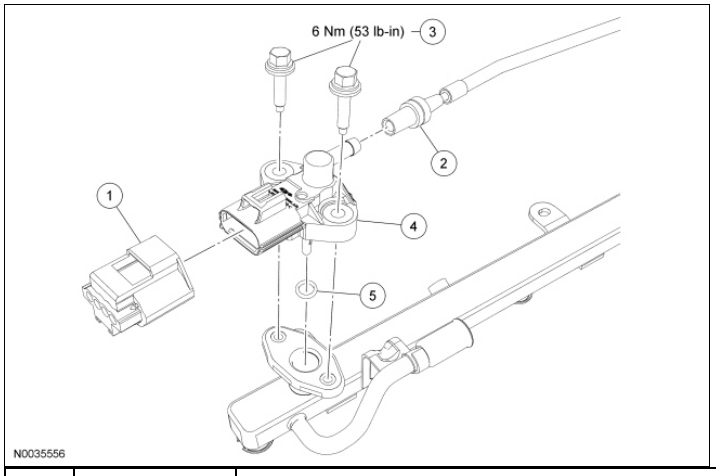
   To install, reverse the removal procedure.

   - Lubricate the new O-ring seal with clean engine oil.

Fuel Rail Pressure and Temperature Sensor - 4.6L (3V)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	14A464	Fuel rail pressure and temperature sensor electrical connector (part of 12B637)
2	9E498	Vacuum hose connector
3	W705870	Fuel rail pressure and temperature sensor bolts (2 required)
4	9G756	Fuel rail pressure and temperature sensor
5	-	O-ring seal (part of 9G756)

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ **WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

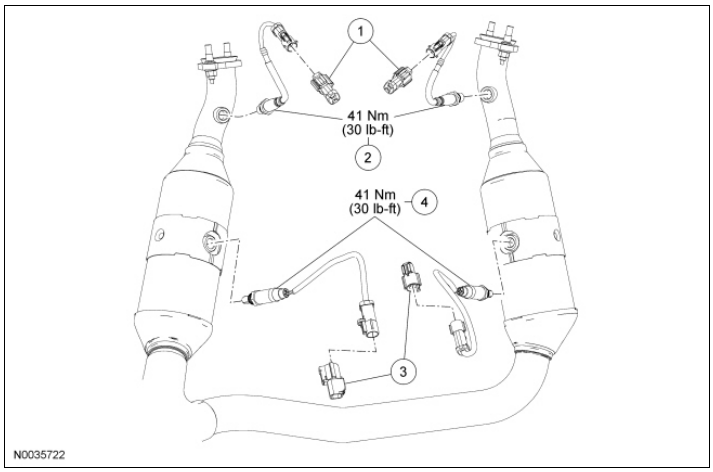
1. Release the fuel system pressure. For additional information, refer to Section 310-00 .
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Disconnect the fuel rail pressure and temperature sensor electrical connector.
4. Disconnect the fuel rail pressure and temperature sensor vacuum hose connector.
5. Remove the 2 bolts and the fuel rail pressure and temperature sensor.
   - To install, tighten to 6 Nm (53 lb-in).
6. Remove and discard the O-ring seal.
7. ***NOTICE:*** **Use an O-ring seal made of special fuel resistant material. Fuel will damage ordinary O-ring seals and may cause the fuel system to leak.**

   NOTICE: **Do not reuse the O-ring seal. The removal and installation process may damage the used O-ring seals and cause the fuel system to leak.**

   To install, reverse the removal procedure.

   - Lubricate the new O-ring seal with clean engine oil.

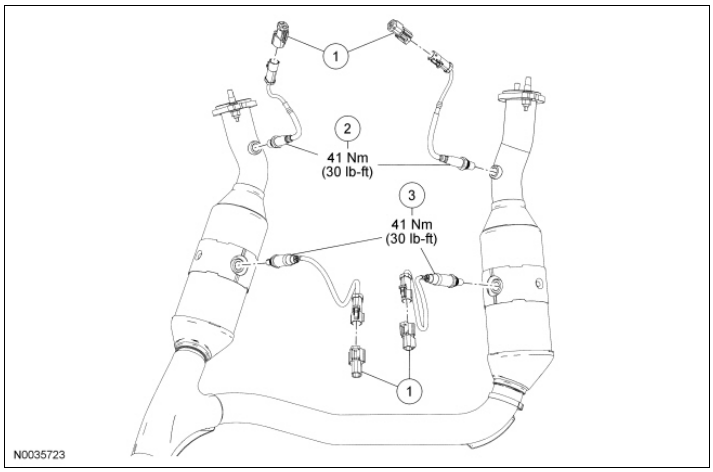
Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor - Exploded View, 4.0L SOHC



Item	Part Number	Description
1	14A464	Heated Oxygen Sensor (HO2S) electrical connectors (2 required) (part of 12B637)
2	9F472	HO2S (2 required)
3	14489	Catalyst Monitor Sensor (CMS) electrical connectors (2 required) (part of 12B637)
4	9G444	CMS (2 required)

1. For additional information, refer to the procedures in this section.

Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor - Exploded View, 4.6L (3V)

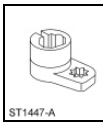


Item	Part Number	Description
1	14A464	Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor (CMS) electrical connectors (4 required) (part of 12B637)
2	9F472	HO2S (2 required)
3	9G444	CMS (2 required)

1. For additional information, refer to the procedures in this section.

Heated Oxygen Sensor (HO2S)

Special Tool(s)

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

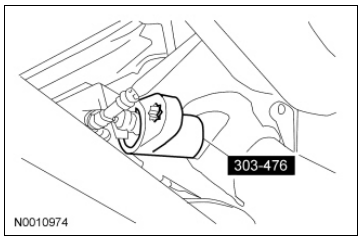
Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-

Removal

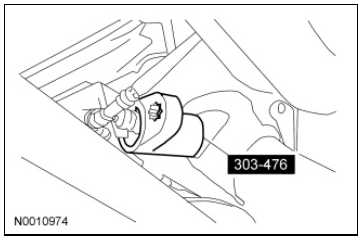
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If the RH Heated Oxygen Sensor (HO2S) is being serviced, remove the 2 bolts and position the heat shield aside.
3. Disconnect the HO2S electrical connector.
4. **NOTE:** If necessary, lubricate the HO2S with penetrating and lock lubricant to ease removal.

   Using the Exhaust Gas Oxygen Sensor Socket, remove the HO2S .



Installation

1. Apply a light coat of nickel anti-seize lubricant to the threads of the HO2S .
2. Using the Exhaust Gas Oxygen Sensor Socket, install the HO2S .
   - Calculate the correct torque wrench setting for the following torque. Refer to the Torque Wrench Adapter Formulas in the Appendix.
   - Using the Exhaust Gas Oxygen Sensor Socket, tighten to 41 Nm (30 lb-ft).

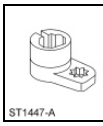


3. Connect the HO2S electrical connector.

4. If the RH HO2S is being serviced, position the heat shield and install the 2 bolts.
   - Tighten to 20 Nm (177 lb-in).

Catalyst Monitor Sensor

Special Tool(s)

 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

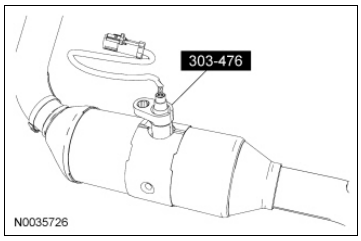
Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-

Removal

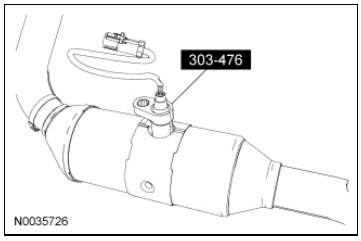
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If the RH Catalyst Monitor Sensor (CMS) is being serviced, remove the 2 bolts and position the heat shield aside.
3. Disconnect the CMS electrical connector.
4. **NOTE:** If necessary, lubricate the CMS with penetrating and lock lubricant to ease removal.

   Using the Exhaust Gas Oxygen Sensor Socket, remove the CMS .



Installation

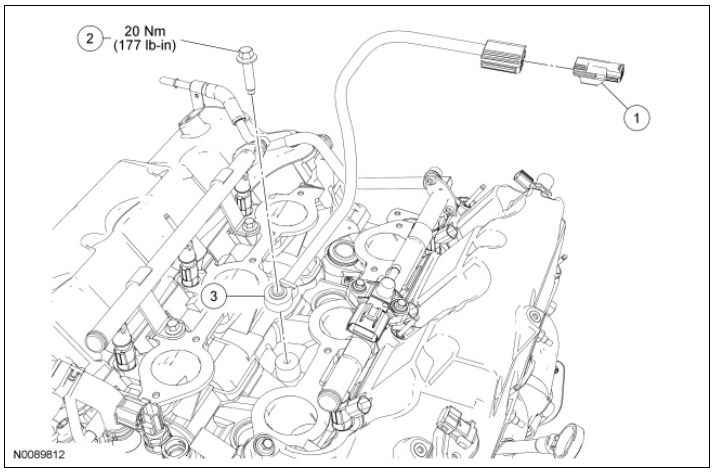
1. Apply a light coat of anti-seize lubricant to the threads of the CMS .
2. Using the Exhaust Gas Oxygen Sensor Socket, install the CMS .
   - Calculate the correct torque wrench setting for the following torque. Refer to the Torque Wrench Adapter Formulas in the Appendix.
   - Using the Exhaust Gas Oxygen Sensor Socket, tighten to 41 Nm (30 lb-ft).



3. Connect the CMS electrical connector.

4. If the RH CMS is being serviced, position the heat shield and install the 2 bolts.
   - Tighten to 20 Nm (177 lb-in).

Knock Sensor (KS) - 4.0L SOHC



Item	Part Number	Description
1	14A624	Knock Sensor (KS) electrical connector (part of 12B637)
2	W500225	KS bolt
3	12A699	KS

Removal and Installation

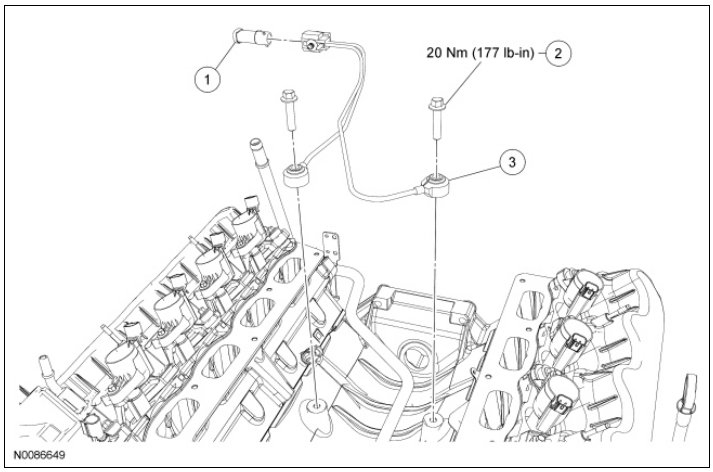
1. Remove the intake manifold. For additional information, refer to Section 303-01A .

2. Disconnect the Knock Sensor (KS) electrical connector.

3. Remove the bolt and the KS .
   - To install, tighten to 20 Nm (177 lb-in).

4. To install, reverse the removal procedure.

Knock Sensor (KS) - 4.6L (3V)



Item	Part Number	Description
1	14A624	Knock Sensor (KS) electrical connector (part of 12C508)
2	W500110	KS bolt (2 required)
3	12A699	KS

Removal and Installation

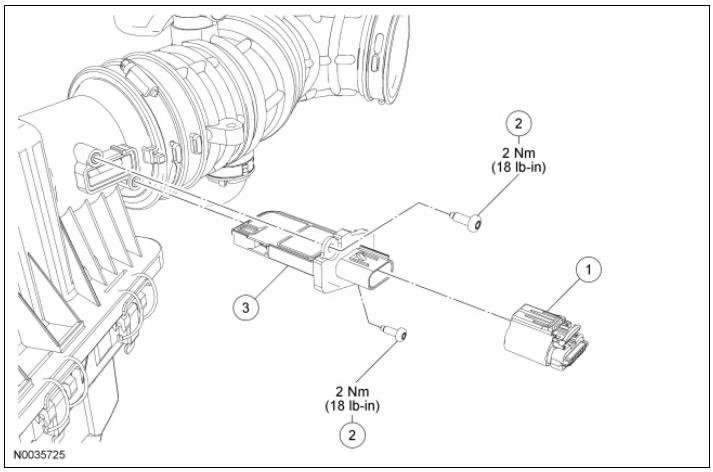
1. Remove the intake manifold. For additional information, refer to Section 303-01B .

2. Disconnect the Knock Sensor (KS) electrical connector.

3. Remove the bolts and the KS .
   - To install, tighten to 20 Nm (177 lb-in).

4. To install, reverse the removal procedure.

Mass Air Flow (MAF) Sensor - 4.0L SOHC



Item	Part Number	Description
1	14A464	Mass Air Flow (MAF) sensor electrical connector (part of 12B637)
2	W705761	MAF sensor bolts (2 required)
3	12B579	MAF sensor

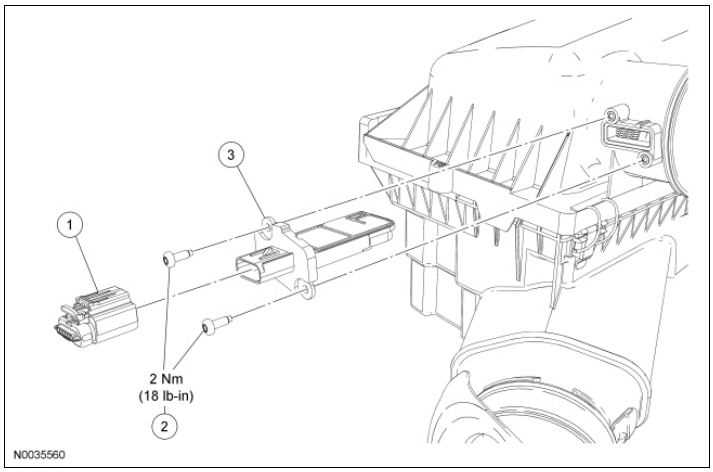
Removal and Installation

1. Disconnect the Mass Air Flow (MAF) sensor electrical connector.

2. Remove the 2 bolts and the MAF sensor.
   - To install, tighten to 2 Nm (18 lb-in).

3. To install, reverse the removal procedure.

Mass Air Flow (MAF) Sensor - 4.6L (3V)



Item	Part Number	Description
1	14A464	Mass Air Flow (MAF) sensor electrical connector (part of 12B637)
2	N709287	MAF sensor bolts (2 required)
3	12B579	MAF sensor

Removal and Installation

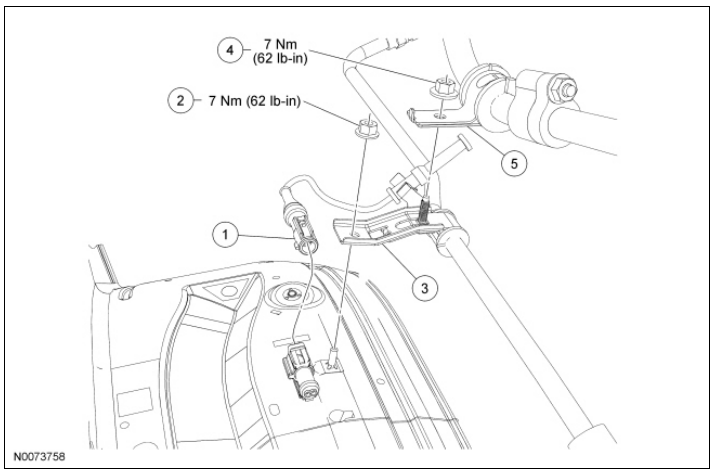
1. Disconnect the Mass Air Flow (MAF) sensor electrical connector.

2. Remove the bolts and the MAF sensor.
   - To install, tighten to 2 Nm (18 lb-in).

3. To install, reverse the removal procedure.

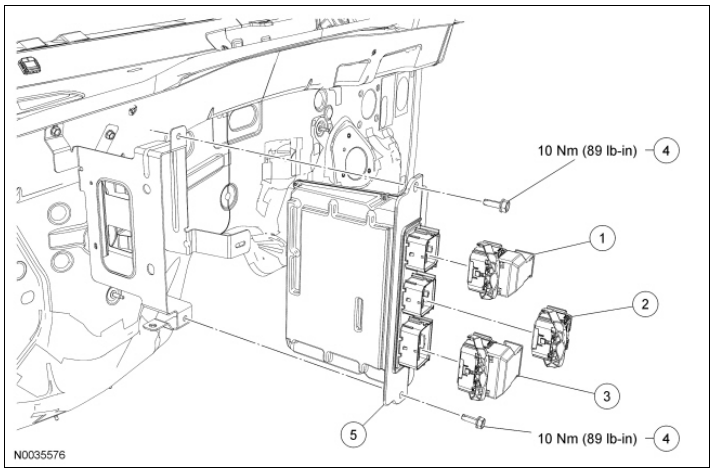
Powertrain Control Module (PCM)

A/C Tube Brackets



Item	Part Number	Description
1	2C204	RH front wheel speed sensor electrical connector
2	N621905	A/C tube bracket nut
3	-	A/C tube bracket (part of 19N651)
4	N705760	A/C tube bracket nut (4.6L [3V] only)
5	-	A/C tube bracket (part of 19N617) (4.6L [3V] only)

PCM



Item	Part Number	Description
1	14A464	PCM electrical connector (part of 12B637)
2	14A464	PCM electrical connector (part of 14398)
3	14A464	PCM electrical connector (part of 12B637)
4	N806972	PCM bolts (2 required)

5	12A651	PCM

Removal

All vehicles

1. **NOTE:** PCM installation DOES NOT require new keys.

   Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation (PMI) procedure. For additional information, refer to Section 418-01 .

Vehicles equipped with a 4.6L (3V) engine

2. Remove the Air Cleaner (ACL). For additional information, refer to Section 303-12 .

All vehicles

3. Disconnect the RH front wheel speed sensor electrical connector. Remove the nut(s) and position the A/C tube bracket(s) and wiring harness aside.

4. Disconnect the PCM connectors.

5. Remove the 2 bolts and the PCM.

Installation

All vehicles

1. Install the PCM and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

2. Connect the PCM electrical connectors.

3. Position the wiring harness and the A/C tube bracket(s) and install the nut(s). Connect the RH front wheel speed sensor electrical connector.
   - Tighten to 7 Nm (62 lb-in).

Vehicles equipped with a 4.6L (3V) engine

4. Install the ACL . For additional information, refer to Section 303-12 .

All vehicles

5. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation (PMI) procedure. For additional information, refer to Section 418-01 .

6. Reprogram the Passive Anti-Theft System (PATS). Carry out the Parameter Reset procedure. For additional information, refer to Section 419-01 .

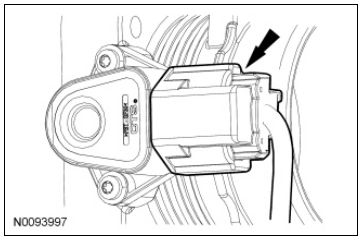
Throttle Position (TP) Sensor

Removal

All vehicles

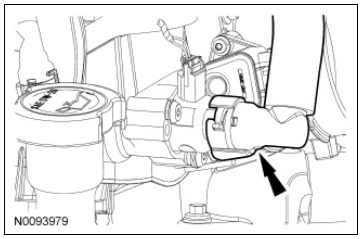
1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to Section 303-12 .

2. Disconnect the Throttle Position (TP) sensor electrical connector.

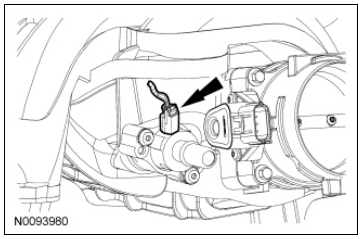


Vehicles equipped with a 4.6L (3V) engine

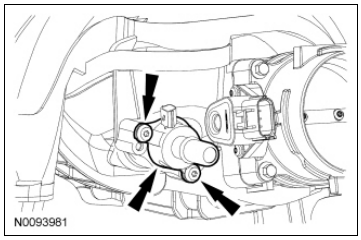
3. Disconnect the PCV hose from the heated PCV fitting.



4. Disconnect the heated PCV fitting electrical connector.



5. Remove the 2 bolts and the heated PCV fitting.
   - Remove and discard the heated PCV fitting O-ring seal.



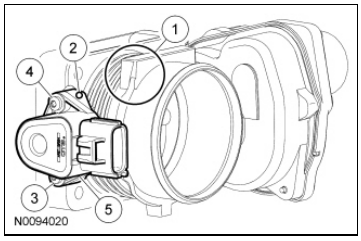
All vehicles

6. ***NOTICE:*** **Do not put direct heat on the Throttle Position (TP) sensor or any other plastic parts because heat damage may occur. Damage may also occur if Electronic Throttle Body (ETB) temperature exceeds 120°C (248°F).**

   NOTE: Do not use power tools.

   Remove the TP sensor.

   1. Using a suitable heat gun, apply heat to the top of the Electronic Throttle Body (ETB) until the top TP sensor bolt ear reaches approximately 55°C (130°F), this should take no more than 3 minutes using a 1100-watt heat gun. The heat gun should be about an 25.4 mm (1 in) away from the ETB .
   2. Monitor the temperature of the top TP sensor bolt ear on the ETB with a suitable temperature measuring device, such as a digital temperature laser or infrared thermometer, while heating the ETB .
   3. Using hand tools, quickly remove the bolt farthest from the heat source first and discard.
   4. Using hand tools, remove the remaining bolt and discard.
   5. Remove and discard the TP sensor.



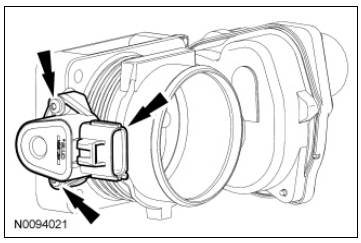
Installation

All vehicles

1. **NOTE:** Do not use power tools.

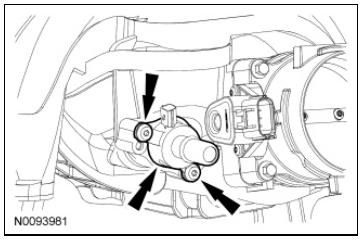
   Install the new TP sensor.

   - Using hand tools, install the 2 new bolts.
     - ♦ Tighten to 3 Nm (27 lb-in).

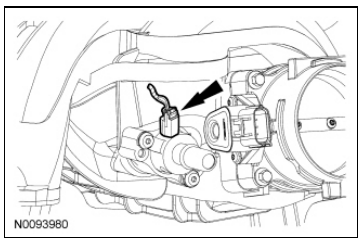


Vehicles equipped with a 4.6L (3V) engine

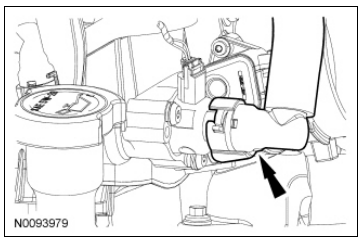
2. Install a new O-ring seal and position the heated PCV fitting and install the 2 bolts.



3. Connect the heated PCV fitting electrical connector.

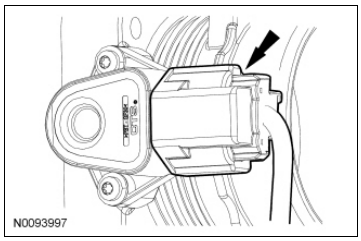


4. Connect the PCV hose to the heated PCV fitting.



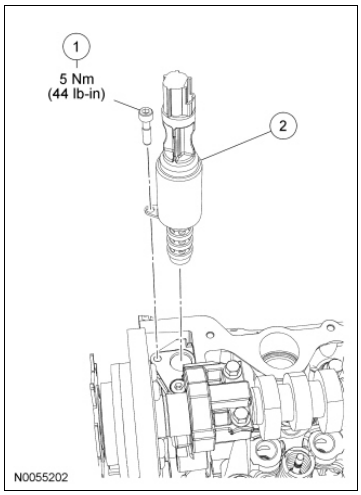
All vehicles

5. Connect the TP sensor electrical connector.



6. Install the ACL outlet pipe. For additional information, refer to Section 303-12 .

Variable Camshaft Timing (VCT) Oil Control Solenoid



Item	Part Number	Description
1	6C260	Variable Camshaft Timing (VCT) oil control solenoid bolt
2	6B297	VCT oil control solenoid

Removal and Installation

1. Remove the valve cover. For additional information, refer to Section 303-01B .

2. Remove the bolt and the Variable Camshaft Timing (VCT) oil control solenoid.
   - To install, tighten to 5 Nm (44 lb-in).

3. To install, reverse the removal procedure.

Alignment Specifications

Item	LH	RH	Total/ Split
Front			
Camber	-0.5° ± 0.75°	-0.5° ± 0.75°	0° ± 0.75°
Caster (Explorer, Mountaineer)	4.4° ± 0.75°	4.6° ± 0.75°	-0.2° ± 0.75°
Caster (Sport Trac)	4.3° ± 0.75°	4.7° ± 0.75°	-0.4° ± 0.75°
Toe (positive value is toe in, negative value is toe out)	-	-	0.20° ± 0.20°
Rear			
Camber	-0.5° ± 0.75°	-0.5° ± 0.75°	0° ± 0.75°
Toe (positive value is toe in, negative value is toe out)	0.05° ± 0.20°	0.05° ± 0.20°	0.10° ± 0.20°

General Specifications

Item	Specification
Ball Joint Deflection	
Lower	0-0.8 mm (0-0.032 in)
Upper	0-0.2 mm (0-0.008 in)
Ride Height (With Full Fluids)	
Front (Explorer, Mountaineer)	16 mm (0.63 in) ± 8 mm (0.31 in)
Front (Sport Trac)	21 mm (0.83 in) ± 8 mm (0.31 in)
Rear (Explorer, Mountaineer)	95 mm (3.74 in) ± 10 mm (0.39 in)
Rear (Sport Trac)	98 mm (3.86 in) ± 10 mm (0.39 in)
Thrust Angle (Dogtracking)	
Thrust Angle - maximum (centerline of front tires compared to centerline of rear tires)	± 0.5°
Vehicle Lean (Side-to-Side Height Differences)	
Front - maximum	7 mm (0.28 in)
Rear - maximum	8 mm (0.32 in)

Torque Specifications

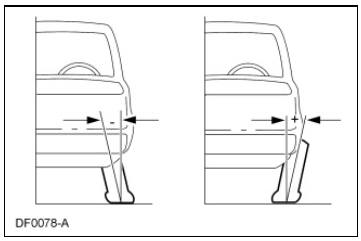
Description	Nm	lb-ft
Front upper arm bolt	150	111
Lower arm rearward nut	200	148
Rear upper arm inboard nut	250	185
Tie-rod jam nut	70	52
Toe link inboard nut	275	202

Suspension System

The front camber and caster are adjusted by loosening the upper control arm bolts which will allow the upper arm to be moved in the slotted frame holes. The LF caster can be adjusted by loosening the lower control arm rearward nut to allow the lower arm to be moved in the slotted frame hole. Front toe is adjusted by the use of the front wheel spindle tie rods. The rear camber is adjusted by replacing the upper arm inboard flagnut with a non-flagnut to allow the arm to be adjusted in the slotted frame holes. The rear toe is adjusted through the use of the rear toe link cam bolt.

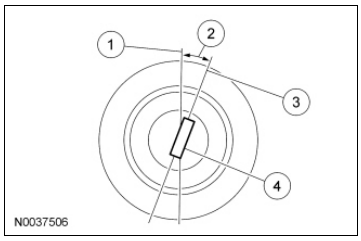
Camber

Negative and Positive Camber



Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

Caster

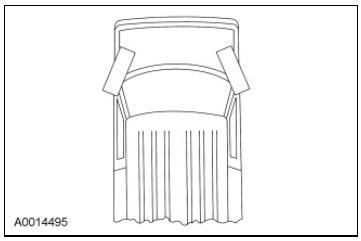


Item	Description
1	True vertical
2	Positive caster
3	Ball joint center line
4	Pivot center line

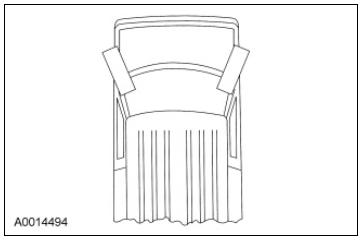
Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications in this section will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

Positive Toe (Toe In)



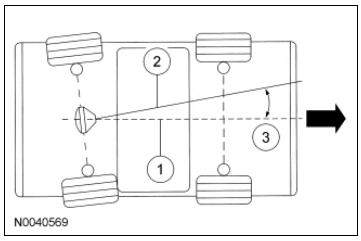
Negative Toe (Toe Out)



The vehicle toe setting:

- affects tire wear and directional stability.
- must be checked after adding aftermarket equipment, such as a snowplow.

Incorrect Thrust Angle (Dogtracking)



Item	Description
1	Vehicle centerline
2	Axle centerline
3	Thrust angle

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts

pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel. For wheel and tire diagnosis, refer to Section 204-04 .

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle, such as wind or road camber.

Suspension System

Inspection and Verification

1. Road test.
   - If any suspension alignment or ride height concerns are present, GO to Symptom Chart - Suspension System .
   - Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are present, GO to Symptom Chart - NVH .

2. Inspect tires.
   - Check the tire pressure with all normal loads in the vehicle and with the tires cold. Refer to the Vehicle Certification (VC) label.
   - Verify that all tires are sized to specification. Refer to Section 204-04 .
   - Inspect the tires for incorrect wear and damage. Refer to Section 204-04 .

3. Inspect chassis and underbody.
   - Remove any excessive accumulation of mud, dirt or road deposits from the chassis and underbody.

4. Inspect for aftermarket equipment.
   - Check for aftermarket changes to the steering, suspension, wheel and tire components (such as competition, heavy duty, etc.) The specifications shown in this manual do not apply to vehicles equipped with aftermarket equipment.

Visual Inspection Chart

Mechanical
• Front wheel bearing(s) • Loose or damaged front or rear suspension components • Loose, damaged or missing suspension fastener(s) • Incorrect spring usage • Damaged or sagging spring(s) • Damaged or leaking shock absorber(s) • Worn or damaged suspension bushing(s) • Loose, worn or damaged steering system components • Damaged axle components

5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.

6. If the fault is not visually evident, GO to Symptom Chart - Suspension System or GO to Symptom Chart - NVH .

Symptom Chart - Suspension System

Symptom Chart - Suspension System

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Squeak or grunt - noise from the front suspension, occurs more in cold ambient temperatures. More noticeable over rough roads or when turning
- Front stabilizer bar insulators
- Under these conditions, the noise is acceptable. CHECK TSBs.
- Clunk - noise from the front suspension, occurs in and out of turns
- Loose front shocks
- INSPECT for shock absorber fasteners. TIGHTEN to specifications. Refer to the appropriate section in Group 204 for the procedure.
- Clunk - noise from the rear suspension, occurs when shifting from REVERSE to DRIVE
- Loose or damaged rear suspension components
- INSPECT for loose or damaged rear suspension components. REPAIR or INSTALL new components as necessary. Refer to the appropriate section in Group 204 for the procedure.
- Click or pop - noise from the front suspension. More noticeable over rough roads or over bumps
- Worn or damaged ball joint(s)
- INSPECT the front ball joints. REFER to the Ball Joint Inspection Component Test in this section. INSTALL new ball joints as necessary.
- Front suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads
- Loose or bent front shock absorber(s)

- Damaged spring or spring mount(s)
- Damaged or worn control/radius arm bushing(s)
- Worn or damaged stabilizer bar bushings or link(s)

- INSPECT the front suspension. INSTALL new components as necessary. Refer to the appropriate section in Group 204 for the procedure.

- Rear suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads

- Loose or bent rear shock absorber(s)
- Damaged spring or spring mount(s)
- Damaged or worn bushing(s)
- Worn or damaged stabilizer bar bushing(s) or link(s)

- INSPECT the rear suspension. INSTALL new components as necessary. Refer to the appropriate section in Group 204 for the procedure.

- Shudder - occurs during acceleration from a slow speed or stop

- Incorrect ride height causing incorrect driveline angle

- REFER to Section 205-00 for driveline angle diagnosis.

- Shimmy

- Loose wheel nut(s)

- TIGHTEN the nut(s) to specification. REFER to Section 204-04 .

- Loose front suspension fastener(s)

- TIGHTEN the fastener(s) to specification. Refer to the appropriate section in Group 204 for the procedure.

- Loose front wheel bearing(s)

- INSPECT the front wheel bearing(s). Refer to the appropriate section in Group 204 for the procedure. INSTALL new bearing(s) as necessary.

- Shock absorber(s)

- INSTALL new shock absorbers as necessary. Refer to the appropriate section in Group 204 for the procedure.

- Shimmy - most noticeable on coast/deceleration. Also hard steering condition

- Excessive positive caster

- CHECK the front caster and ADJUST as necessary. REFER to Camber and Caster Adjustment - Front in this section.

- Rough/harsh ride

- Shock absorber(s)

- INSTALL new shock absorber(s) as necessary. Refer to the appropriate section in Group 204 for the procedure.
- Spring(s)
- INSTALL new spring(s) as necessary. Refer to the appropriate section in Group 204 for the procedure.

Pinpoint Tests

Pinpoint Test A: Vehicle Drifts/Pulls

This pinpoint test is intended to diagnose the following:

- Unevenly loaded vehicle
- Tire pressure
- Tire forces
- Brake drag
- Incorrect vehicle alignment
- Steering system

PINPOINT TEST A: VEHICLE DRIFTS/PULLS

Test Step	Result / Action to Take
A1 CHECK FOR UNEVENLY LOADED VEHICLE	
• Visually check the vehicle for an uneven loading condition. • **Is the vehicle unevenly loaded?**	**Yes** ADVISE the customer of uneven loading condition. **No** GO to A2 .
A2 CHECK THE TIRE PRESSURES AND TIRE CONDITIONS	
• Check the tire pressures. Refer to the Vehicle Certification (VC) label located on the driver door jamb. Check the tires for uneven/abnormal wear. Refer to Diagnosis and Testing - Wheels and Tires in Section 204-04 . • **Are the tire pressures and tire conditions OK?**	**Yes** GO to A3 . **No** ADJUST the tire pressures to the specified pressure or INSTALL new tires as necessary.
A3 ISOLATE TIRE DRIFT/PULL CONDITION	
• Cross the front wheel and tire assemblies from left-to-right. Refer to Section 204-04 . • **Does the vehicle drift/pull?**	**Yes** If the vehicle drifts/pulls in the opposite direction, tire forces are causing the drift/pull. ROTATE the wheel and tire assemblies front-to-rear. REFER to Section 204-04 . If the vehicle drifts/pulls in the

	same direction, GO to A4 . **No** Tire forces were causing the drift/pull and the concern has been corrected.
A4 CHECK FOR BRAKE DRAG	
• Spin all 4 wheel and tire assemblies by hand and check for brake drag. • **Do the wheels spin freely?**	**Yes** GO to A5 . **No** REFER to Section 206-00 to diagnose brake drag condition.
A5 CHECK THE WHEEL ALIGNMENT	
• Using alignment equipment and the manufacturer's instructions, check the wheel alignment. • **Is the wheel alignment out of specification?**	**Yes** ADJUST the alignment as necessary. REFER to General Procedures in this section. **No** REFER to Section 211-00 to diagnose steering system drift/pull/wander condition.

Component Tests

Ball Joint Inspection

1. Prior to inspecting the ball joints for wear, inspect the wheel bearings. Refer to Section 100-04 .

2. **NOTE:** In order to obtain accurate measurements, the suspension must be in full rebound with the weight of the vehicle supported by the frame.

   Raise and support the vehicle by the frame to allow the wheels to hang in the rebound position.

3. Inspect the ball joint and ball joint boot for damage.
   - If the ball joint or ball joint boot is damaged, install a new ball joint as necessary. Refer to Section 204-01A for Rear Wheel Drive (RWD) vehicles and Section 204-01B for Four-Wheel Drive (4WD) vehicles.

NOTE: Carry out Steps 4 through 6 to inspect the lower ball joint. Carry out Steps 7 through 9 to inspect the upper ball joint.

4. ***NOTICE:*** **Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage may occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.**

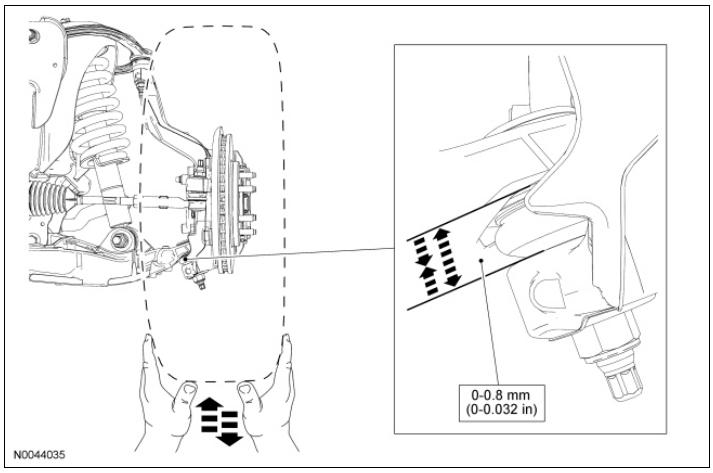
   NOTE: The weight of the wheel and tire assembly must be overcome to obtain an accurate measurement on the dial indicator.

   Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the wheel and tire assembly by hand. Note any relative vertical movement between the wheel knuckle and lower arm at the lower ball joint.

- If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
- If relative movement is found, continue with Step 5.

5. **NOTE:** In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis (center line) of the ball joint.

   To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the lower control arm and the wheel knuckle or ball joint stud.



6. Measure the ball joint deflection while an assistant pushes up and pulls down on the wheel and tire assembly by hand.
   - If the deflection exceeds the specification, a new ball joint must be installed. Refer to Section 204-01A for RWD vehicles and Section 204-01B for 4WD vehicles.
   - If the deflection meets the specification, continue with the procedure.

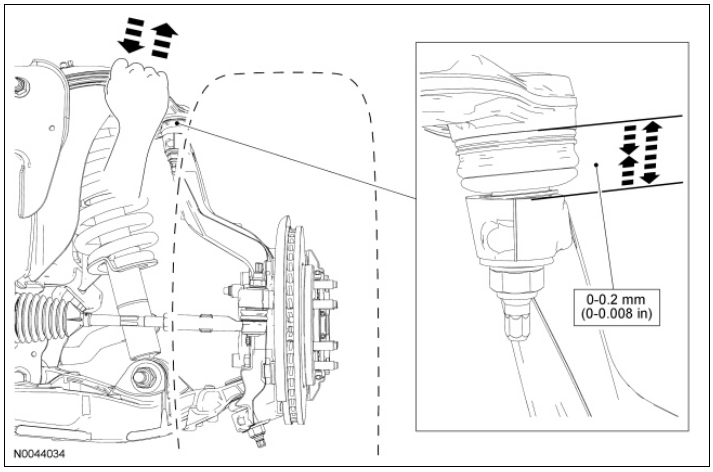
7. ***NOTICE:*** **Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage may occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.**

   Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the upper control arm by hand. Note any relative vertical movement between the wheel knuckle and upper arm at the upper ball joint.

   - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
   - If relative movement is found, continue with Step 8.

8. **NOTE:** In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis of the ball joint.

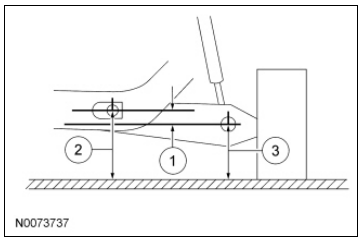
   To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the upper control arm and the wheel knuckle or ball joint stud.



9. Measure the ball joint deflection while an assistant pushes up and then pulls down on the upper control arm by hand.
    - If the deflection exceeds the specification, a new ball joint must be installed. For additional information, refer to Section 204-01A for RWD vehicles and Section 204-01B for 4WD vehicles.
    - If the deflection meets the specification, no further action is required.

Ride Height Measurement

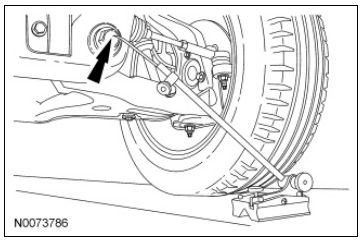
Front Ride Height Measurement



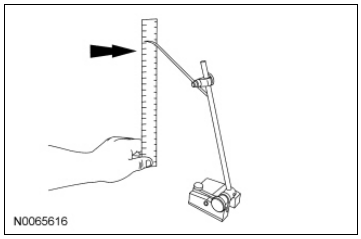
Item	Description
1	Ride height = 2-3
2	Measurement 2
3	Measurement 3

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

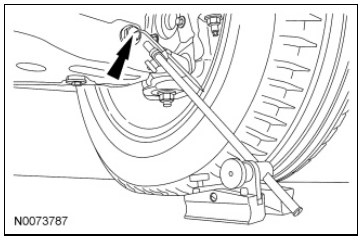
1. Position a suitable surface gauge (such as Starrett 57D Surface Gauge), on a flat, level surface and adjust the gauge arm until the scriber point is located in the center of the lower arm inboard bolt.
   - Lock the surface gauge in this position.



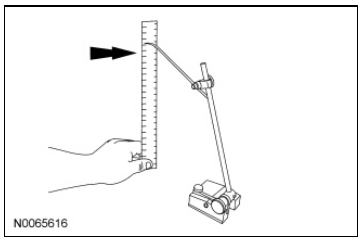
2. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 2).



3. Position the surface gauge on the same flat, level surface as used in Step 1, adjust the gauge arm until the scriber point is located in the center of the shock absorber lower bolt.
   - Lock the surface gauge in this position.

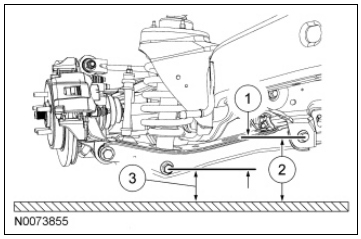


4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 3).



5. Subtract measurement 3 from measurement 2 to obtain the front ride height.
    - Refer to Specifications in this section.

Rear Ride Height Measurement



Item	Description
1	Ride height = 2-3
2	Measurement 2
3	Measurement 3

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

1. Measure the distance between the flat level surface and the center of the lower arm inboard bolt (measurement 2).

2. Measure the distance between the flat level surface and the center of the shock absorber lower bolt (measurement 3).

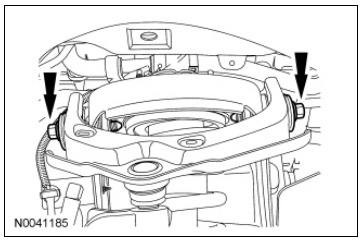
3. Subtract measurement 3 from measurement 2 to obtain the rear ride height.
    - Refer to Specifications in this section.

Camber and Caster Adjustment - Front

1. Using alignment equipment and the manufacturer's instructions, measure the front caster and camber.

2. Loosen the upper arm bolt(s) and adjust the caster and camber settings. Refer to the following chart.
   - When making adjustments that require moving both the front and the rear of the upper arm, move both ends of the arm equally.

Adjustment	Front of Upper Arm	Rear of Upper Arm
Increase caster	Out	In
Decrease caster	In	Out
Increase camber	Out	Out
Decrease camber	In	In
Increase caster and camber simultaneously	Out	-
Decrease caster and camber simultaneously	In	-

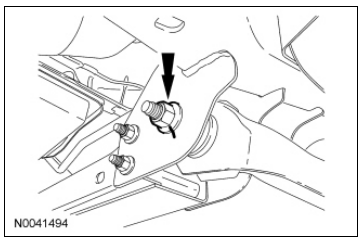


3. **NOTE:** Make sure that the weight of the vehicle is on the wheels and that the caster and camber settings are not disturbed while tightening the bolt(s).

   Tighten the upper arm bolt(s) to 150 Nm (111 lb-ft).

4. **NOTE:** A caster split adjustment can be made by loosening the LF lower arm rearward nut and adjusting the rear of the LF lower arm.

   Remove and discard the LF lower control arm rearward nut.



5. **NOTE:** Do not fully tighten the nut and bolt at this time.

   Install a new LF lower arm rearward nut.

6. Position the LF lower arm until the caster split is within specification.

7. **NOTE:** Make sure that the weight of the vehicle is on the wheels and that the caster settings are not disturbed while tightening the nut.

   Tighten the LF lower arm rearward nut to 200 Nm (148 lb-ft).

8. Recheck the camber and caster, adjust as necessary.

9. Check and, if necessary, adjust the front toe.

Toe Adjustment - Front

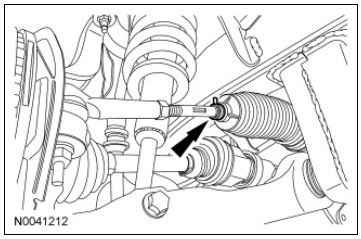
1. Using alignment equipment and the manufacturer's instructions, measure the front toe.

2. Start the engine and center the steering wheel.

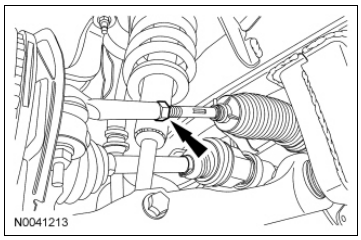
3. Turn the engine OFF and, using a suitable holding device, lock the steering wheel in the straight ahead position.

4. **NOTE:** Do not allow the steering gear bellows to twist when the front wheel inner tie rod is rotated.

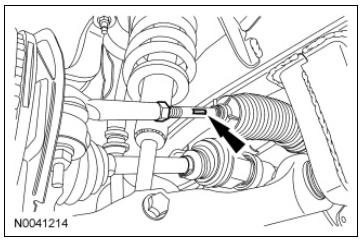
   Remove the clamps.



5. Loosen the tie-rod jam nuts.



6. Rotate the front wheel inner tie rods until the toe setting is within specification.



7. ***NOTICE:*** **Make sure to hold the tie-rod end stationary while tightening the nut or damage to the steering gear bellows can occur.**

   NOTE: Make sure that the toe settings are not disturbed while tightening the nuts.

   Tighten the tie-rod jam nuts to 70 Nm (52 lb-ft).

8. Install the clamps.

9. Recheck the toe settings and adjust if necessary.

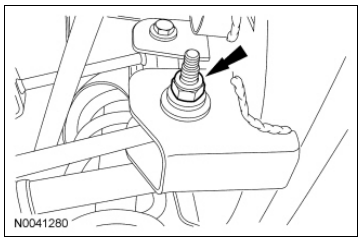
Toe Adjustment - Rear

1. Using alignment equipment and the manufacturer's instructions, measure the rear toe.

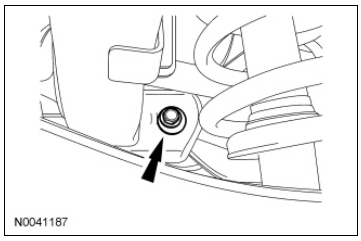
2. Start the engine and center the steering wheel.

3. Turn the engine OFF and, using a suitable holding device, lock the steering wheel in the straight ahead position.

4. Loosen the rear toe link inboard nut.



5. Rotate the rear toe link cam bolt until the toe setting is within specification.



6. **NOTE:** Make sure the toe settings are not disturbed while tightening the nut.

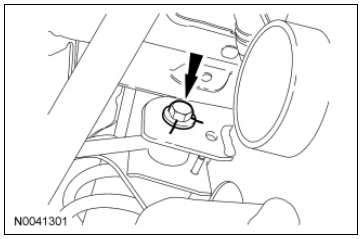
   While holding the adjustment cam bolt, tighten the toe link inboard nut.

   - Tighten to 275 Nm (202 lb-ft).

7. Recheck the toe settings and adjust if necessary.

Camber Adjustment - Rear

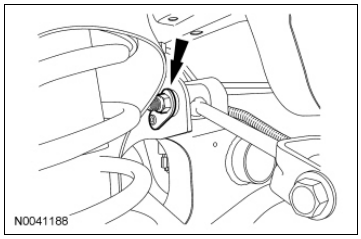
1. Index-mark the upper arm inboard bolt to the frame.



2. **NOTE:** The upper arm inboard flagnut must be removed and replaced with a non-flagnut to allow for the adjustment of the arm in the frame slot.

   Remove and discard the upper arm inboard bolt and flagnut.

   - Install a new non-flagnut.



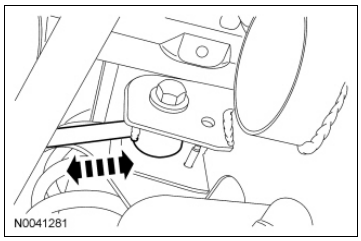
3. Using alignment equipment and the manufacturer's instructions, measure the rear camber.

4. **NOTE:** The weight of the vehicle must be off of the wheels in order to adjust the rear camber.

   NOTE: For camber adjustment, 1 mm (0.03 in) of movement equals 0.24 degrees of camber.

   NOTE: To decrease the camber, move the upper arm inward. To increase the camber, move the upper arm outward.

   Position the upper arm until the camber setting is within specification.



5. **NOTE:** Make sure that the camber settings are not disturbed while tightening the nut.

   Tighten the upper arm inboard nut to 250 Nm (185 lb-ft).

6. Recheck the camber settings and adjust as necessary.

7. Check and, if necessary, adjust the rear toe.

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate bolt	165	122	-
Brake disc shield bolt	8	-	71
Lower arm forward nut	400	296	-
Lower arm rearward nut	200	148	-
Lower ball joint nut	150	111	-
Shock absorber lower bolt and flag nut	350	258	-
Shock absorber rod nut	65	48	-
Shock absorber upper mount nut	30	22	-
Stabilizer bar bracket bolt	55	41	-
Stabilizer bar link nut and grommet	35	26	-
Tie-rod end nut	103	76	-
Upper arm bolt and flag nut	150	111	-
Upper ball joint nut	55	41	-
Wheel bearing and wheel hub bolt	122	90	-
Wheel speed sensor bolt	18	-	159
Wheel speed sensor harness bracket bolt	8	-	71

Front Suspension

The Rear Wheel Drive (RWD) front suspension consists of the following components:

- Lower arms
- Shock absorber and spring assemblies
- Stabilizer bar links, bushings and brackets
- Upper arms
- Wheel bearing and wheel hub
- Wheel knuckles
- Wheel studs

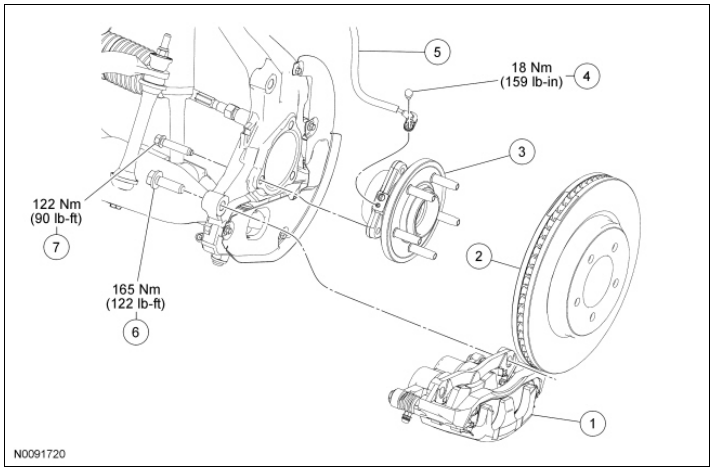
The front suspension utilizes an upper and lower arm and is an independent suspension design. This type of suspension uses 2 parallel arms. Each arm has 2 mounting positions to the chassis and one ball joint attachment at the wheel knuckle. The shock absorber mounts to the lower arm and along with the spring, controls vertical movement. A stabilizer bar and links are included to control suspension lean/sway during turns. Double-arm designs allow for carefully controlled motion of the wheel throughout suspension travel, controlling such parameters as camber angle, caster angle and toe.

Front Suspension

Refer to Section 204-00 .

Wheel Bearing and Wheel Hub

Removal and Installation



Item	Part Number	Description
1	2B120 RH/ 2B121 LH	Brake caliper assembly
2	1125	Brake disc
3	1104	Wheel bearing and hub assembly
4	W500212	Wheel speed sensor bolt
5	2C204	Wheel speed sensor
6	2027	Brake caliper anchor plate bolt (2 required)
7	1107	Wheel bearing and hub assembly bolt (3 required)

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the bolts and position the caliper, pads and anchor plate assembly aside.

   - Discard the bolts.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten the new bolts to 165 Nm (122 lb-ft).

3. Remove the brake disc.

4. **NOTE:** Inspect and if necessary, clean area around wheel speed sensor before removing it from the wheel bearing and hub.

   Remove the wheel speed sensor bolt and disconnect the wheel speed sensor from the wheel bearing and hub assembly.

   - To install, tighten to 18 Nm (159 lb-in).

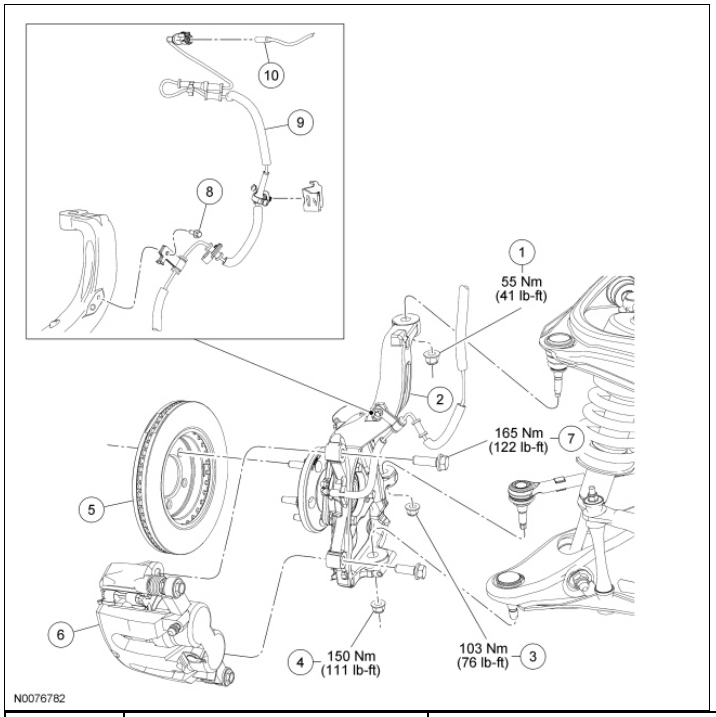
5. Remove the 3 bolts and the wheel bearing and wheel hub.
   - Discard the bolts.
   - To install, tighten the new bolts to 122 Nm (90 lb-ft).

6. To install, reverse the removal procedure.

Wheel Knuckle

Special Tool(s)

 ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	W520214	Upper ball joint nut
2	3C489 RH/ 3C459 LH	Wheel knuckle
3	W707251	Tie-rod end nut
4	W710046	Lower ball joint nut
5	1125	Brake disc
6	2B120 RH/ 2B121 LH	Brake caliper assembly
7	2027	Brake caliper anchor plate bolt (2 required)
8	W500212	Wheel speed sensor harness bracket bolt
9	2C204	Wheel speed sensor harness (part of 2C204)
10	-	Wheel speed sensor electrical connector (part of 14398)

Removal and Installation

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the bolts and position the caliper, pads and anchor plate assembly aside.

   - Discard the bolts.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten the new bolts to 165 Nm (122 lb-ft).

3. Remove the brake disc.

4. Disconnect the wheel speed sensor harness pin-type retainers.

5. Disconnect the wheel speed sensor electrical connector.

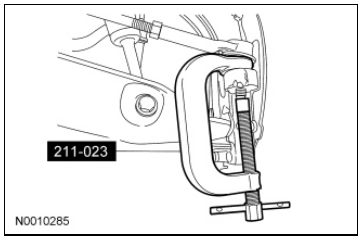
6. Remove the wheel speed sensor harness bracket bolt from the wheel knuckle.
   - To install, tighten to 8 Nm (71 lb-in).

7. Remove and discard the tie-rod end nut.
   - To install, tighten the new nut to 103 Nm (76 lb-ft).

8. ***NOTICE:*** **Do not use a hammer to separate the tie rod from the wheel knuckle or damage to the wheel knuckle can result.**

   NOTICE: **Do not damage the tie-rod boot while installing the C-Frame and Screw.**

   Using the C-Frame and Screw, separate the tie-rod end from the wheel knuckle.

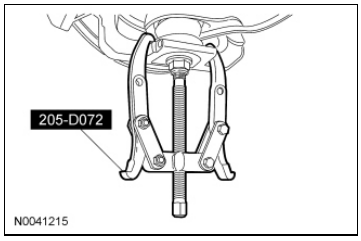


9. Remove and discard the lower ball joint nut.
   - To install, tighten the new nut to 150 Nm (111 lb-ft).

10. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

    NOTICE: **Do not damage the ball joint boot while installing the 2-Jaw Puller.**

    Using the 2-Jaw Puller, separate the lower ball joint from the wheel knuckle.

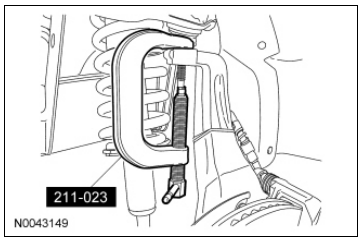


11. Remove and discard the upper ball joint nut.
    - To install, tighten the new nut to 55 Nm (41 lb-ft).

12. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

    NOTICE: **Do not damage the ball joint boot while installing the C-Frame and Screw.**

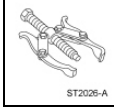
    Using the C-Frame and Screw, separate the upper ball joint and remove the wheel knuckle.

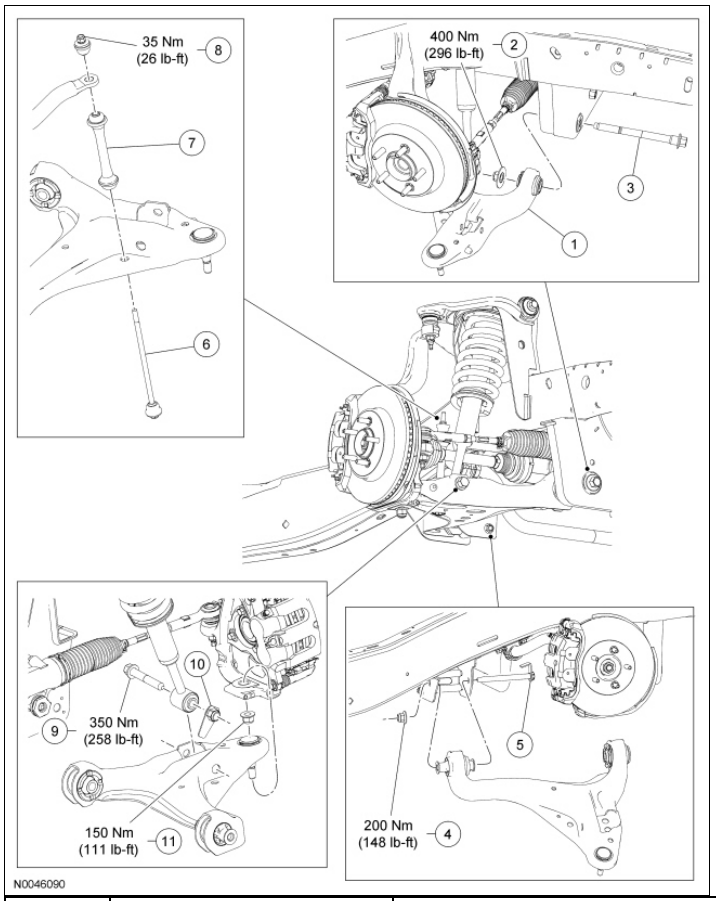


13. To install, reverse the removal procedure.
    - Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Lower Arm

Special Tool(s)

 ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent



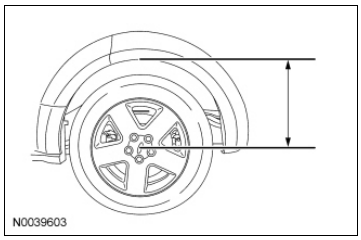
Item	Part Number	Description
1	3042 RH/ 3051 LH	Lower arm
2	W710796	Lower arm forward nut
3	W711505	Lower arm forward bolt
4	W707254	Lower arm rearward nut
5	W711533	Lower arm rearward bolt
6	5495	Stabilizer bar link stud (part of 5K183)
7	5K483	Stabilizer bar link assembly
8	5C491	Stabilizer bar link nut and grommet
9	W710775	Shock absorber lower bolt
10	W710747	Shock absorber lower flag nut
11	W710046	Lower ball joint nut

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as when removed or incorrect clamp load and damage to components may occur.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



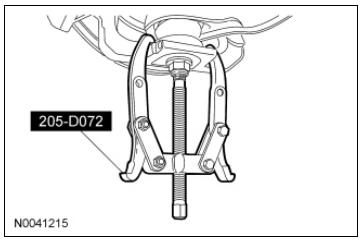
2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. Remove and discard the lower ball joint nut.

4. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

   NOTICE: **Do not damage the ball joint boot while installing the 2-Jaw Puller.**

   Using the 2-Jaw Puller, separate the lower ball joint from the wheel knuckle.



5. Remove and discard the stabilizer bar link nut and grommet.

6. Remove the stabilizer bar link.

7. Remove and discard the shock absorber lower bolt and flag nut.

8. Remove and discard the lower arm forward nut and bolt.

9. Remove the lower arm rearward nut and bolt and the lower control arm.
   - Discard the nut and bolt.

Installation

NOTICE: **Before tightening any suspension bushing fasteners, use a suitable jack to raise the**

suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height). This will prevent incorrect clamp load and bushing damage.

1. **NOTE:** Do not tighten the bolt at this time.

   Position the lower arm and install the new lower arm rearward bolt and nut.

2. **NOTE:** Do not tighten the bolt at this time.

   Install the new lower arm forward bolt and nut.

3. **NOTE:** Do not tighten the bolt at this time.

   Install the new shock absorber lower bolt and flag nut.

4. Position the stabilizer bar link and install the new nut.
   - Tighten the nut to 35 Nm (26 lb-ft).

5. Connect the lower ball joint to the wheel knuckle and install the new lower ball joint nut.
   - Tighten to 150 Nm (111 lb-ft).

6. Using a suitable jack, raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height).

7. Tighten the shock absorber lower bolt to 350 Nm (258 lb-ft).

8. Tighten the lower arm forward nut to 400 Nm (296 lb-ft).

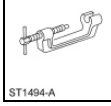
9. Tighten the lower arm rearward nut to 200 Nm (148 lb-ft).

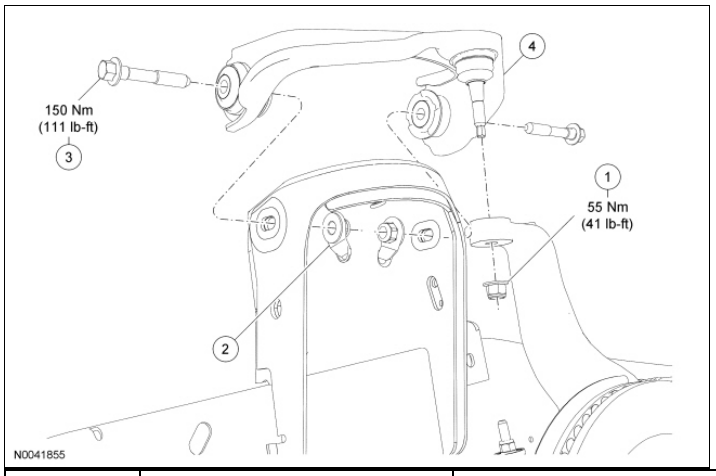
10. Install the wheel and tire. For additional information, refer to Section 204-04 .

11. Check and if necessary, align the front end. For additional information, refer to Section 204-00 .

Upper Arm

Special Tool(s)

 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)

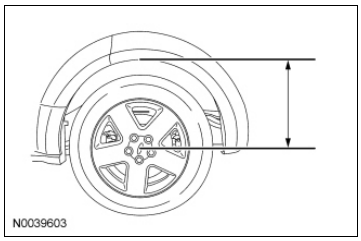


Item	Part Number	Description
1	W520214	Upper ball joint nut
2	W711223	Upper arm flag nut (2 required)
3	W711504	Upper arm bolt (2 required)
4	3084 RH/ 3091 LH	Upper arm

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

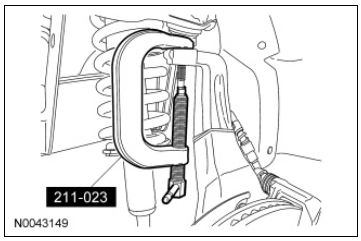
3. Using a suitable jack support the lower control arm near the lower ball joint.

4. Remove and discard the upper ball joint nut.

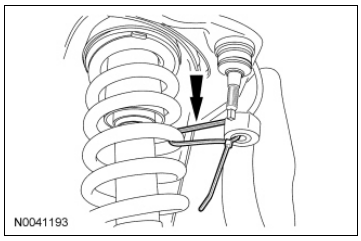
5. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

   NOTICE: **Do not damage the ball joint boot while installing the C-Frame and Screw.**

   Using the C-Frame and Screw, separate the upper ball joint from the wheel knuckle.



6. Using a plastic tie strap, support the suspension at the wheel knuckle.



7. Remove and discard the 2 upper arm bolts and flag nuts and remove the upper arm.

Installation

NOTICE: **Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height). This will prevent incorrect clamp load and bushing damage.**

1. **NOTE:** Do not tighten the bolt at this time.

   Position the upper arm and install the 2 new upper arm bolts and flag nuts.

2. Remove the plastic tie strap.

3. Connect the upper ball joint to the wheel knuckle and install the new upper ball joint nut.
   - Tighten to 55 Nm (41 lb-ft).

4. Using a suitable jack, raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height).

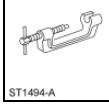
5. Tighten the 2 upper arm bolts to 150 Nm (111 lb-ft).

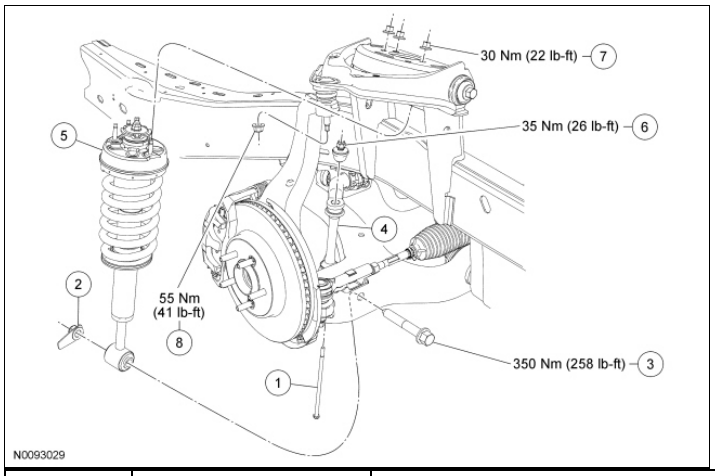
6. Install the wheel and tire. For additional information, refer to Section 204-04 .

7. Check and if necessary, align the front end. For additional information, refer to Section 204-00 .

Shock Absorber and Spring Assembly

Special Tool(s)

 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	5495	Stabilizer bar link stud (part of 5K483)
2	W710747	Shock absorber lower flag nut
3	W710775	Shock absorber lower bolt
4	5K483	Stabilizer bar link assembly
5	18B036	Shock absorber and spring assembly
6	5C491	Stabilizer bar link nut and grommet
7	W704790	Shock absorber upper nuts (3 required)
8	W520214	Upper ball joint nut

Removal

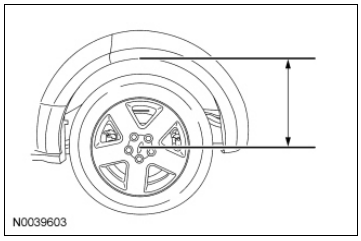
⚠ WARNING: Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Keep all body parts clear of shock absorbers or strut rods. Shock absorbers or struts can extend unassisted. Failure to follow this instruction may result in serious personal injury.

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as when removed or incorrect clamp load and damage to components may occur.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove and discard the 3 shock absorber upper mount nuts.

3. Remove the wheel and tire. For additional information, refer to Section 204-04 .

4. Using a suitable jack, support the lower control arm near the lower ball joint.

5. Remove and discard the stabilizer bar link nut and grommet and then remove the stabilizer bar link.

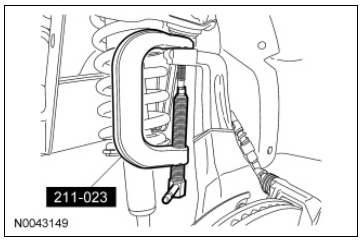
6. Remove and discard the shock absorber lower bolt and flag nut.

7. Remove and discard the upper ball joint nut.

8. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

   NOTICE: **Do not damage the ball joint boot while installing the C-Frame and Screw.**

   Using the C-Frame and Screw, separate the upper ball joint from the wheel knuckle.



9. While lowering the suspension, remove the shock and spring assembly.

Installation

NOTICE: **Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height). This will prevent unequal clamp load and bushing damage.**

NOTE: For additional information on the disassembly and assembly of the shock absorber and spring assembly, refer to Shock Absorber and Spring Assembly in this section.

1. Install the shock absorber and spring assembly.

2. Connect the upper ball joint to the wheel knuckle and install the new upper ball joint nut.

- Tighten to 55 Nm (41 lb-ft).

3. **NOTE:** Do not tighten the bolt at this time.

   Install the new shock absorber lower bolt and flag nut.

4. Using a suitable jack, raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height).

5. Position the stabilizer bar link and install the new nut.
   - Tighten to 35 Nm (26 lb-ft).

6. Tighten the shock absorber lower bolt to 350 Nm (258 lb-ft).

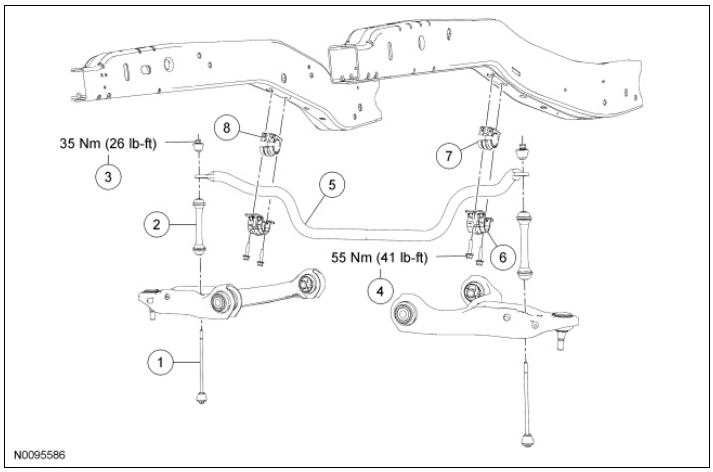
7. Install the 3 new shock absorber upper mount nuts.
   - Tighten to 30 Nm (22 lb-ft).

8. Remove the jack.

9. Install the wheel and tire. For additional information, refer to Section 204-04 .

10. Check and if necessary, align the front end. For additional information, refer to Section 204-00 .

Stabilizer Bar and Link



Item	Part Number	Description
1	5495	Stabilizer link stud (2 required) (part of 5K483)
2	5K483	Stabilizer bar link assembly (2 required)
3	5C491	Stabilizer bar link nut and grommet (2 required)
4	W707472	Stabilizer bar bracket bolt (4 required)
5	5494	Stabilizer bar
6	3B353	Stabilizer bar bracket (2 required)
7	5484	Stabilizer bar bushing LH
8	5G484	Stabilizer bar bushing RH

Removal and Installation

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as when removed or incorrect clamp load and damage to components may occur.**

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. Remove and discard the 2 stabilizer bar nuts and grommets.
   - To install, tighten the new nuts to 35 Nm (26 lb-ft) at curb height.

3. Remove and discard the 2 stabilizer bar studs.

4. Remove the 2 stabilizer bar links.

5. **NOTE:** Inspect and clean the mating surfaces and the internal threads. Make sure all mating surfaces are free of foreign material and remove any thread locking compound from the internal threads.

NOTE: Rotate the stabilizer bar and pull outward to remove.

Remove the 4 stabilizer bar bracket bolts and the stabilizer bar, and the brackets and bushings.

- Discard the bolts.
- To install, tighten the new bolts to 55 Nm (41 lb-ft) at curb height.

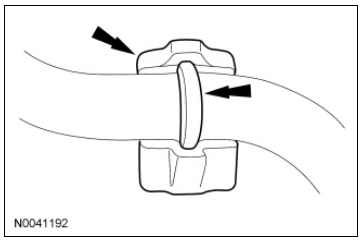
6. ***NOTICE:*** **The LH and RH side stabilizer bar bushings are different and are not interchangeable. Make sure the bushings are installed on the correct side or damage to the bushings will occur.**

   NOTE: When installing the LH side sway bar bushings onto the sway bar, match the groove in the bushing to the upset on the sway bar.

   NOTE: Inspect the stabilizer bar bushings for wear or damage. Install new bushings as necessary.

   NOTE: Tighten LH side first.

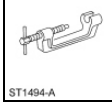
   Remove the 2 stabilizer bar bushings.

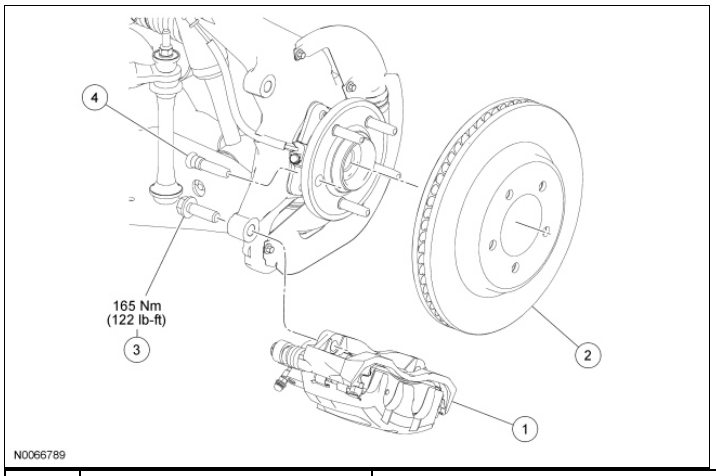


7. To install, reverse the removal procedure.

Wheel Studs

Special Tool(s)

 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	2B120 RH/ 2B121 LH	Brake caliper assembly
2	1125	Brake disc
3	2027	Brake caliper anchor plate bolt (2 required)
4	1107	Wheel stud

Removal

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

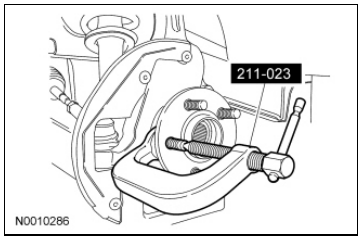
2. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the bolts and position the caliper, pads and anchor plate assembly aside.

   - Discard the bolts.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten the new bolts to 165 Nm (122 lb-ft).

3. Remove the brake disc.

4. Using the C-Frame and Screw, remove the wheel stud.



Installation

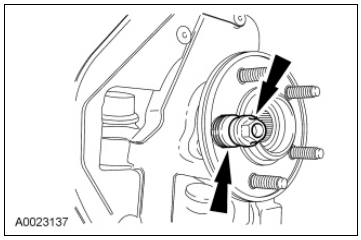
1. ***NOTICE:*** **Do not use power tools to install the wheel stud. The serrations on the stud can be stripped.**

   NOTE: Do not use the wheel nut that came with the vehicle.

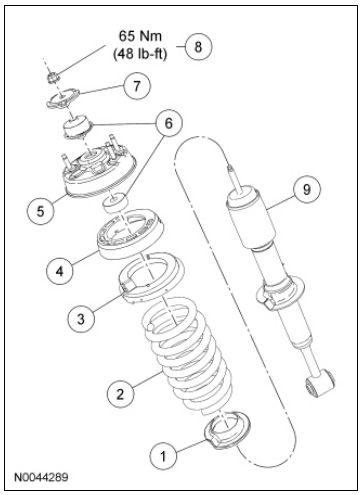
   NOTE: Make sure to use washers that have an ID that is larger than the OD of the wheel stud serrations. Use enough washers (approximately 4) to allow the wheel stud to fully seat against the hub flange.

   Install approximately 4 washers and a new wheel nut on the wheel stud and tighten the nut until the stud seats against the flange.

   - Discard the wheel nut and washers.



Shock Absorber and Spring Assembly



Item	Part Number	Description
1	-	Coil spring insulator (part of 5415)
2	5310	Coil spring
3	-	Insulator (part of 5415)
4	-	Supporter (part of 5415)
5	18183	Upper shock mount
6	-	Upper mount bushings (part of 18198)
7	-	Upper washer (part of 18198)
8	-	Shock absorber rod nut (part of 18198)
9	18124	Shock absorber

Disassembly and Assembly

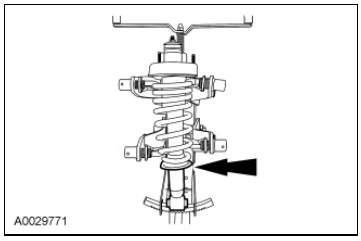
⚠ WARNING: Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Keep all body parts clear of shock absorbers or strut rods. Shock absorbers or struts can extend unassisted. Failure to follow this instruction may result in serious personal injury.

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the shock absorber and spring assembly. For additional information, refer to Shock Absorber and Spring Assembly in this section.

2. Using a suitable spring compressor, compress the spring until the tension is released from the shock absorber.

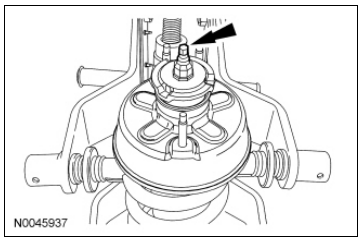


3. ***NOTICE:*** **When installing the shock rod nut, make sure the shock rod and bushing are centered in the upper mount before tightening the nut or damage to the shock or bushing may occur.**

   NOTE: Use the holding feature to prevent the shock absorber rod from turning while removing and installing the nut.

   Remove and discard the shock absorber rod nut.

   - To install, tighten the new nut to 65 Nm (48 lb-ft).



4. Remove the shock absorber.

5. Remove the washer and upper mount bushing.

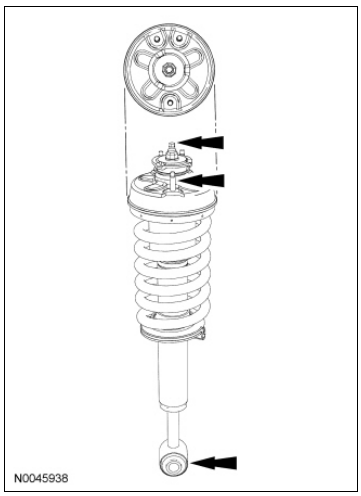
6. Remove the upper shock absorber mount.

7. Remove the dust boot.

8. Carefully release the spring compressor and remove the coil spring.

9. ***NOTICE:*** **Make sure that the upper shock mount stud, shock rod and shock lower bushing are aligned before tightening shock absorber rod nut or damage to the bushing may occur.**

   To assemble, reverse the disassembly procedure.



Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate bolt	165	122	-
Brake disc shield bolt	8	-	71
Halfshaft nut	250	184	-
Lower arm forward bolt	400	296	-
Lower arm rearward nut	200	148	-
Lower ball joint nut	150	111	-
Shock absorber bolt and flagnut	350	258	-
Shock absorber rod nut	65	48	-
Shock absorber upper mount nut	30	22	-
Stabilizer bar bracket bolt	55	41	-
Stabilizer bar link nut and grommet	35	26	-
Tie-rod end nut	103	76	-
Upper arm bolt	150	111	-
Upper ball joint nut	55	41	-
Wheel hub bolt	122	90	-
Wheel speed sensor bolt	18	-	159
Wheel speed sensor bracket bolt	8	-	71

Front Suspension

The Four-Wheel Drive (4WD) front suspension consists of the following components:

- Lower arms
- Shock absorber and spring assemblies
- Stabilizer bar, bushings and brackets
- Stabilizer bar links
- Upper arms
- Wheel bearing and wheel hub
- Wheel knuckles
- Wheel studs

The front suspension utilizes an upper and lower arm and is an independent suspension design. This type of suspension uses 2 parallel arms. Each arm has 2 mounting positions to the chassis and one ball joint attachment at the wheel knuckle. The shock absorber mounts to the lower arm and along with the spring, controls vertical movement. A stabilizer bar and links are included to control suspension lean/sway during turns. Double-arm designs allow for carefully controlled motion of the wheel throughout suspension travel, controlling such parameters as camber angle, caster angle and toe.

Front Suspension

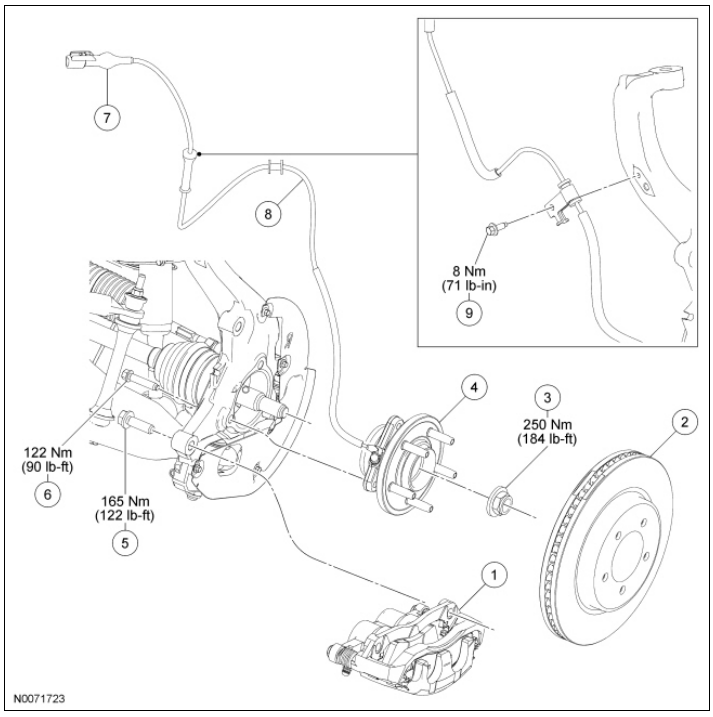
Refer to Section 204-00 .

Wheel Bearing and Wheel Hub

Special Tool(s)

 ST2272-A	Remover, Front Wheel Hub 205-D070 (D93P-1175-B) or equivalent

Removal and Installation



Item	Part Number	Description
1	2B120 RH/ 2B121 LH	Brake caliper assembly
2	1125	Brake disc
3	W706540	Halfshaft nut
4	1104	Wheel bearing and hub assembly
5	2027	Brake caliper anchor plate bolt (2 required)
6	1107	Wheel bearing and hub bolt (3 required)
7	-	Wheel speed sensor electrical connector (part of 2C216 LH/ 2C190 RH)
8	2C216 LH/ 2C190 RH	Wheel speed sensor
9	W500212	Wheel speed sensor harness bracket bolt

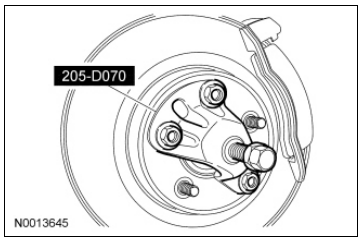
NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the**

same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. Remove and discard the halfshaft nut.
   - To install, tighten the new nut to 250 Nm (184 lb-ft).

3. Using the Front Wheel Hub Remover, separate the outboard CV joint from the wheel hub.



4. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the bolts and position the caliper, pads and anchor plate assembly aside.

   - Discard the bolts.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten the new bolts to 165 Nm (122 lb-ft).

5. Remove the brake disc.

6. **NOTE:** A new wheel bearing and wheel hub comes with the wheel speed sensor installed.

   Disconnect the wheel speed sensor harness electrical connector and remove and discard the wheel speed sensor harness bracket bolt.

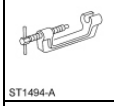
   - To install, tighten to 8 Nm (71 lb-in).

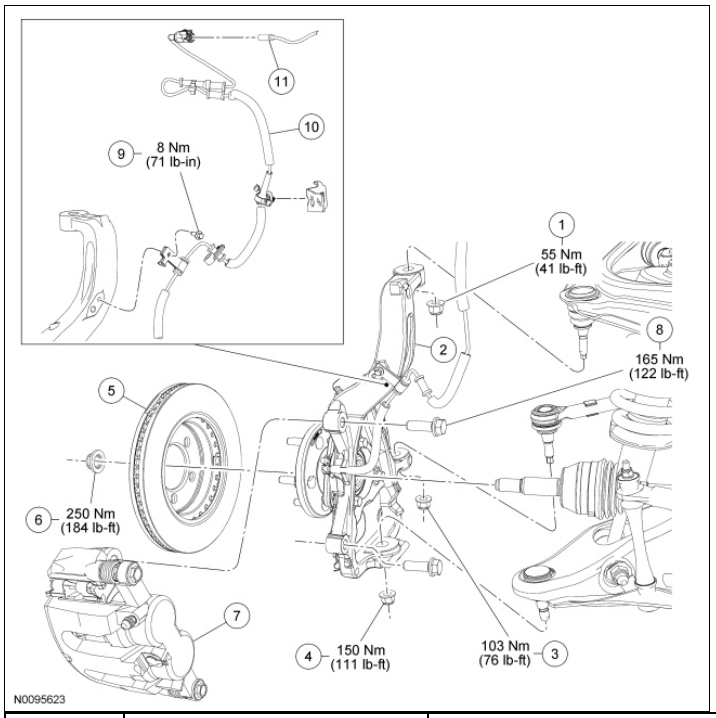
7. Remove the 3 bolts and the wheel bearing and hub assembly.
   - Discard the bolts.
   - To install, tighten the new bolts to 122 Nm (90 lb-ft).

8. To install, reverse the removal procedure.

Wheel Knuckle

Special Tool(s)

 ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)
 ST2272-A	Remover, Front Wheel Hub 205-D070 (D93P-1175-B) or equivalent



Item	Part Number	Description
1	W520214	Upper ball joint nut
2	3C489 RH/ 3C459 LH	Wheel knuckle
3	W707251	Tie-rod end nut
4	W710046	Lower ball joint nut
5	1125	Brake disc
6	W706540	Halfshaft nut
7	2B120 RH/ 2B121 LH	Brake caliper assembly
8	2027	Brake caliper anchor plate bolt (2 required)
9	W500212	Wheel speed harness bracket bolt

10	2C204	Wheel speed sensor harness (part of 2C204)
11	-	Wheel speed sensor electrical connector (part of 14398)

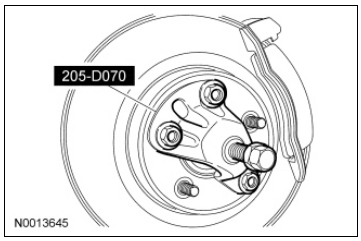
Removal and Installation

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. Remove and discard the halfshaft nut.
   - To install, tighten to 250 Nm (184 lb-ft).

3. Using the Front Wheel Hub Remover, separate the outboard CV joint from the wheel hub.



4. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the bolts and position the caliper, pads and anchor plate assembly aside.

   - Discard the bolts.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten to 165 Nm (122 lb-ft).

5. Remove the brake disc.

6. Remove the wheel speed sensor harness bracket bolt from the wheel knuckle.
   - To install, tighten to 8 Nm (71 lb-in).

7. Disconnect the wheel speed sensor harness pin-type retainers.

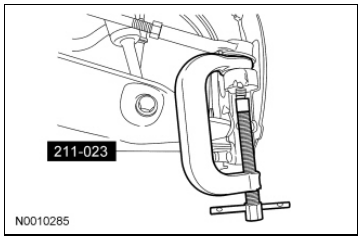
8. Disconnect the wheel speed sensor electrical connector.

9. Remove and discard the tie-rod end nut.
   - To install, tighten the new nut to 103 Nm (76 lb-ft).

10. ***NOTICE:*** **Do not use a hammer to separate the tie rod from the wheel knuckle or damage to the wheel knuckle can result.**

    NOTICE: **Do not damage the tie-rod boot while installing the C-Frame and Screw.**

    Using the C-Frame and Screw, separate the tie-rod end from the wheel knuckle.

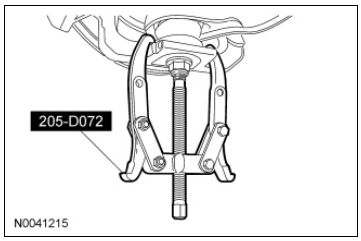


11. Remove and discard the lower ball joint nut.
    - To install, tighten the new nut to 150 Nm (111 lb-ft).

12. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

    NOTICE: **Do not damage the ball joint boot while installing the 2-Jaw Puller.**

    Using the 2-Jaw Puller, separate the lower ball joint from the wheel knuckle.

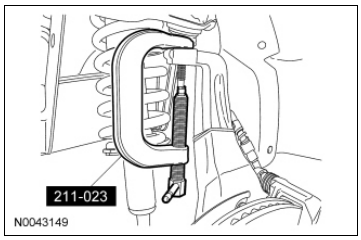


13. Remove and discard the upper ball joint nut.
    - To install, tighten the new nut to 55 Nm (41 lb-ft).

14. ***NOTICE:*** **Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

    NOTICE: **Do not damage the ball joint boot while installing the C-Frame and Screw.**

    Using the C-Frame and Screw, separate the upper ball joint and remove the wheel knuckle.



15. To install, reverse the removal procedure.
    - Check and if necessary, align the front end. For additional information, refer to Section 204-00 .

Lower Arm

Removal and Installation

For additional information, refer to Section 204-01A .

Upper Arm

Removal and Installation

For additional information, refer to Section 204-01A .

Shock Absorber and Spring Assembly

Removal and Installation

For additional information, refer to Section 204-01A .

Stabilizer Bar and Link

Removal and Installation

For additional information, refer to Section 204-01A .

Wheel Studs

Removal and Installation

For additional information, refer to Section 204-01A .

Shock Absorber and Spring Assembly

Disassembly and Assembly

1. For additional information, refer to Section 204-01A .

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper guide pin bolt	32	24	-
Brake disc shield bolt	8	-	71
Fuel tank filler pipe bracket bolt	15	-	133
Fuel tank filler pipe hose clamps	3	-	27
Halfshaft nut and washer	275	203	-
Lower arm inboard bolt	250	185	-
Lower arm outboard bolt	275	203	-
Parking brake cable bracket bolt	10	-	89
Shock absorber lower bolt	275	203	-
Shock absorber rod nut	65	48	-
Shock absorber upper mount nut	30	22	-
Stabilizer bar bracket nut	48	35	-
Stabilizer bar link nut and grommet	30	22	-
Toe link cam adjuster nut	275	203	-
Toe link outboard bolt	325	240	-
Trailing arm bolt	300	222	-
Upper arm outboard bolt	225	166	-
Upper arm inboard nut	250	185	-
Wheel speed sensor bolt	8	-	71
Wheel knuckle bolt	275	203	-

Rear Suspension

The rear suspension consists of the following components:

- Lower control arms
- Shock absorber and spring assemblies
- Stabilizer bar
- Stabilizer bar bushings and brackets
- Stabilizer bar links
- Toe links
- Trailing arms
- Upper control arms (camber adjustment)
- Wheel bearings
- Wheel hubs
- Wheel knuckles
- Wheel studs

The rear suspension utilizes an independent short/long arm design. This suspension system incorporates a separate wheel knuckle for each wheel and allows the wheels to react to road imperfections independent of each other. This independent action offers improved isolation from the effects of jounce and rebound.

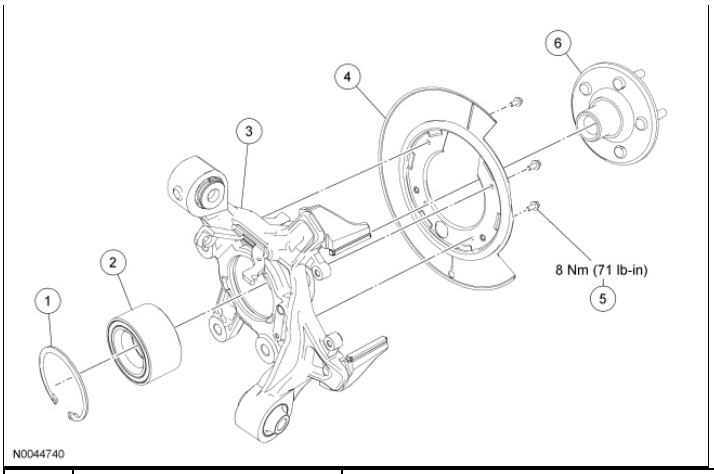
Rear Suspension

Refer to Section 204-00 .

Wheel Bearing and Wheel Hub

Special Tool(s)

 ST1895-A	Puller, Bearing 205-D064 (D84L-1123-A) or equivalent



Item	Part Number	Description
1	1A124	Snap ring
2	1215	Wheel bearing
3	5B759 LH/ 5B758 RH	Wheel knuckle assembly
4	2C029 LH/ 2C028 RH	Brake disc shield
5	W500212	Brake disc shield bolt (3 required) (part of 2C028)
6	1109	Wheel hub

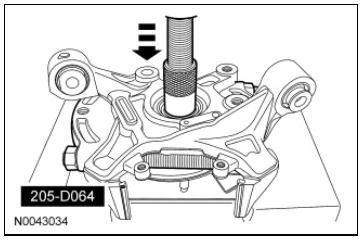
Removal and Installation

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.

2. Remove the 3 brake disc shield bolts.
   - To install, tighten to 8 Nm (71 lb-in).

3. Using the Bearing Puller and a suitable press, remove the wheel hub.



4. Remove the snap ring.

5. Using a suitable press and adapters, remove the wheel bearing.

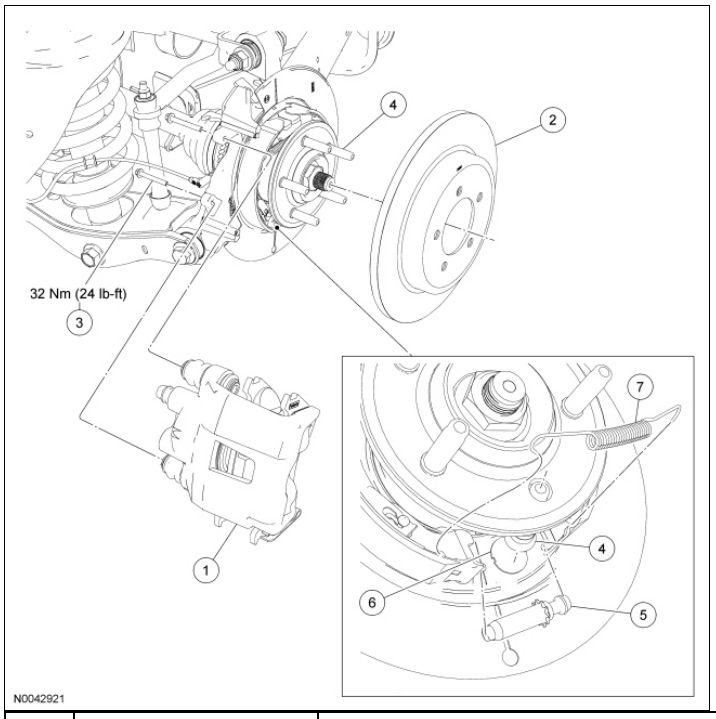
6. To install, reverse the removal procedure.

7. Install the wheel knuckle. For additional information, refer to Wheel Knuckle in this section.

Wheel Studs

Special Tool(s)

 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	2553 LH/ 2552 RH	Brake caliper
2	2C026	Brake disc
3	2333	Brake caliper bolt (2 required)
4	1107	Wheel stud
5	2041	Parking brake shoe adjuster
6	-	Brake disc shield access hole cover
7	-	Parking brake shoe adjuster spring (part of 2648)

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed, or incorrect clamp load and component damage may occur.**

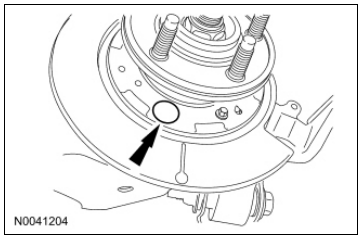
1. Remove the wheel and tire. For additional information, refer to Section 204-04 .
2. ***NOTICE:*** **Care must be used when servicing rear brake components without disconnecting the parking brake cable from the brake caliper lever. Carefully position the caliper aside using a suitable support or damage to the parking brake cable end fittings can occur.**

   NOTICE: **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the bolts and position the brake caliper aside.

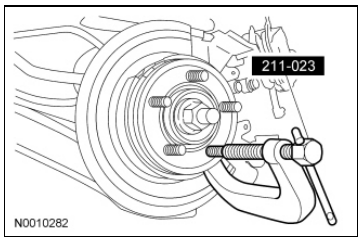
   - Support the caliper using mechanic's wire.
3. Remove the brake disc.
4. Remove the parking brake shoe adjuster spring and adjuster.
5. **NOTE:** The brake shield has an access hole knockout that must be removed to allow for the removal of the wheel stud.

   Using a suitable punch, remove the access hole cover from the brake shield.



6. **NOTE:** Make sure that the wheel stud is aligned with the recessed area of the wheel knuckle.

   Using the C-Frame and Screw, press the wheel stud until it makes contact with the edge of the wheel knuckle.



7. Route the wheel stud through the access hole and discard the wheel stud.

Installation

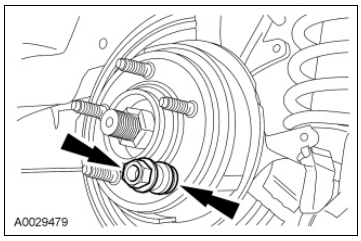
1. Position the new wheel stud aligning the serrations in the wheel hub made by the original wheel stud.
2. ***NOTICE:*** **Do not use power tools to install the wheel stud. The serrations on the stud can be stripped.**

NOTE: Do not use the wheel nut that came with the vehicle.

NOTE: Make sure to use washers that have an ID that is larger than the OD of the wheel stud serrations. Use enough washers (approximately 4) to allow the wheel stud to fully seat against the hub flange.

Place approximately 4 flat washers over the outside end of the wheel stud and thread a standard wheel nut with the flat side against the washers. Tighten the wheel nut until the wheel stud seats against the back side of the wheel extension.

- Discard the wheel nut and washers.



3. ***NOTICE:*** **A plug must be installed in place of the knockout to prevent contamination to the parking brake shoe assemblies.**

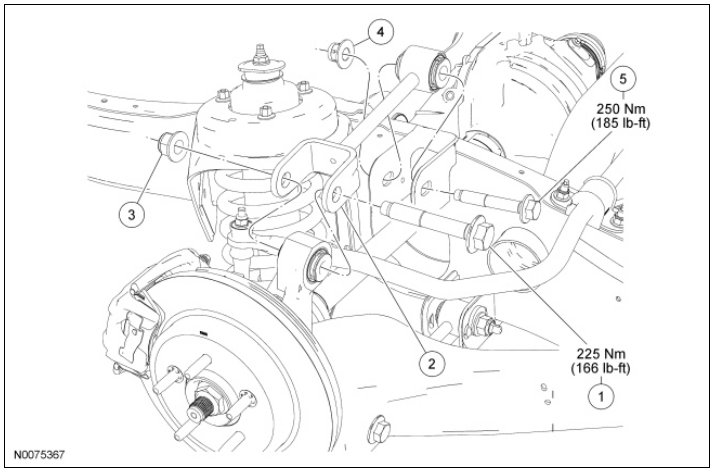
   Install a plug into the access hole on the brake shield.

4. Install the parking brake shoe adjuster and spring.

5. Install the brake disc.

6. Position the brake caliper and install the bolts.
   - Tighten to 32 Nm (24 lb-ft).

Upper Arm



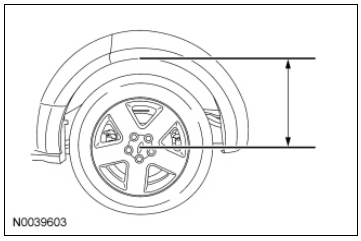
Item	Part Number	Description
1	W711444	Upper arm outboard bolt
2	5A994	Upper arm
3	W520216	Upper arm outboard nut
4	W707254	Upper arm inboard nut
5	W711444	Upper arm inboard bolt

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed, or incorrect clamp load and component damage may occur.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. Position a suitable jack under the wheel knuckle and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1.

4. Remove and discard the upper arm outboard nut and bolt.

5. **NOTE:** The inboard nut that is installed at the assembly plant is a flagnut. This flagnut is used to set and maintain the rear camber settings. Discard the flagnut and install a non-flagnut to allow the rear camber to be adjusted.

   Remove and discard the upper arm inboard bolt and flagnut and remove the upper arm.

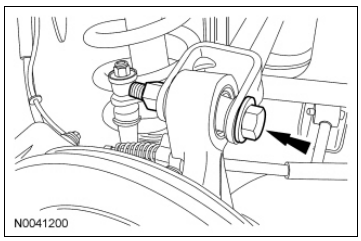
Installation

1. Position the upper arm and install a new inboard bolt and non-flagnut.
   - Tighten to 250 Nm (185 lb-ft).

2. ***NOTICE:*** **The upper arm outboard bolt must be installed with the bolt head toward the front of the vehicle or wheel damage can occur.**

   Install a new outboard bolt and nut with the bolt head toward the front of the vehicle.

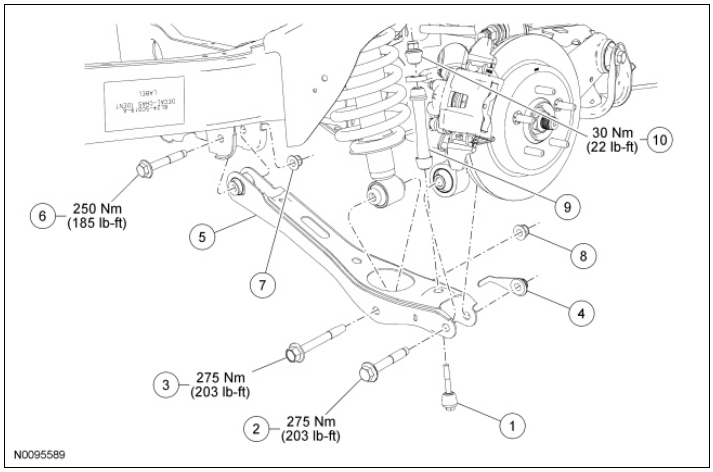
   - Tighten to 225 Nm (166 lb-ft).



3. Lower the suspension and remove the jack.

4. Check and, if necessary, align the rear end. For additional information, refer to Section 204-00 .

Lower Arm



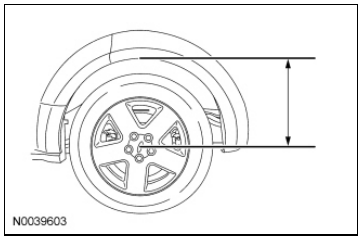
Item	Part Number	Description
1	-	Stabilizer bar link stud (part of 5K484)
2	W711444	Lower arm outboard bolt
3	W711608	Shock absorber lower bolt
4	W712412	Lower arm outboard flagnut
5	5B530	Lower arm
6	W711444	Lower arm inboard bolt
7	W520216	Lower arm inboard nut
8	W520216	Shock absorber lower nut
9	5K484	Stabilizer bar link assembly
10	5C491	Stabilizer bar link nut and grommet

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed, or incorrect clamp load and component damage may occur.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. Position a suitable jack under the wheel knuckle and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1.

4. Remove and discard the lower arm outboard bolt and flagnut.

5. Remove the stabilizer bar link nut and grommet and the stabilizer bar link.
   - Discard the nut and grommet.

6. Lower the suspension and remove the jack.

7. Remove and discard the shock absorber lower nut and bolt.

8. Remove and discard the lower arm inboard nut and bolt and remove the lower arm.

Installation

1. **NOTE:** Do not tighten the lower arm inboard nut at this time.

   Position the lower arm and install a new lower arm inboard bolt and nut.

2. **NOTE:** Do not tighten the shock absorber lower nut at this time.

   Position the lower arm and install a new shock absorber lower bolt and nut.

3. Position a suitable jack under the wheel knuckle and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1.

4. Install the stabilizer link and a new nut and grommet.
   - Tighten to 30 Nm (22 lb-ft).

5. Install a new lower arm outboard bolt and flagnut.
   - Tighten the bolt to 275 Nm (203 lb-ft).

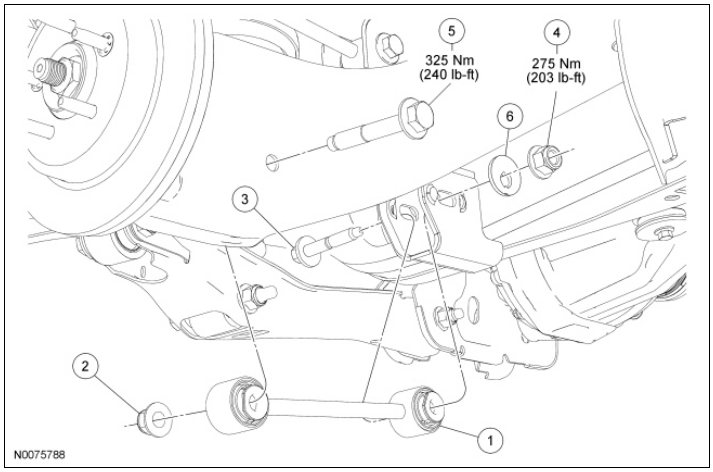
6. Tighten the lower arm inboard bolt to 250 Nm (185 lb-ft).

7. Tighten the shock absorber lower bolt to 275 Nm (203 lb-ft).

8. Lower the suspension and remove the jack.

9. Install the wheel and tire. For additional information, refer to Section 204-04 .

Toe Link



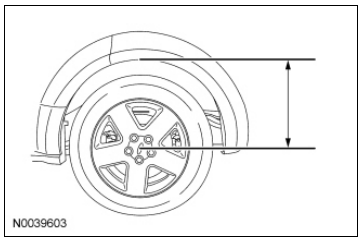
Item	Part Number	Description
1	5A972	Toe link
2	W520216	Toe link outboard nut
3	5K978	Cam bolt
4	W707254	Cam adjuster nut
5	W711444	Toe link outboard bolt
6	5K751	Adjustment cam

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed or incorrect clamp load and component damage may occur.**

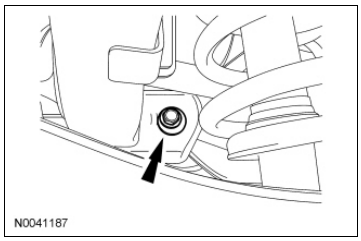
1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. Position a suitable jack under the wheel knuckle and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1.

4. Index-mark the toe link cam bolt to the subframe.



5. Remove the toe link cam adjuster nut, cam adjuster and cam bolt.
   - Discard the nut.

6. Remove and discard the toe link outboard nut and bolt and remove the toe link.

Installation

1. Position the toe link and install a new outboard bolt and nut.
   - Tighten to 325 Nm (240 lb-ft).

2. **NOTE:** Do not tighten the cam adjuster nut at this time.

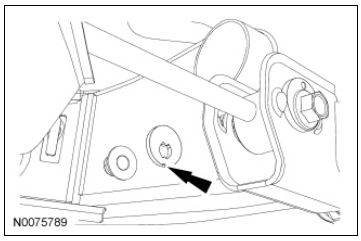
   NOTE: The cam adjuster must be installed with the small tooth facing toward the frame bracket.

   Install the toe link cam bolt, cam adjuster and a new nut.

3. **NOTE:** Make sure the cam bolt and the adjustment cam are seated between the offsets before tightening the nut.

   Align the index mark on the cam bolt with the index mark on the subframe and tighten the nut.

   - Tighten to 275 Nm (203 lb-ft).

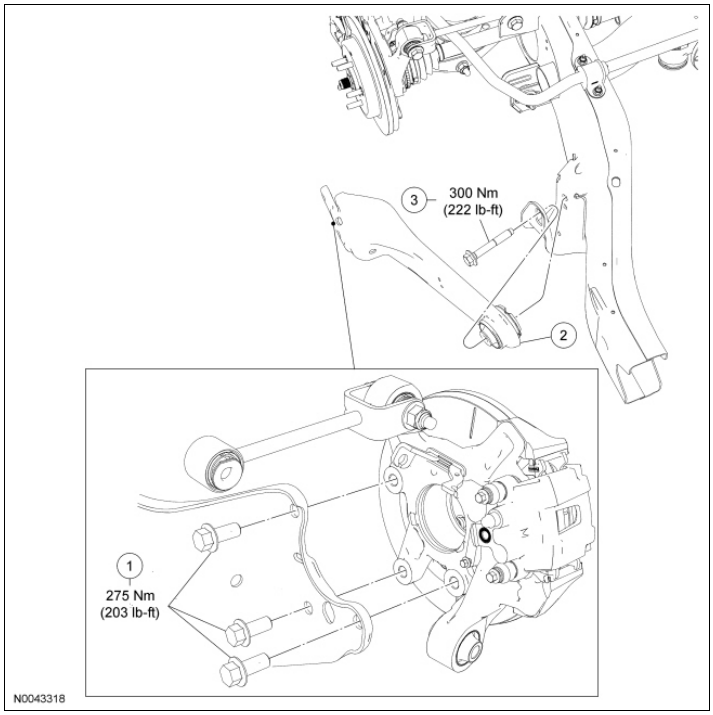


4. Lower the suspension and remove the jack.

5. Install the wheel and tire. For additional information, refer to Section 204-04 .

6. Check and, if necessary, adjust the rear toe. For additional information, refer to Section 204-00 .

Trailing Arm



Item	Part Number	Description
1	W710678	Wheel knuckle bolts (3 required)
2	5B731 LH/ 5B730 RH	Trailing arm
3	W711046	Trailing arm bolt

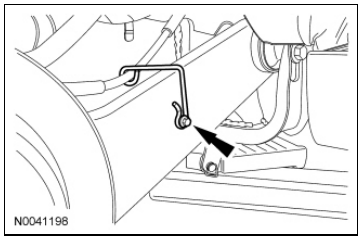
Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed or incorrect clamp load and damage to components may occur.**

1. Remove the toe link. For additional information, refer to Toe Link in this section.

2. Remove the parking brake cable bracket bolt.
   - To install, tighten to 10 Nm (89 lb-in).

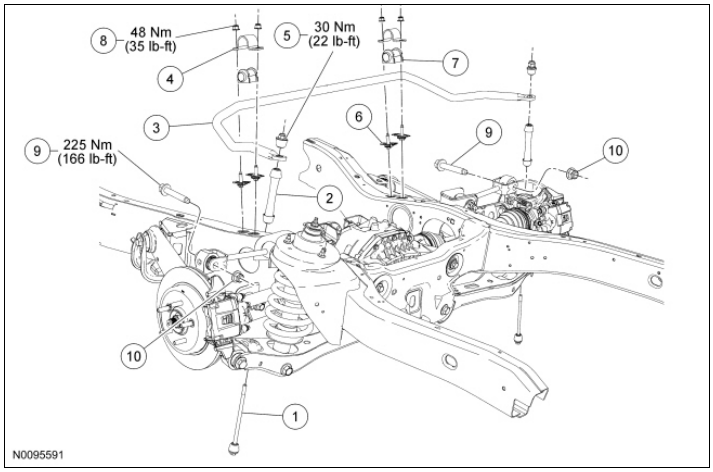


3. Remove and discard the trailing arm bolt.
    - To install, tighten the new bolt to 300 Nm (222 lb-ft) at curb height.

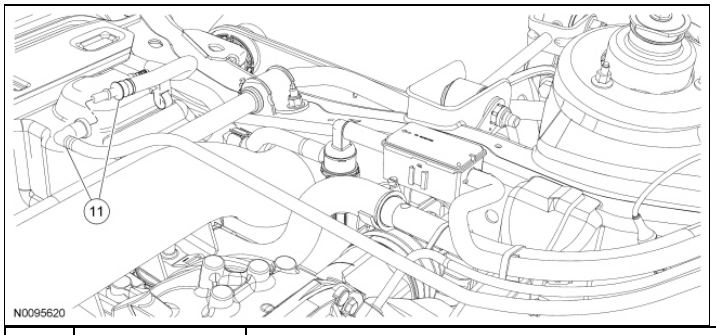
4. Remove the 3 wheel knuckle bolts and the trailing arm.
    - Discard the bolts.
    - To install, tighten the new bolts to 275 Nm (203 lb-ft).

5. To install, reverse the removal procedure.

Stabilizer Bar and Link - Explorer, Mountaineer



Item	Part Number	Description
1	-	Stabilizer bar link stud (2 required) (part of 5K484)
2	5K484	Stabilizer bar link assembly (2 required)
3	5A772	Stabilizer bar
4	5B491	Stabilizer bar bracket (2 required)
5	5C491	Stabilizer bar link nut and grommet (2 required) (part of 5K484)
6	W711295	Stabilizer bar bracket stud (4 required)
7	4A037	Stabilizer bar bushing (2 required)
8	W520213	Stabilizer bar bracket nut (4 required)
9	W711444	Upper arm outboard bolts
10	W520216	Upper arm outboard nuts



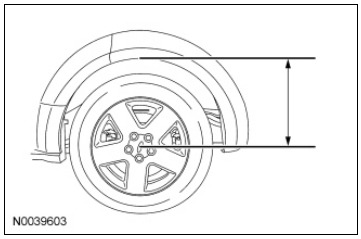
Item	Part Number	Description
11	-	Fuel filler pipe tube-to-fuel pressure sensor line (part of 9034)

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

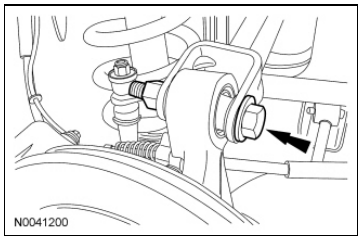
NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed or incorrect clamp load and damage to components may occur.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. Remove and discard the outboard nut and bolt from both upper arms.

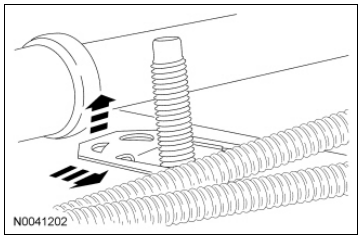


4. Remove the stabilizer bar link nut and grommet and the stabilizer bar link.
   - Discard the nut and grommet.

5. Remove and discard the 4 stabilizer bar bracket nuts.

6. Remove the 2 stabilizer bar brackets and the 2 stabilizer bar bushings.

7. Remove the 4 stabilizer bar bracket studs.
   - For the front studs, push the stud down and slide the stud toward the rear of the vehicle.
   - For the rear studs, push the stud down and slide the stud toward the front of the vehicle.

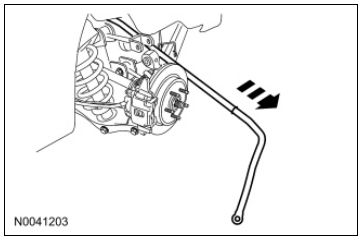


8. Disconnect the fuel filler pipe tube-to-fuel pressure sensor line quick connect coupling.

9. Unclip the fuel filler pipe tube-to-fuel pressure sensor line from the fuel tank and position aside.

10. ***NOTICE:*** **Extreme care must be exercised when removing and installing the stabilizer bar on vehicles equipped with rear Air Conditioning (A/C) and/or rear heating or damage to the A/C lines and rear heater hoses can occur.**

    With the aid of an assistant, remove the stabilizer bar from the LH side of the vehicle.



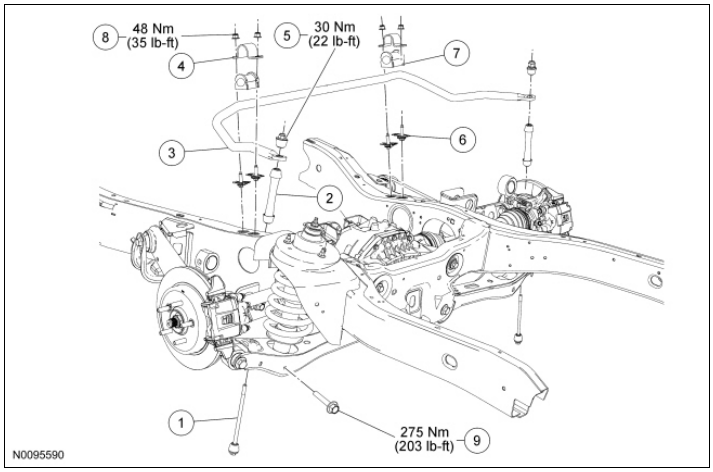
Installation

1. With the aid of an assistant, install the stabilizer bar into the LH side of the vehicle.
2. Connect the fuel filler pipe tube-to-fuel sensor line.
3. Connect the fuel filler pipe tube-to-fuel pressure sensor line quick connect coupling.
4. Install the 4 stabilizer bar bracket studs.
5. Install the 2 stabilizer bar bushings and the 2 stabilizer bar brackets.
6. Install the 4 new stabilizer bar bracket nuts.
   - Tighten to 48 Nm (35 lb-ft).
7. Using the jack, raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 (curb height) in Removal.
8. Install the stabilizer bar link and new link nut and grommet.
   - Tighten the nut to 30 Nm (22 lb-ft).
9. ***NOTICE:*** **The upper arm outboard bolts must be installed with the bolt head toward the front of the vehicle or wheel damage may occur.**

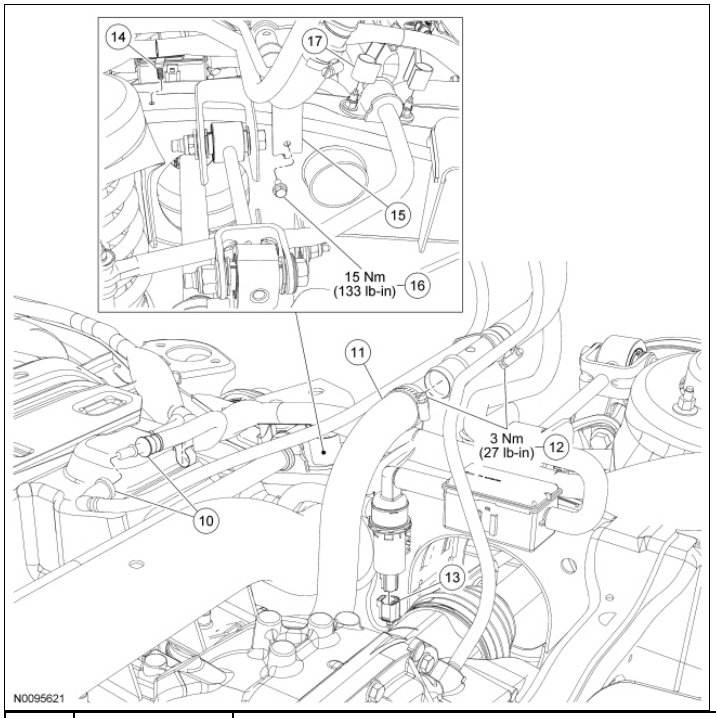
   Install the 2 new upper arm outboard bolts and the 2 new upper arm outboard nuts.

   - Tighten to 225 Nm (166 lb-ft).
10. Remove the jack.
11. Install the wheel and tire. For additional information, refer to Section 204-04 .

Stabilizer Bar and Link - Explorer Sport Trac



Item	Part Number	Description
1	-	Stabilizer bar link stud (2 required) (part of 5K484)
2	5K484	Stabilizer bar link assembly (2 required)
3	5A772	Stabilizer bar
4	5B491	Stabilizer bar bracket (2 required)
5	5C491	Stabilizer bar link nut and grommet (2 required) (part of 5K484)
6	W711295	Stabilizer bar bracket stud (4 required)
7	4A037	Stabilizer bar bushing (2 required)
8	W520213	Stabilizer bar bracket nut (4 required)
9	W711608	Shock absorber lower bolt



Item	Part Number	Description
10	-	Fuel filler pipe tube-to-fuel pressure sensor line (part of 9034)
11	9037	Fuel filler pipe hose
12	-	Fuel filler pipe hose clamps (2 required)
13	-	Evaporative Emission (EVAP) canister vent valve electrical connector (part of 14407)
14	-	Wiring harness clip (part of 9034)
15	-	Fuel tank filler pipe bracket (part of 14407)
16	W704901	Fuel tank filler pipe bracket bolt
17	-	Wiring harness retainer caps (part of 14407)

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed or incorrect clamp load and damage to components may occur.**

1. Remove both upper arms. For additional information, refer to Upper Arm in this section.

2. **NOTE:** Removal of the LH shock absorber lower bolt will allow more movement of the wheel knuckle when installing the stabilizer bar.

   Remove the LH shock absorber lower bolt.

3. Disconnect the Evaporative Emission (EVAP) canister vent valve electrical connector.

4. Unclip the wiring harness from the frame.

5. Remove the fuel tank filler pipe bracket bolt.

6. Loosen the fuel tank filler pipe hose clamps and disconnect the hose.

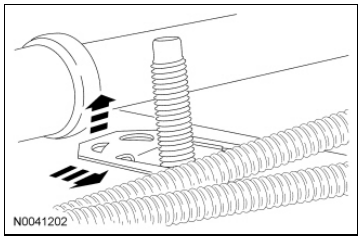
7. Remove the stabilizer bar link nut and grommet and the stabilizer bar link.
   - Discard the nut and grommet.

8. Remove the wiring harness retainer caps from the stabilizer bar bracket studs.

9. Remove and discard the 4 stabilizer bar bracket nuts.

10. Remove the 2 stabilizer bar brackets and the 2 stabilizer bar bushings.

11. Remove the 4 stabilizer bar bracket studs.
    - For the front studs, push the stud down and slide the stud toward the rear of the vehicle.
    - For the rear studs, push the stud down and slide the stud toward the front of the vehicle.



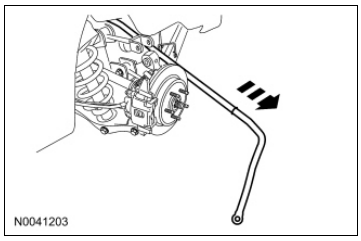
12. Disconnect the fuel filler pipe tube-to-fuel pressure sensor line quick connect coupling.

13. Unclip the fuel filler pipe tube-to-fuel pressure sensor line from the fuel tank and position aside.

14. ***NOTICE:*** **When removing the stabilizer bar, care must be taken to avoid damage to the wiring harness, fuel lines, fuel filler tube and body.**

    NOTICE: **Extreme care must be exercised when removing and installing the stabilizer bar on vehicles equipped with rear Air Conditioning (A/C) and/or rear heating, or damage to the A/C lines and rear heater hoses can occur.**

    With the aid of an assistant, remove the stabilizer bar from the LH side of the vehicle.



Installation

NOTICE: **When installing the stabilizer bar, care must be taken to avoid damage to the wiring harness, fuel lines, fuel filler tube and body.**

NOTICE: **Extreme care must be exercised when removing and installing the stabilizer bar on vehicles equipped with rear Air Conditioning (A/C) and/or rear heating, or damage to the A/C lines and rear**

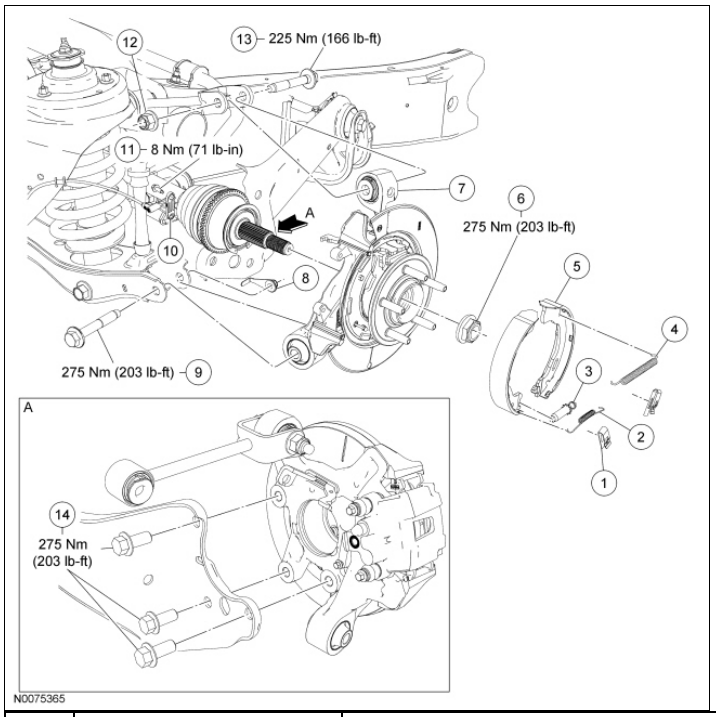
heater hose may occur.

1. With the aid of an assistant, install the stabilizer bar into the LH side of the vehicle.
2. Connect the fuel filler pipe tube-to-fuel sensor line.
3. Connect the fuel filler pipe tube-to-fuel pressure sensor line quick connect coupling.
4. Install the 4 stabilizer bar bracket studs.
5. Install the 2 stabilizer bar bushings and the 2 stabilizer bar brackets.
6. Install the 4 new stabilizer bar bracket nuts.
   - Tighten to 48 Nm (35 lb-ft).
7. Install the wiring harness retaining caps onto the stabilizer bar studs.
8. Use the jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1 of the Upper Arm procedure in this section.
9. Install the stabilizer bar link, the new link nut and the grommet.
   - Tighten to 30 Nm (22 lb-ft).
10. Connect the fuel tank filler hose.
    - Tighten the 2 filler pipe hose clamps to 3 Nm (27 lb-in).
11. Install the fuel tank filler pipe bracket bolt.
    - Tighten to 15 Nm (133 lb-in).
12. Connect the wiring harness clip to the frame.
13. Connect the EVAP canister vent electrical connector.
14. Install the new LH shock absorber lower bolt.
    - Tighten to 275 Nm (203 lb-ft).
15. Install both upper arms. For additional information, refer to Upper Arm in this section.

Wheel Knuckle

Special Tool(s)

 ST2272-A	Remover, Front Wheel Hub 205-D070 (D93P-1175-B) or equivalent



Item	Part Number	Description
1	-	Parking brake shoe clip (2 required) (part of 2648)
2	-	Parking brake shoe adjuster spring (part of 2648)
3	2041	Parking brake shoe adjuster
4	-	Parking brake shoe retracting spring (part of 2648)
5	-	Parking brake shoe (2 required) (part of 2648)
6	N808405	Halfshaft nut
7	5B758 LH/ 5B759 RH	Wheel knuckle
8	W710808	Lower arm outboard flagnut
9	W712412	Lower arm outboard bolt
10	2C024	Wheel speed sensor
11	-	Wheel speed sensor bolt (part of 2C024)

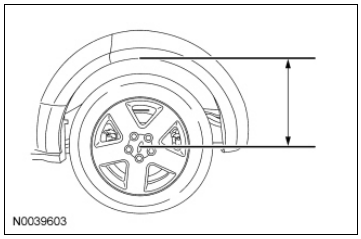
12	W520216	Upper arm outboard nut
13	W711444	Upper arm outboard bolt
14	W710678	Wheel knuckle bolts (3 required)

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

NOTICE: **Orientation of the suspension fasteners is important. Make sure the fasteners are installed in the same direction as they were in when removed or incorrect clamp load and damage to components may occur.**

1. Measure the distance from the center of the hub to the lip of the fender with the vehicle in a level, static ground position (curb height).



2. If equipped, remove the wheel speed sensor bolt and position the sensor aside.

3. ***NOTICE:*** **Do not loosen the halfshaft nut and washer until the wheel and tire are removed from the vehicle. Wheel bearing damage will occur if the wheel bearing is unloaded with the weight of the vehicle applied.**

   NOTE: Apply the brake to keep the halfshaft from rotating.

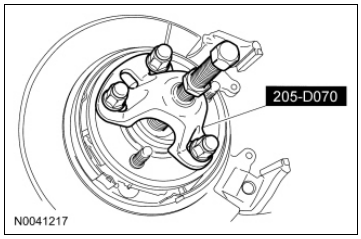
   NOTE: Do not discard the halfshaft nut at this time.

   Remove the halfshaft nut.

4. Remove the parking brake shoes. For additional information, refer to Section 206-05 .

5. ***NOTICE:*** **Do not use a hammer to separate the halfshaft from the hub. Damage to the threads and internal Constant Velocity (CV) joint components may result.**

   Using the Front Wheel Hub Remover, press the halfshaft from the hub.



6. Position a suitable jack under the wheel knuckle and raise the suspension until the distance between the center of the hub and the lip of the fender is equal to the measurement taken in Step 1.

7. Remove and discard the toe link outboard nut and bolt.

8. Remove and discard the upper arm outboard nut and bolt.

9. Remove and discard the lower arm outboard nut and bolt.

10. Remove and discard the 3 wheel knuckle bolts and remove the wheel knuckle.

11. If a new wheel knuckle is being installed, remove the wheel bearing and wheel hub. For additional information, refer to Wheel Bearing and Wheel Hub in this section.

Installation

1. Position the wheel knuckle and install 3 new wheel knuckle bolts.
   - Tighten to 275 Nm (203 lb-ft).

2. Install a new lower arm outboard bolt and flagnut.
   - Tighten the nut to 275 Nm (203 lb-ft).

3. ***NOTICE:*** **The upper arm outboard bolt must be installed with the bolt head toward the front of the vehicle or wheel damage may occur.**

   Install a new upper arm outboard bolt and nut with the bolt head toward the front of the vehicle.

   - Tighten to 225 Nm (166 lb-ft).

4. Position the toe link and install a new toe link outboard bolt and nut.
   - Tighten to 325 Nm (240 lb-ft).

5. Lower the suspension and remove the jack.

6. Install the parking brake shoes. For additional information, refer to Section 206-05 .

7. Position the wheel speed sensor and install the bolt.
   - Tighten to 8 Nm (71 lb-in).

8. ***NOTICE:*** **Do not tighten the rear halfshaft nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered to the ground. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.**

   NOTE: Apply the brake to keep the halfshaft from rotating.

   Position the halfshaft in the hub and use the previously removed halfshaft nut to seat the halfshaft.

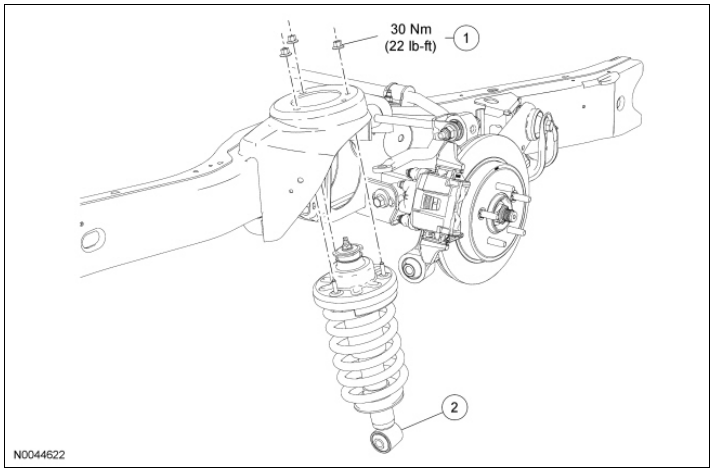
   - Tighten to 275 Nm (203 lb-ft).
   - Remove and discard the nut.

9. ***NOTICE:*** **Install and tighten the new halfshaft nut to specification within 5 minutes of starting it on the threads. Always install a new halfshaft nut after loosening or when not tightening within the specified time or damage to the components may occur.**

   Install a new halfshaft nut.

   - Tighten to 275 Nm (203 lb-ft).

Shock Absorber and Spring Assembly



Item	Part Number	Description
1	W704790	Shock absorber upper mount nut (3 required)
2	18W002	Shock absorber and spring assembly

Removal

NOTICE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

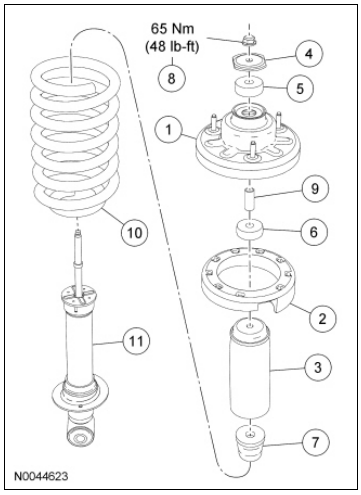
1. Remove the lower arm. For additional information, refer to Lower Arm in this section.

2. Remove and discard the 3 shock absorber upper mount nuts and remove the shock absorber and spring assembly.
   - To install, tighten the new nuts to 30 Nm (22 lb-ft).

3. For additional information on the disassembly and assembly of the shock absorber and spring assembly, refer to Shock Absorber and Spring Assembly in this section.

4. To install, reverse the removal procedure.

Shock Absorber and Spring Assembly

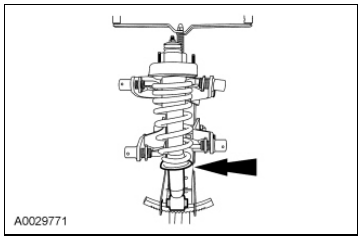


Item	Part Number	Description
1	18178	Shock absorber upper mount
2	5536	Spring upper seat
3	-	Dust boot (part of 18125)
4	-	Upper washer (part of 18A103)
5	-	Mount upper bushing (part of 18A103)
6	-	Mount lower bushing (part of 18A103)
7	-	Jounce bumper (part of 18125)
8	-	Shock absorber rod nut
9	-	Crush sleeve (part of 18A103)
10	5560	Coil spring
11	18125	Shock absorber

Disassembly and Assembly

1. Remove the shock absorber and spring assembly. For additional information, refer to Shock Absorber and Spring Assembly in this section.

2. Using a suitable spring compressor, compress the spring until the tension is released from the shock absorber.

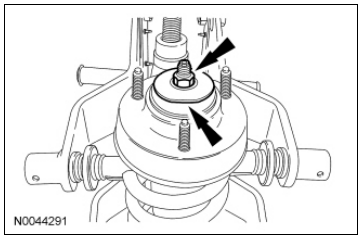


3. ***NOTICE:*** **When installing the shock rod nut, make sure the shock rod and bushing are centered in the upper mount before tightening the nut or damage to the shock bushing may occur.**

NOTE: Use the hex-holding feature to prevent the shock absorber rod from turning while removing and installing the nut.

Remove and discard the shock absorber rod nut.

- To install, tighten the new nut to 65 Nm (48 lb-ft).



4. Remove the shock absorber.

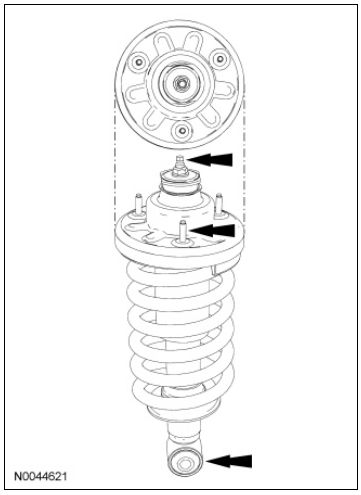
5. Remove the shock absorber upper mount.

6. Remove the upper mount bushing.

7. Carefully release the spring compressor and remove the coil spring.

8. **NOTE:** Make sure the upper shock mount stud, shock rod and shock lower bushing are aligned before tightening the shock rod nut.

   To assemble, reverse the disassembly procedure.



Material

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2	-	-
Motorcraft® Wheel and Tire Cleaner ZC-37-A	-	-

General Specifications

Item	Specification
Tire Inflation	
Tires	See safety certification sticker located on driver door jamb.
Wheel Weights	
Wheel weight type	Use a wheel weight manufacturer's rim gauge to determine the correct wheel weight application

Torque Specifications

Description	Nm	lb-in
Sensor band (worm gear)	3	27
Wheel nuts [a]	-	-

[a] Refer to the procedure in this section.

Wheels And Tires

Safety Precautions

⚠ WARNING: Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.

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

⚠ WARNING: Before servicing any tire, ask the customer if anyone injected a tire sealant into the tire. Tire sealants may be flammable and can burn or explode if exposed to an ignition source. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Replacement wheels must be equivalent to the original equipment wheels in:

- load carrying capacity.
- diameter, width and offset.
- pilot hole and bolt circle.

Combined load carrying capacity of replacement wheels for a given axle, must be equal to or greater than that axle's gross axle weight rating (GAWR) identified on the vehicle's Safety Compliance Certification label. All other specifications should be evaluated by measurement of both the original wheel and the replacement wheel. If specifications are not equivalent, the safety and handling of the vehicle may be degraded, which may result in serious injury to the vehicle occupant(s).

⚠ WARNING: Never use wheels different than the original equipment. Additionally, never use wheel nuts different than the original equipment. Failure to follow these instructions may result in damage to the wheel or mounting system. This damage could cause the wheel to come off while the vehicle is being driven, which could result in serious personal injury or death to vehicle occupant(s).

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

⚠ WARNING: Keep eyes away from valve stem when deflating tires. Reduce air pressure in tire as much as possible by pushing in valve core plunger prior to removing the core. Escaping air can carry particles that can injure the eyes. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Only use replacement tires that are the same size, load index, speed rating and type (such as P-metric versus LT-metric or all-season versus all-terrain) as those originally provided by Ford. The recommended tire and wheel size may be found on either the Safety Compliance Certification Label or the Tire Label, which is located on the B-pillar or edge of the driver's door. If the information is not found on these labels, consult a Ford dealer. Use of any tire or wheel not recommended by Ford can affect the safety and performance of the vehicle, which could result in an increased risk of loss of vehicle control, vehicle rollover, personal injury and death. Additionally, the use of non-recommended tires and wheels could cause steering, suspension, axle or transfer case/power

transfer unit failure.

NOTICE: **Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents or damage to the wheel finish may occur. Use Wheel and Tire Cleaner ZC-27-A or -B or equivalent.**

Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

To equalize tire wear, the tires should be rotated at recommended intervals.

Tire Pressure Monitoring System (TPMS)

NOTE: The Smart Junction Box (SJB) is also identified as the Generic Electronic Module (GEM).

The Tire Pressure Monitoring System (TPMS) includes:

- the SJB , TPMS functionality is integrated within the SJB .
- four tire pressure sensors.
- four tire pressure sensor cradles.
- four tire pressure sensor straps.
- an Instrument Cluster (IC) indicator.
- a message center (if equipped).

Tire Pressure Monitoring System (TPMS) Module

The SJB contains the TPMS functionality. Refer to Tire Pressure Monitoring System in Diagnosis and Testing for TPMS fault diagnosis and repair.

The SJB compares the information of each tire pressure sensor transmission against a pressure limit. If the SJB determines that the tire pressure has fallen below the low limit, the SJB communicates this to the IC on the vehicle communication bus.

Tire Pressure Monitoring System (TPMS) Pressure Sensor

The SJB monitors the air pressure in the 4 road tires with tire pressure sensors. The sensors transmit radio frequency signals to the SJB approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph).

The tire pressure sensors are battery operated and are mounted to metal brackets (called cradles) on the wheels inside the tires. The sensors are mounted 180 degrees from the valve stem.

The tire pressure sensor can be serviced separately from the cradle and the strap.

Tire Pressure Monitoring System (TPMS) Pressure Sensor Cradle

The tire pressure sensor cradles are mounted to the wheels with metal straps and have an adhesive strip to aid in their retention to the wheel.

The sensor cradle is available with the strap in a kit. To service the sensor cradle, the strap must be removed and discarded.

Tire Pressure Monitoring System (TPMS) Pressure Sensor Strap

The sensor strap keeps the sensor and the cradle retained to the wheel. A factory-installed strap is joined together with a one-time-use buckle and a dealer-installed strap is joined together with a worm gear (similar to a radiator hose clamp). Both straps should be discarded after removal and should not be reused.

The cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter.

Instrument Cluster (IC) and Message Center

The IC illuminates the TPMS indicator when it receives a message from the SJB to do so and displays the appropriate message(s) in the message center (if equipped).

The IC and message center are diagnosed and serviced in their own respective workshop manual sections. Refer to the appropriate section in Group 413 for the procedure.

Wheels And Tires

Special Tool(s)

 ST2869-A	Digital Tire Pressure Gauge 204-354
 ST3058-A	Hunter Road Force® Wheel Balancer GSP9700 Series

Inspection and Verification

⚠ WARNING: Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.

Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, GO to Symptom Chart - NVH .

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which may indicate a need for balancing, rotation or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

Replacement tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.
- tire construction type.

The use of any other tire/wheel size, load range or type can seriously affect:

- ride.
- handling.
- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.
- wheel bearing life.
- braking performance.

New wheels need to be installed when the vehicle wheels:

- are bent.
- are cracked.
- are dented.

- are heavily corroded.
- are leaking.
- have elongated wheel hub bolt holes.
- have excessive lateral or radial runout.

It is mandatory to use only the tire sizes recommended on the tire label located on the driver door or door pillar attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect the tires for signs of uneven wear. Refer to the following descriptions to identify the type of wear and GO to Symptom Chart - Tire Wear for the appropriate repair action to be carried out.

2. Check the tires for:
   - cuts.
   - stone bruises.
   - abrasions.
   - blisters.
   - embedded objects.

3. Check the valve stems for:
   - cracks.
   - cuts.

Install a new valve stem when damage is found or anytime a new tire is installed.

4. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands become less than 2/32 inch.

Tire Wear

Tire wear is commonly defined as a loss of tread depth. Tire tread wear occurs due to friction with the contact surface (road/pavement). The tread should wear down uniformly all the way around the circumference of the tire and all the way across the tread face. When this does not occur, the tire may have abnormal/incorrect wear.

Normal Tire Wear

Normal tire wear is identified as even wear around and across the tread. Because there are many factors (driving style, road surfaces, type of vehicle, type of tire) that can affect tire wear, there is no absolute mileage expectation for a normal wear condition. A tire is considered worn-out when the tread has worn to the level of the tread-wear indicators.

Abnormal/Incorrect Tire Wear

Abnormal/incorrect tire wear is identified as tire wear that is not even around or across the tread and that creates performance-related issues.

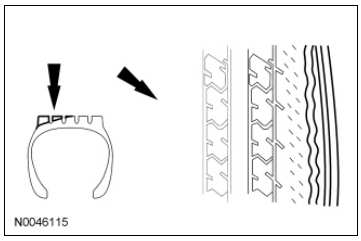
Abnormal/incorrect wear can be caused by numerous factors, some of which include driving style (aggressive, passive), climate (hot, cold), road conditions, vehicle loading and maintenance (correct tire pressure, rotation intervals and balance). It is important to determine the root cause of wear on a vehicle before carrying out repair. Tires exhibiting abnormal/incorrect tire wear may still be serviceable provided that the minimum tread depth is greater than 2/32 inch and the tire is not causing a vehicle performance (noise/vibration) concern.

Some abnormal/incorrect wear patterns look the same all the way around the tread of the tire, other wear patterns are not consistent and can occur in various spots on the tread area. The underlying causes of the 6 wear categories are different. Refer to the following descriptions to identify the type of wear and GO to Symptom Chart - Tire Wear for the appropriate repair action to be carried out.

Inner Edge/Shoulder Wear

Inner edge (or shoulder) wear occurs on the inside edge of the tire and is usually caused by excessive toe out and/or excessive negative camber. If the tread depth of the outer shoulder is at least 50% greater than the tread depth of the inner shoulder, the tire is experiencing inner edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, it may be necessary to measure the tread depth of each rib and compare it to that of the shoulder.

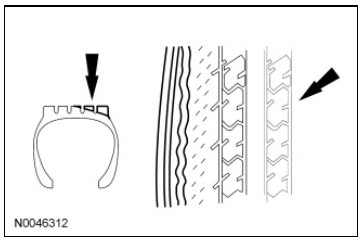
NOTE: RF tire shown, others similar.



Outer Edge/Shoulder Wear

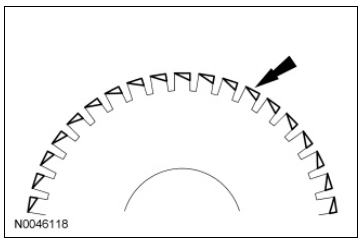
Outer edge (or shoulder) wear occurs on the outside edge of the tire and is usually caused by excessive toe in and/or excessive positive camber. If the tread depth of the inner shoulder is at least 50% greater than the tread depth of the outer shoulder, the tire is experiencing outer edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, it may be necessary to measure the tread depth of each rib and compare it to that of the shoulder.

NOTE: RF tire shown, others similar.



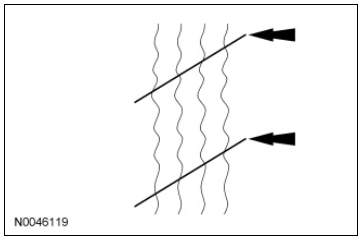
Heel/Toe Wear

Heel/toe wear (also known as feathering) occurs along the outside or inside edge/shoulder of the tire. To determine whether tires have this type of wear, visually inspect the tires in both the inside and outside shoulder ribs. In some instances, it may be necessary to measure the difference in tread depth of leading versus trailing edge of each lug in the inside and outside shoulder rib.



Diagonal Wear

Diagonal wear occurs diagonally across the tread area and around the circumference of the tire. To determine whether tires have this type of wear, visually inspect the tires to determine if the wear pattern runs diagonally across the tread and around the circumference of the tire. In some instances, the difference in tread depth along the diagonal wear pattern may need to be measured.



Symptom Chart - Tire Wear

Symptom Chart - Tire Wear
NOTE: For suspension system and additional alignment diagnosis, refer to Section 204-00 .

ConditionPossible SourcesAction

- Inner edge/shoulder wear
- Excessive toe out and/or negative camber
- GO to Pinpoint Test A .
- Incorrect wheel and tire assembly rotation intervals
- GO to Pinpoint Test A .
- High-speed cornering
- GO to Pinpoint Test A .
- Outer edge/shoulder wear
- Excessive toe in and/or positive camber
- GO to Pinpoint Test B .
- Incorrect wheel and tire assembly rotation intervals
- GO to Pinpoint Test B .
- High-speed cornering
- GO to Pinpoint Test B .
- Heel/toe wear

- Excessive toe in/out
- Incorrect wheel and tire assembly rotation intervals

- ROTATE the wheel and tire assemblies. CHECK the alignment, ADJUST as necessary.

- Diagonal wear

- Excessive toe in/out

- GO to Pinpoint Test C .

- Incorrect tire rotation intervals

- GO to Pinpoint Test C .

- Loose, worn or damaged suspension components

- REFER to Section 204-00 .

Symptom Chart - NVH

Symptom Chart - NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Wobble or shimmy

- Bent wheel

- INSTALL a new wheel as necessary.

- Damaged tire

- INSTALL a new tire as necessary.

- Loose wheel nuts

- TIGHTEN to specification.

- High-speed shake

- Tires/wheels

- REFER to Wheel and Tire Runout Component Tests in this section.

- Vehicle vibration

- Tires/wheels
- REFER to Wheel and Tire Runout Component Tests in this section.

Pinpoint Tests

For a description of the various tire wear patterns, refer to Inspection and Verification.

Pinpoint Test A: Inner Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:
- Excessive toe out
- Incorrect wheel and tire rotation

PINPOINT TEST A: INNER EDGE/SHOULDER WEAR

Test Step	Result / Action to Take
A1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the inside edge/shoulder tread depth. • **Is the tread depth greater than 2/32 inch?**	**Yes** ROTATE the wheel and tire assemblies. CHECK and ADJUST the toe to nominal +0.15 degrees (toe in). CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 .

Pinpoint Test B: Outer Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:
- Excessive toe in
- Incorrect wheel and tire rotation

PINPOINT TEST B: OUTER EDGE/SHOULDER WEAR

Test Step	Result / Action to Take
B1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the outside edge/shoulder tread depth.	**Yes** ROTATE the wheel and tire assemblies. CHECK and ADJUST the toe to nominal -0.15 degrees (toe

• **Is the tread depth greater than 2/32 inch?**	out). CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to Section 204-00 .

Pinpoint Test C: Diagonal Wear

This pinpoint test is intended to diagnose the following:

- Incorrect wheel and tire rotation
- Excessive toe in/out
- Incorrect tire inflation
- Loose, worn or damaged suspension components

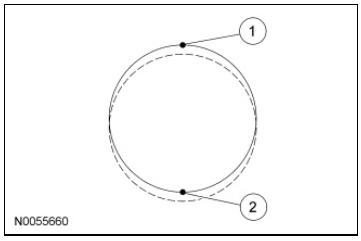
PINPOINT TEST C: DIAGONAL WEAR

Test Step	Result / Action to Take
C1 MEASURE THE TREAD DEPTH	
• Using a tread depth gauge or similar tool, measure the tread depth of the wear pattern. • **Is the tread depth greater than 2/32 inch?**	**Yes** If no performance concerns (noise/vibration) are present, the tire can remain in service. CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to Section 204-00 . **No** INSTALL a new tire(s). CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to Section 204-00 .

Component Tests

Radial Runout

Radial runout is the egg-shaped deviation from a perfect circle and is measured perpendicular to the circumference. On a wheel and tire assembly, this means measuring the center tire tread rib. The center rib is indicative of the condition of the tire as a whole. Total runout is the difference between the maximum-to-minimum gauge reading. The high spot is the location of maximum runout.



Item	Description
1	High spot
2	Low spot

Loaded Runout Measurement (Hunter Road Force® 9700 Series Wheel Balancer)

NOTE: Diagnosis of tire/wheel vibration should not be performed on tires with less than 320 km (200 mi). Some initial tire/wheel vibration issues (such as flat spotting) will correct themselves after the tires have been in service for 320 km (200 mi).

This procedure is intended to assist with the diagnosis of wheel and tire assembly runout and/or force variation issues.

The Hunter Road Force® 9700 Series Wheel Balancer measures the wheel and tire assembly's loaded runout and the tire's radial spring rate. The balancer then converts the runout into pounds of force (termed as Road Force®). Measuring loaded runout (Road Force®) is more effective than measuring unloaded runout using a dial indicator.

1. Using a tire crayon, record the vehicle position on the inward sidewall of all 4 tires.

2. Remove the wheel and tire assemblies. For additional information, refer to Wheel and Tire in this section.

3. **NOTE:** Use only the Digital Tire Pressure Gauge any time tire pressures are measured to be sure that accurate values are obtained.

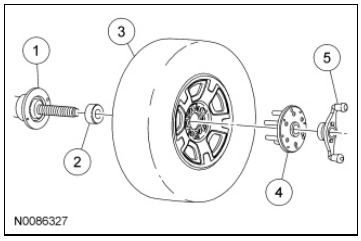
   Make sure that the tire pressures are set to the correct pressure as indicated on the Vehicle Certification (VC) label.

4. ***NOTICE:*** **Make sure that the correct wheel balancer adapters are used when mounting the assembly to the wheel balancer or damage to the wheel may occur.**

   NOTE: Make sure that the wheel and tire assembly is clean and free of foreign material prior to installation on the balancer.

   NOTE: The wheel balancer inflation station must be turned OFF for tires with inflation pressures of 414 kPa (60 psi) or above.

   Mount the wheel and tire assembly on a suitable wheel balancer using the correct wheel balancer adapters as shown. Refer to the list of recommended wheel balancer adapters on the PTS website.



Item	Description
1	Wheel balancer
2	Cone
3	Wheel and tire assembly
4	Finger plate
5	Balancer wing nut

5. Measure the Road Force®.
    - Temporarily mark the high spot and the Road Force® value on the sidewall of the tire. If the wheel and tire assembly Road Force® value is greater than 11 kg (25 lb), carry out the Match Mounting procedure to optimize the wheel and tire assembly.
    - If the wheel and tire assembly Road Force® value is 11 kg (25 lb) or less, permanently mark the high spot and the Road Force® value on the inward sidewall of the tire for reference during future wheel and tire service. Balance the assembly and install the wheel and tire on the vehicle using the Wheel-to-Hub Optimization procedure.

Runout Measurement (Dial Indicator)

NOTE: Diagnosis of tire/wheel vibration should not be performed on tires with less than 320 km (200 mi). Some initial tire/wheel vibration issues (such as flat spotting) will correct themselves after the tires have been in service for 320 km (200 mi).

NOTE: Loaded run-out measurements are the preferred method for verifying tire serviceability. While a dial indicator can be used to optimize the position of the tire on the wheel the unloaded run-out measurement cannot accurately determine if the tire should be removed from service.

The following procedures should be used if normal diagnostics leads to a potential runout issue.

Some vehicles may exhibit a wheel and tire vibration caused by excessive runout. Radial runout measurements can be taken using a dial indicator and should be measured with the wheel and tire assembly mounted on a suitable wheel balancer. The dial indicator should be mounted securely to eliminate gauge movement when measuring runout.

1. **NOTE:** Use only the Digital Tire Pressure Gauge any time tire pressures are measured to be sure that accurate values are obtained.

   Make sure that the tire pressures are set to the correct pressure as indicated on the VC label.

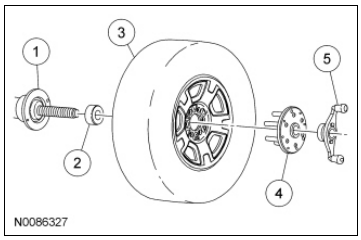
2. Using a tire crayon, record the vehicle position on the inward sidewall of all 4 tires.

3. Remove the wheel and tire assemblies. Refer to Wheel and Tire in this section.

4. *NOTICE:* **Make sure that the correct wheel balancer adapters are used when mounting the assembly to the wheel balancer or damage to the wheel may occur.**

   NOTE: Make sure that the wheel and tire assembly is clean and free of foreign material prior to installation on the balancer.

   Mount the wheel and tire assembly on a suitable wheel balancer using the correct wheel balancer adapters as shown. Refer to the list of recommended wheel balancer adapters on the PTS website.

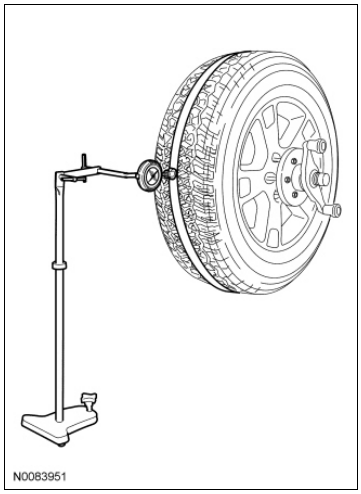


Item	Description
1	Wheel balancer
2	Cone
3	Wheel and tire assembly
4	Finger plate
5	Balancer wing nut

5. **NOTE:** Masking tape can be applied on the center tread rib to allow for a smoother measuring surface. Some fluctuation of the gauge reading is expected. Observe the overall sweep of the gauge from the highest to the lowest spot on the tire.

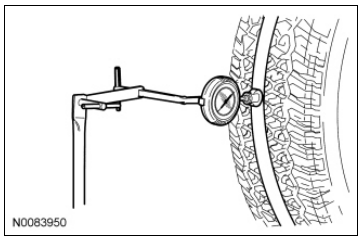
   Position the dial indicator and stand with the dial indicator on the center tread rib.

   - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
   - Adjust the runout gauge to read 0.
   - Rotate the wheel and tire assembly one complete revolution to make sure that the low spot has been found and that the dial indicator returns to a 0 reading.



6. While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the radial runout.

- Note the variance (runout) from 0 on the dial of the gauge.
- If the runout reading of a wheel and tire assembly is greater than 1.14 mm (0.045 in), locate and temporarily mark the high spot and runout reading on the sidewall of the tire and carry out the Match Mounting procedure to optimize the wheel and tire assembly.
- If the runout reading of a wheel and tire assembly is 1.14 mm (0.045 in) or less, permanently mark the high spot and the runout reading on the inward sidewall of the tire for reference during future wheel and tire service. Balance the assembly and install the wheel and tire on the vehicle using the Wheel-to-Hub Optimization procedure.

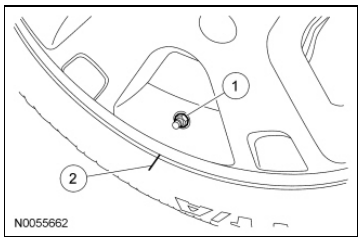


Match Mounting

NOTE: Road Force® values in illustrations are shown in pounds.

Match mounting is a technique used to reduce radial runout or road force on wheel and tire assemblies. Excessive runout is a source of ride quality complaints and match mounting can be used to minimize the runout. Match mounting can be accomplished by changing the position of the tire on the wheel.

1. Position the wheel and tire assembly on a tire machine and put a reference mark on the tire sidewall at the valve stem position.



Item	Description
1	Valve stem
2	Reference mark

2. ***NOTICE:*** **For tires equipped with a Tire Pressure Monitoring System (TPMS), the sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire from the wheel as instructed in the Disassembly and Assembly procedure. Failure to follow these instructions may result in TPMS component damage.**

   NOTE: Always make sure that the final high spot and measurement values are permanently marked on the inward sidewall of the tire for reference during future wheel and tire service.

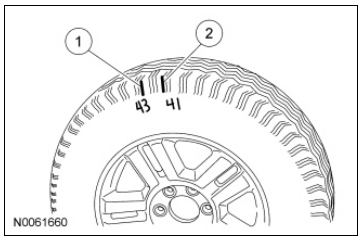
   Using a suitable tire machine, separate the tire beads from the wheel.

   - Lubricate the tire beads using a suitable fast drying, corrosion inhibiting tire bead lubricant.

- Position the tire 180 degrees (half-way around) on the rim so the valve stem reference mark is now opposite the valve stem.

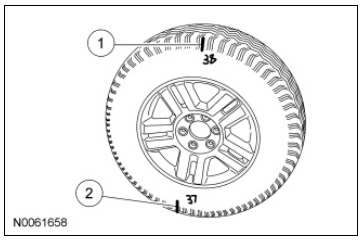
3. Re-inflate the wheel and tire assembly to the specified air pressure and measure the assembly again using the dial indicator or Hunter Road Force® 9700 Series Wheel Balancer. Mark the second high spot on the tire.
    - If the runout or Road Force® is reduced to within specifications, the concern has been resolved. Balance the assembly and install on the vehicle using the Wheel-to-Hub Optimization procedure.

4. If the second runout or Road Force® measurement is still not within specification and both high spots are close to each other (within 101.6 mm [4 in]), the root cause is probably the tire (the high spot followed the tire).
    - To be **SURE** that the tire is causing the high runout, it is necessary to have 2 runout or Road Force® measurements that are not within specification and the high spots must be in approximately the same location on the tire's sidewall. If the tire is the cause, install a new tire, balance the assembly and install on the vehicle using the Wheel-to-Hub Optimization procedure.
    - If the second high spot is not within 101.6 mm (4 in) of the first high spot, proceed to the next step.



Item	Description
1	First high spot on the tire
2	Second high spot on the tire

5. If the second high spot is still above specification and is within 101.6 mm (4 in) of being opposite the first high spot on the wheel, the root cause is probably the wheel (the high spot followed the wheel). Dismount the tire from the wheel, mount the wheel on a balancer and check the wheel runout. If the wheel runout exceeds 1.14 mm (0.045 in), install a new wheel, balance the assembly and install on the vehicle using the Wheel-to-Hub Optimization procedure.

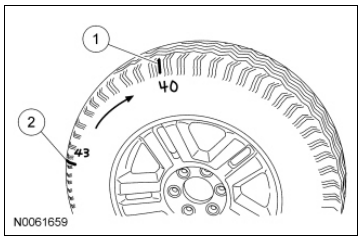


Item	Description
1	First high spot on the tire
2	Second high spot on the tire

6. **NOTE:** If the second high spot did not follow the wheel or the tire and the runout is still not within specification, improvements may be made by rotating the tire 90 degrees (one-fourth turn).

   Draw an arrow on the tire sidewall from the second high spot towards the first high spot (in the shortest direction).

   - Separate the tire beads from the wheel and rotate the tire 90 degrees (one-fourth turn) in the direction of the arrow.

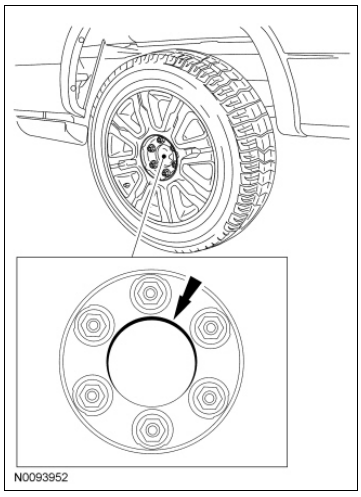


Item	Description
1	First high spot on the tire
2	Second high spot on the tire

Wheel-to-Hub Optimization

Wheel-to-hub optimization is important. Clearance between the wheel and hub can be used to offset or neutralize the Road Force® or run-out of the wheel and tire assembly. For every 0.001 in of wheel-to-hub clearance, the Road Force® can be affected between 1 and 3 pounds depending on the tire stiffness.

NOTE: The example below illustrates how the clearance between the wheel and the hub can be used to offset the high spot of radial run-out or Road Force®. Following the procedure will ensure the best optimization.



1. Position the wheel and tire assembly on the vehicle so that the high spot location is at the 6 o'clock position and install the wheel nuts by hand until snug.

2. **NOTE:** Do not allow the full weight of the vehicle to rest on the tires while tightening the wheel nuts.

   Lower the vehicle until the tires make contact with the ground, slightly loading the suspension. Tighten the wheel nuts as described in Wheel and Tire in this section.

Tire Pressure Monitoring System

Special Tool(s)

 ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
 ST2869-A	Digital Tire Pressure Gauge 204-354
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also referred to as the Generic Electronic Module (GEM).

The Tire Pressure Monitoring System (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency signals, to the SJB . TPMS functionality is integral to the SJB . These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressures must be adjusted and the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

Ambient Temperature Change and Tire Pressure

⚠ WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Do not inflate tire higher than maximum pressure stamped on tire sidewall. Premature tire wear or damage to the tire may result.**

Tire pressures fluctuate with temperature changes. For this reason, tire pressure must be set to specification when tires are at outdoor ambient temperatures. If the vehicle is allowed to warm up to shop temperatures, and the outside temperature is less than shop temperature, the tire inflation pressure must be adjusted accordingly.

If the tires are inflated to specification at shop temperatures, and the vehicle is moved outdoors when the outdoor ambient temperature is significantly lower, the tire pressure may drop enough to be detected by the TPMS and activate the TPMS indicator.

As the ambient temperature decreases by 6°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 6°C (10°F) ambient temperature drop as necessary to keep the tire at the specified Vehicle Certification (VC) label pressure. Refer to the following tables to adjust the tire pressure indoors for colder outside temperatures.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]
** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 70˚F. Max Pressure Adjustment is 7 psi.

Outside Temperature (˚F)	Tire Placard Pressure (PSI)																	
	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[1]
** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 21˚C. Max Pressure Adjustment is 50 kPa.

Outside Temperature (˚C)	Tire Placard Pressure (kPa)																	
	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1]When Outside (Ambient) Temperature is greater than 21˚C (70˚F), Inflate tires to placard pressure.
[1]Use the table to adjust tire pressure for P-metric and LT tires only.
[1]Do NOT use table for Commercial Truck Tires (i.e. 19.5 inch tires for F450 & F550). See F-Super Duty Service Manual for tire inflation procedure.

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Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will result in a false low tire pressure event, which will cause the TPMS indicator to illuminate.

1. The TPMS indicator remains on continuously for the following condition:
    - Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold

pressure as indicated on the VC label.

2. **NOTE:** The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB .

   If the vehicle has been stationary for more than 30 minutes, carry out the Tire Pressure Monitoring System (TPMS) Sensor Activation procedure in this section.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds, then remains ON solid when the ignition switch is turned to the ON position, for the following conditions:

1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE PRESSURE SENSOR FAULT when a tire pressure sensor is malfunctioning. GO to Symptom Chart .

2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the Instrument Cluster (IC) has not received any signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE PRESSURE MONITOR FAULT. GO to Symptom Chart .

3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE PRESSURE MONITOR FAULT when the TPMS is malfunctioning or communication with the IC has been lost. GO to Symptom Chart .

Tire Pressure Monitoring System (TPMS) PID Definitions and Intermittent Troubleshooting

TPMS Status (TP_STAT) PID

The SJB monitors the TPMS status. The current status can be viewed by accessing the TPMS status PID: TP_STAT using the scan tool. This helps identify the current system status and may aid in diagnosing the system. The PID has 4 valid states:

1. TP_STAT = SENSOR FAULT.
   - If the module has not received the tire pressure status from 1 to 3 TPMS sensors for 20 minutes when the vehicle speed is above 32 km/h (20 mph), the PID displays SENSOR FAULT.

2. TP_STAT = SYSTEM FAULT.
   - If the module has not received the tire pressure status from **all** 4 TPMS sensors for 20 minutes and the vehicle speed is above 32 km/h (20 mph), the PID displays SYSTEM FAULT.

3. TP_STAT = LOW.
   - If the module has detected that at least 1 TPMS sensor is reporting low tire pressure, the PID displays LOW.

4. TP_STAT = SYSTEM ACTIVE.
   - If the TPMS is functioning normally, the PID displays SYSTEM ACTIVE.

TPMS Last Warning Event PID Definitions

The TPMS uses the TPMS last warning event PIDs to store detailed information about the last 5 times the TPMS warning indicator was activated. These PIDs can be used to acquire more information about a particular TPMS event.

EVT1_IGN through EVT5_IGN

The number of key cycles since the TPMS warning indicator was activated. This PID cycles from zero to 255 and then starts over from zero again. This can be used to determine how long ago a TPMS event occurred and the time (in key cycles) between events.

EVT1_TLOC through EVT5_TLOC

This is the last programmed location for the sensor identifier causing each TPMS event. Due to tire rotation, the sensor may no longer be at the original location. It is suggested that all the PIDs be recorded, the system retrained, and then the sensor identifier PIDs be used to pinpoint the actual location of each sensor.

EVT1_PSI through EVT5_PSI

This is the tire pressure associated with each TPMS warning indicator event. This can be used along with the function code to clearly identify the TPMS events that were strictly due to low pressure. It can also be used to determine when a sensor is transmitting inaccurate tire pressure.

EVT1_STAT through EVT5_STAT

Describes the warning status of each TPMS event by using the information received from the TPMS status (TP_STAT) PID. If there is a communication issue, the status could be Normal.

- Unknown
- Normal (normal operation)
- Low (low pressure event)
- Fault (sensor fault or system fault)

EVT1_TxID through EVT5_TxID

This is the identifier of the sensor involved in each TPMS event. EVT1 is the most recent event that triggered the TPMS warning indicator.

Wheel Rotation and Sensor Training Techniques

Moving a Problem Sensor/Wheel to a Different Position

If a sensor in a certain location has caused several events, yet the sensor trains and seems to operate normally, moving that particular wheel to a different location on the vehicle is a good way to isolate the issue to a certain sensor/wheel location. Rotate the wheels and road test the vehicle. This can be done in an attempt to replicate the issue. This determines if the issue followed the sensor or remained in the original sensor location.

Training Sensors in a Different Order

This is a technique to get past a left front sensor that may not be responding to determine if the remaining sensors train to the module. This can help save time determining if other sensors are having issues or if the module is experiencing training difficulties with a certain location.

Training Known Good Sensors From Another Vehicle

Training known good sensors from another vehicle cannot differentiate between a faulted module and Radio Frequency Interference (RFI), as some noise source could be preventing the module from receiving the tire

pressure status from the original sensors as well as the known good sensors. This technique that can be used to differentiate between a sensor and module issue. If the module in the vehicle cannot train any of its own sensors, and likewise cannot train known good sensors from another vehicle, then the issue is with the module or the RFI , and not with the original sensors. The original sensors should not be replaced.

Items That Cause RFI

Non-OEM Equipment

The following equipment has been found to sometimes cause RFI :

- Video equipment has been found to cause RFI especially when the video and power supply lines are near the TPMS .
- Car alarms (even those installed by dealerships) have been found to create enough RFI to cause the TPMS to malfunction or lose considerable range. These car alarms can sometimes be difficult to locate, as they are usually hidden somewhere out of the way for reduced accessibility.
- Many different in-vehicle cell phone chargers have been found to cause considerable RFI . The vehicles with the power point closest to the TPM are the most affected. It must be noted that most cell phone chargers do not produce high levels of RFI all the time. This depends on the state of charge of the cell phone battery. The phone must be almost completely discharged in some cases.
- Power supplies and DC/AC inverters typically create a lot of RFI . Most consumer grade equipment has very little filtering or shielding.

OEM Modules

In some cases, the RFI may actually be caused by a module or ground on the vehicle. Depending on the severity of the issue, a dirty ground, improperly built ground shield or module can disable the system. Modules that have microcontrollers using clock circuits to create the timing pulses for the microprocessor may radiate RFI .

Using Customer's Electronics to Pinpoint the Radio Frequency Interference (RFI) Source

This can be a way to determine the cause of an issue well before the sensors and module are replaced with little or no affect on the system performance. Since this takes more up-front work, it relies on working with the customer to determine what equipment was being used at the time of the event.

Options for Eliminating Intermittent TPMS Conditions Caused by RFI

- If an OEM component or customer device is causing an RFI issue, replace the device.
- If a phone charger is causing an RFI issue, the customer should consult their cell phone provider to acquire a different phone charger.
- If a device such as a dealer-installed alarm is causing an RFI issue, move the device to another location on the vehicle. In the case of a portable device, move the power cord to another power point location.

In summary, if the RFI source is present and cannot be moved or replaced, the intermittent issue remains. The vehicle owner must accept RFI and the unwanted system operation it can cause.

Inspection and Verification

1. **NOTE:** The tire pressure sensors are not designed to be used with aftermarket wheels.

   NOTE: The use of run-flat tires (tires with steel body cord plies in the tire sidewall) where not originally equipped, may cause the Tire Pressure Monitoring System (TPMS) to malfunction and is

therefore not recommended.

Verify the customer concern by inspecting the vehicle and observing the message center (if equipped) and the TPMS indicator.

2. **NOTE:** The valve-mounted TPMS sensors and the strap-mounted TPMS sensors are not compatible. Swapping wheels from one vehicle to another with the different systems will set a TPMS fault.

   NOTE: Swapping wheels between vehicles with the same TPMS will cause a TPMS fault to be set if the sensors are not trained. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.

   NOTE: Non-OEM modifications made to the vehicle may result in false TPMS warnings.

   Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
• Low tire pressure • Tire Pressure Monitoring System (TPMS) sensor damaged or missing • Spare tire installed as a road wheel • Incorrect TPMS sensor installed • TPMS sensor installed incorrectly • Sensors not trained after a tire rotation on vehicles with different front and rear tire pressures • Non-OEM wheels installed (aftermarket rims) • Non-OEM equipped run-flat tires installed • Other non-OEM modifications (roll cages, service barriers, part racks, ladder racks)	• Wiring, terminals or connectors • Smart Junction Box (SJB) damaged • Aftermarket electronic accessories

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:

- verify the ignition key is in the ON position.
- verify the scan tool operation with a known good vehicle.
- refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. Clear the CMDTCs and carry out the self test diagnostics for the SJB (the TPMS is part of the SJB).

9. If the DTCs retrieved are related to the concern, GO to the Tire Pressure Monitoring System (TPMS) DTC Chart. For all other DTCs, refer to the Master DTC Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Tire Pressure Monitoring System (TPMS) DTC Chart

DTC	Description	Source	Action
B106A	Pressure Sensor Range Bit Incorrect State	Smart Junction Box (SJB)	GO to Pinpoint Test G .
B106B	Tire Pressure Sensor Low Battery	SJB	DTC B106B can be set during SJB configuration. GO to Pinpoint Test H .
B106D	Tire Pressure Monitoring System (TPMS) Initiators Not Configured	SJB	DTC B106D is only present when a new SJB is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. VERIFY the SJB is correctly configured. If DTC B106D is still present, REFER to Section 418-01 .
B2477	Module Configuration Failure/Mismatch	SJB	DTC B2477 is only present when a new SJB is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. MAKE SURE the SJB is configured correctly. If DTC B2477 is still present, REFER to Section 418-01 .
B2868	LF Tire Pressure Sensor Fault	SJB	DTC B2868 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2869	RF Tire Pressure Sensor Fault	SJB	DTC B2869 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2870	RR Tire Pressure Sensor Fault	SJB	DTC B2870 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2871		SJB	

	LR Tire Pressure Sensor Fault		DTC B2871 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
B2872	Tire Pressure Sensor Fault	SJB	**NOTE:** If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB . ACTIVATE the TPMS sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Activation in this section. GO to Pinpoint Test F .
B287A	Tire Pressure System Fault	SJB	GO to Pinpoint Test F .
C2780	ECU in Manufacturing Mode	SJB	DTC C2780 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
U0155	Lost Communication with Instrument Cluster	SJB	REFER to Section 418-00 to diagnose the no communication problem.
All other SJB DTCs	-	SJB	REFER to the Master DTC Chart in Section 419-10 .

Symptom Chart

Symptom Chart
NOTE: For vehicles with different front and rear tire pressure (such as E-Series and certain F-Series), the tire pressures must be adjusted and the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will result in a false low tire pressure event, which will cause the Tire Pressure Monitoring System (TPMS) indicator to illuminate.

For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Failure of a TPMS component may not cause the message center to display a fault message or a DTC to be stored. The Symptom Chart is a starting point to begin diagnosis of these concerns.

ConditionPossible SourcesAction

- Tire Pressure Monitoring System (TPMS) indicator ON solid and message center (if equipped) displays LOW TIRE PRESSURE
- Spare tire currently in use
- INSTALL the repaired road wheel/tire in place of the spare tire.
- Air pressure not set to specifications listed on the Vehicle Certification (VC) label
- GO to Pinpoint Test D .

- Sensors not trained following tire rotation

- ADVISE customer that on vehicles with different front and rear tire pressure, the sensors must be trained as directed in their Owner's Literature.

- Smart Junction Box (SJB) will not enter sensor training mode when using the TPMS sensor training procedure

- Brake ON/OFF switch
- Ignition switch
- Vehicle communication bus
- SJB

- GO to Pinpoint Test E .

- TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE SENSOR FAULT and DTC B2872 is present

- Intermittent TPMS operation due to Radio Frequency Interference (RFI)
- TPMS sensors not trained
- Not all TPMS sensors are installed
- TPMS sensor(s)
- SJB

- **NOTE:** If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB .

  ACTIVATE the TPMS sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Activation in this section. GO to Pinpoint Test F .

- TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE MONITOR FAULT and DTC B287A is present

- TPMS sensors not trained
- Not all TPMS sensors are installed

- **NOTE:** If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB .

  ACTIVATE the TPMS sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Activation in this section. GO to Pinpoint Test F .

- TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE MONITOR FAULT and there are no DTCs present

- Vehicle communication issue between the SJB and the Instrument Cluster (IC)

- REFER to Section 418-00 to diagnose the no communication concern.

- SJB

- REFER to Section 419-10 to diagnose the SJB .

- One or more sensors will not train

- TPMS sensor(s)
- Vehicle communication issue
- SJB

- RETRIEVE and RECORD DTCs. REFER to Tire Pressure Monitoring System (TPMS) DTC Chart.

- One or more sensors will not train and no DTCs are present

- TPMS sensor(s)

- TRAIN all 4 tire pressure sensors. REFER to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.
- For any sensor(s) that did not train, ATTEMPT to activate the same sensor with the activation tool. If the sensor still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth turn and ATTEMPT to activate the same sensor again.
- If the sensor(s) fail to train a second time, INSTALL a new sensor(s). REFER to Tire Pressure Monitoring System (TPMS) Sensor in this section.

Pinpoint Tests

Pinpoint Test D: Tire Pressure Monitoring System (TPMS) Indicator ON Solid and Message Center (if equipped) Displays LOW TIRE PRESSURE

Normal Operation

The Tire Pressure Monitoring System (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency signals, to the Smart Junction Box (SJB). TPMS functionality is integral to the SJB . These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function (integral to the SJB) compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the Instrument Cluster (IC). The IC then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

This symptom can also be caused by a spare tire currently being used in place of a road tire. Make sure that the spare tire is not currently in use. On vehicles with different front and rear tire pressures, if the sensors are not trained following a tire rotation, this symptom will also be present. Advise the customer that on vehicles with different front and rear tire pressures, the sensors must be trained as directed in the Owner's Literature.

This pinpoint test is intended to diagnose the following:
- Low air pressure in tire(s)
- Tire pressure sensor(s)

PINPOINT TEST D: TPMS INDICATOR ON SOLID AND MESSAGE CENTER (IF EQUIPPED) DISPLAYS LOW TIRE PRESSURE

NOTE: Use only the Digital Tire Pressure Gauge any time tire pressures are measured to be sure that accurate values are obtained.

NOTE: If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.

Test Step	Result / Action to Take
D1 CHECK THE TIRE PRESSURE	
• Measure and record the air pressure in all 4 road tires. • Adjust the air pressure for those found to be below the specification listed on the Vehicle Certification (VC) label. • **NOTE:** If the vehicle has been stationary for more than 30 minutes, activate each TPMS sensor. Refer to Tire Pressure Monitoring System (TPMS) Sensor Activation in this section. The TPMS sensor does not transmit when the vehicle is stationary. • Verify system operation. • **Have the TPMS indicator and the message center (if equipped) warnings gone out?**	**Yes** The system is functioning normally, diagnosis is complete. INFORM the customer of correct tire pressure maintenance as instructed in the scheduled maintenance guide and the Owner's Literature. **No** GO to D2 .
D2 CHECK THE SYSTEM COMPONENTS	
• Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger SJB . • Read and record the following PIDs: ♦ Left Front Tire Pressure (LF_PRES) ♦ Right Front Tire Pressure (RF_PRES) ♦ Left Rear Outer Tire Pressure (LRO_PRES) ♦ Right Rear Outer Tire Pressure (RRO_PRES) • Compare the air pressure readings recorded from the function test to those recorded in D1. • **Do the compared tire pressure values match within ±5 psi, and have the TPMS indicator and the message**	**Yes** The system is functioning normally, diagnosis complete. **No** **Before installing a new sensor(s):** If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth turn and ATTEMPT to activate the same sensor(s) again. INSTALL new tire pressure sensors for those with discrepancies or those that fail to activate. REFER to Tire Pressure Monitoring System (TPMS) Sensor in this section.

center (if equipped) warnings gone out?	

Pinpoint Test E: SJB Will Not Enter Sensor Training Mode When Using the TPMS Sensor Training Procedure

Normal Operation

For the Smart Junction Box (SJB) to enter Tire Pressure Monitoring System (TPMS) sensor training mode, the SJB must receive valid inputs from the Brake Pedal Position (BPP) switch (OFF-ON-OFF) and ignition switch (both OFF and RUN), and it must receive valid vehicle speed sensor input (0 km/h [0 mph]). Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section for the complete sensor training procedure.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Brake ON/OFF switch
- Ignition switch
- SJB

PINPOINT TEST E: SJB WILL NOT ENTER SENSOR TRAINING MODE WHEN USING THE TPMS SENSOR TRAINING PROCEDURE

Test Step	Result / Action to Take
E1 CHECK THE SJB BRAKE ON/OFF (GEM_BOO) PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger SJB . • Monitor the GEM_BOO PID (SJB reads the brake switch directly). • Press and release the brake pedal while monitoring the PID. • **Do the brake pedal PID values match the brake pedal positions?**	**Yes** GO to E2 . **No** REFER to Section 417-01 to continue diagnosis of the stoplamp switch.
E2 CHECK THE SJB IGNITION SWITCH PIDs	
• Monitor the following ignition switch PIDs: ♦ Ignition Switch Off (IGN_O_ECU) ♦ Ignition Switch RUN (IGN_R_ECU) • Cycle the ignition switch to the RUN and OFF position while monitoring the PIDs (SJB reads the ignition switch directly).	**Yes** GO to E3 . **No** REFER to Section 211-05 to continue diagnosis of the ignition switch.

• **Do the ignition switch status PID values match the ignition switch positions?**	
E3 CHECK THE SJB VEHICLE SPEED (VSS_GEM) PID	
• Monitor the VSS_GEM PID (SJB receives vehicle speed from the Instrument Cluster (IC)). • **Does the vehicle speed PID value match the speed of the vehicle?**	**Yes** GO to E4 . **No** REFER to Section 413-01 to diagnosis of the IC /vehicle speed concern.
E4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check the connectors for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect all the SJB connectors and make sure that they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: TPMS Indicator FLASHES for 70 Seconds and Then Remains ON Solid When the Ignition Key is Turned to the ON Position, the Message Center (if equipped) Displays TIRE PRESSURE SENSOR or MONITOR FAULT and DTC B2872 or B287A is Present

Normal Operation

If there is a fault with 1, 2 or 3 of the Tire Pressure Monitoring System (TPMS) sensors, DTC B2872 sets. The TPMS warning indicator flashes for 70 seconds and then remains ON continuously when the ignition switch is turned to the ON position and the message center (if equipped) displays TIRE PRESSURE SENSOR FAULT.

If the Smart Junction Box (SJB) does not get a response from **all** 4 of the TPMS sensors, DTC B287A sets and the message center (if equipped) displays TIRE PRESSURE MONITOR FAULT.

It should be noted that TPMS communication can be interrupted by Radio Frequency Interference (RFI), which can cause intermittent issues. RFI is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment. Anytime the TPMS sensor training procedure is performed successfully, the warning indicator is extinguished and the vehicle must be driven for 18-20 minutes before the SJB initiates a self test to verify system operation.

- TP_STAT PID = SYSTEM FAULT is displayed if the SJB does not receive a signal transmission from **all** 4 TPMS sensors for 20 minutes and the vehicle speed is above 32 km/h (20 mph).
- TP_STAT PID = SENSOR FAULT is displayed if the SJB does not receive a signal transmission from 1, 2, or 3 TPMS sensors for 20 minutes and the vehicle speed is above 32 km/h (20 mph).

This pinpoint test is intended to diagnose the following:
- Intermittent TPMS operation due to RFI

- TPMS sensor(s) not trained
- Not all TPMS sensors are installed
- TPMS sensor(s)
- SJB

PINPOINT TEST F: TPMS INDICATOR FLASHES FOR 70 SECONDS AND THEN REMAINS ON SOLID WHEN THE IGNITION KEY IS TURNED TO THE ON POSITION, THE MESSAGE CENTER (IF EQUIPPED) DISPLAYS TIRE PRESSURE SENSOR OR MONITOR FAULT AND DTC B2872 OR B287A IS PRESENT

Test Step	Result / Action to Take
F1 CHECK THE HORN OPERATION	
• Press the steering wheel horn pad for 2 seconds. • **Does the horn sound?**	**Yes** GO to F2 . **No** For horn diagnosis, REFER to Section 413-06 .
F2 CHECK THE TPMS STATUS (TP_STAT) PID	
NOTE: Make sure that all aftermarket electronic equipment has been disconnected (if possible) and that the customer has been questioned about the kinds of electronic equipment they may have been using in the vehicle when this issue was identified. • Connect the scan tool. • **NOTE:** A spare tire cannot be programmed to the vehicle, even if equipped with a TPMS sensor. If a damaged road wheel is located in the trunk and the SJB cannot communicate with it, or if the damaged wheel has been dropped off at a dealership or repair shop, the SJB sets a TPMS sensor fault. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - SJB . • Monitor the TP_STAT PID. • **Does the PID display SENSOR FAULT?**	**Yes** GO to F3 . **No** If the TP_STAT PID displays **SYSTEM** FAULT, GO to F5 .
F3 CARRY OUT THE SENSOR TRAINING PROCEDURE	
• Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each TPMS sensor transmitted to the SJB ?**	**Yes** The system is operating correctly at this time. The concern may have been caused by RFI . CLEAR the DTCs. REPEAT the self-test. TEST for normal operation. REFER to PID Definitions and Intermittent Troubleshooting in this section for information on locating sources of RFI . **No**

	GO to F4 .
F4 CHECK FOR CORRECT TPMS OPERATION	
• Move the vehicle to rotate the wheels at least one-fourth of a turn. Leave the vehicle doors open. • Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each TPMS sensor transmitted to the SJB ?**	**Yes** The system is operating correctly at this time. The concern may have been caused by RFI . CLEAR the DTCs. REPEAT the self-test. TEST for normal operation. REFER to PID Definitions and Intermittent Troubleshooting in this section for information on locating sources of RFI . **No** GO to F5 .
F5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB electrical connectors. • Check the connectors for: ♦ corrosion ♦ pushed-out pins ♦ bent pins ♦ spread terminals • Connect all the SJB connectors and make sure that they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** **NOTE:** The sensors may not be present. DISMOUNT the tire. REFER to Wheel and Tire in this section. VERIFY the sensors are present and mounted to the wheels. If missing, INSTALL new sensors. If the sensors are present, INSTALL a new SJB . REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: DTC B106A

Normal Operation

This DTC may be encountered if a sensor designed for a different application is installed. Low pressure applications utilize a black- or blue-colored sensor, while heavy duty applications utilize a green-colored sensor. The Smart Junction Box (SJB) will only allow one type of sensor to be trained using the Tire Pressure Monitoring System (TPMS) sensor training procedure. Make sure the correct sensors are used to avoid compatibility issues.

- DTC B106A (Pressure Sensor Range Bit Incorrect State) - When an attempt has been made to train a non-compatible sensor, the SJB will set DTC B106A.

This pinpoint test is intended to diagnose the following:

- Incorrect tire pressure sensor(s) installed

PINPOINT TEST G: DTC B106A

Test Step	Result / Action to Take
G1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH AN INCORRECT SENSOR	
• Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB ?**	**Yes** CLEAR the DTCs. REPEAT the self test. VERIFY system operation. **No** **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again. If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to Tire Pressure Monitoring System (TPMS) Sensor in this section.

Pinpoint Test H: DTC B106B

Normal Operation

If there is a fault in the Tire Pressure Monitoring System (TPMS), such as a damaged or missing sensor(s), damaged module or a communication issue within the vehicle, DTCs are set in the Smart Junction Box (SJB), the TPMS warning indicator will flash for 70 seconds and then remain ON solid when the ignition switch is turned to the ON position and the message center (if equipped) will display TIRE PRESSURE SENSOR FAULT.

The tire pressure sensor is battery powered.

This DTC may be set when attempting to train a tire pressure sensor(s) with a low battery.

This pinpoint test is intended to diagnose the following:

- Tire pressure sensor battery
- Tire pressure sensor(s)

PINPOINT TEST H: DTC B106B

Test Step	Result / Action to Take
H1 DETERMINE WHICH SENSOR HAS A LOW BATTERY	
• Train all 4 tire pressure sensors. Refer to Tire Pressure Monitoring System (TPMS) Sensor	**Yes** CLEAR the DTCs. REPEAT the self test. VERIFY system operation. **No**

Training in this section. • **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB ?**	**Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again. If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to Tire Pressure Monitoring System (TPMS) Sensor in this section.

Tire Pressure Monitoring System (TPMS) Sensor Training

Special Tool(s)

 ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the Smart Junction Box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation in this section.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with a Tire Pressure Monitoring System (TPMS).

Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the Tire Pressure Monitor Activation Tool, attempt to activate the same sensor with the Tire Pressure Monitor Activation Tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least one-fourth of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

1. **NOTE:** An animated version of this procedure is available on-line.

   Turn the ignition switch to the OFF position, then press and release the brake pedal.

2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

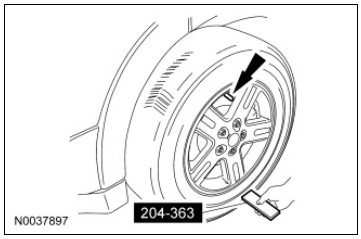
3. Press and release the brake pedal.

4. Turn the ignition switch to the OFF position.

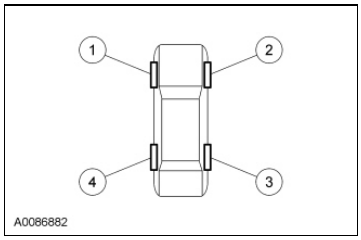
5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
    - The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. **NOTE:** It may take up to 6 seconds to activate a tire pressure sensor. During this time, the Tire Pressure Monitor Activation Tool must remain in place 180 degrees from the valve stem.

   Place the Tire Pressure Monitor Activation Tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the Tire Pressure Monitor Activation Tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB . An animated version of this procedure is available on-line.



7. Within 2 minutes of the horn sounding, place the Tire Pressure Monitor Activation Tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and release the test button to train the RF tire pressure sensor.



8. **NOTE:** Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

   Repeat Step 7 for the RR and LR tires.
   The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.
   For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor identifiers trained to the SJB and document them on the applicable warranty claim.

10. **NOTE:** This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns with a newly programmed SJB .

    If the sensors are being trained due to the installation of a new SJB , clear any DTCs and carry out the SJB On-Demand Self Test.

Tire Pressure Monitoring System (TPMS) Sensor Activation

Special Tool(s)

 ST2941-A	Activation Tool, Tire Pressure Monitor 204-363

NOTE: The tire pressure sensors will go into a "sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode. It will be necessary to wake them up so they will transmit the latest tire pressure information.

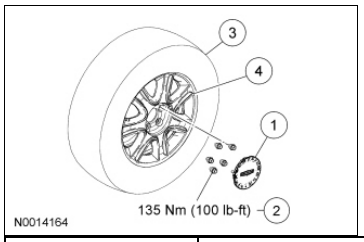
1. Turn the ignition switch to the ON position.
2. Position the Tire Pressure Monitor Activation Tool against the LF tire sidewall, 180 degrees from the tire valve stem.
3. **NOTE:** The Tire Pressure Monitor Activation Tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire pressure sensor.

   Press the test button on the Tire Pressure Monitor Activation Tool to activate the sensor, activate the sensor at least 2 times.
4. Repeat Steps 2 and 3 for the remaining tires.
5. If the Tire Pressure Monitoring System (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart in Diagnosis and Testing in this section.

Wheel and Tire

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	-
Motorcraft® Wheel and Tire Cleaner ZC-37-A	-



Item	Part Number	Description
1	1A096	Center cap
2	1012	Wheel nut (5 required)
3	1508	Tire
4	1007	Wheel

Removal

1. If equipped, remove the center cap.
2. ***NOTICE:*** **Do not use heat to loosen a seized wheel nut or damage to the wheel and wheel bearing can occur.**

   With the weight of the vehicle on the wheels, loosen the wheel nuts.
3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
4. Remove the wheel nuts and the wheel and tire assembly.

Installation

1. ⚠ **WARNING: When a wheel is installed, always remove any corrosion, dirt or foreign material present on the mounting surface of the wheel and the mounting surface of the wheel hub, brake drum or brake disc. Make sure that any fasteners that attach the rotor to the hub are secured so they do not interfere with the mounting surfaces of the wheel. Failure to follow these instructions when installing wheels may result in the wheel nuts loosening and the wheel coming off while the vehicle is in motion, which could result in loss of control, leading to serious injury or death to vehicle occupant(s).**

⚠ **WARNING: Retighten wheel nuts within 160 km (100 mi) after a wheel is reinstalled. Wheels can loosen after initial tightening. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

Clean the wheel-to-wheel hub mounting surface(s).

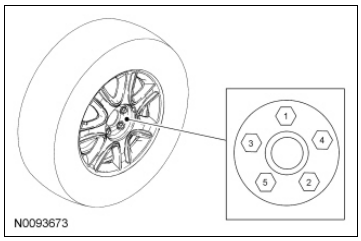
2. ***NOTICE:*** **Make sure to apply a thin coat of anti-seize lubricant only to the area of the wheel that contacts hub pilot surface. Do not allow the lubricant to make contact with the wheel studs, brake pads or brake disc. Brake component damage or incorrect wheel nut clamp load may occur.**

   Apply a thin coat of anti-seize lubricant to the wheel hub pilot surface.

3. Position the tire and wheel assembly and install the wheel nuts hand-tight, then lower the vehicle.

4. ***NOTICE:*** **Failure to tighten the wheel nuts in a star pattern can result in high brake disc runout, which will speed up the development of brake roughness, shudder and vibration.**

   Tighten the wheel nuts, using the pattern indicated, to 135 Nm (100 lb-ft).

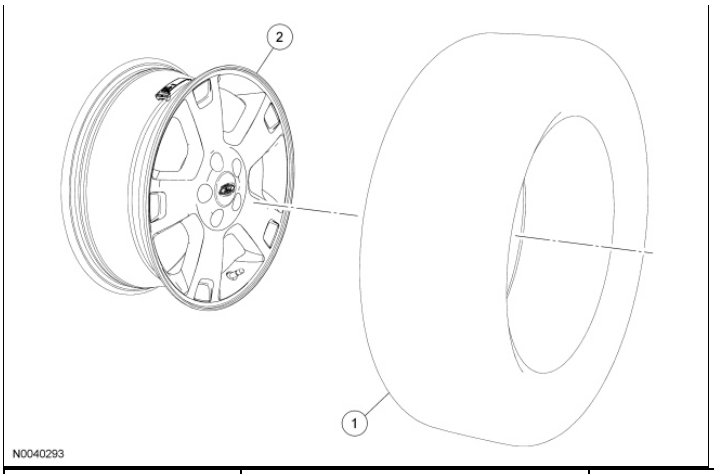


5. If removed, install the center cap.

Wheel and Tire

Special Tool(s)

 ST2869-A	Digital Tire Pressure Gauge 204-354



Item	Part Number	Description
1	1508	Tire
2	1007	Wheel

Disassembly

NOTICE: **Failure to follow the instructions below may result in damage to the Tire Pressure Monitoring System (TPMS) sensor.**

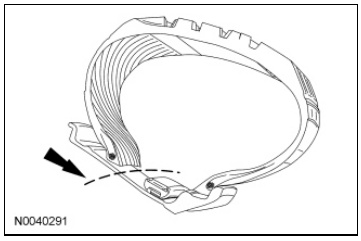
NOTE: Use only the Digital Tire Pressure Gauge any time tire pressures are measured to be sure that accurate values are obtained.

NOTE: A wheel and tire equipped with a Tire Pressure Monitoring System (TPMS) sensor will have the following verbiage stamped or cast on the wheel: SENSOR MAY BE INSIDE. An animated version of this procedure is available on-line.

NOTE: The TPMS sensor is mounted to the wheel 180 degrees opposite of the valve stem and is held in place by a stainless steel strap. The sensor is not mounted to the valve stem.

1. Remove the wheel and tire. For additional information, refer to Wheel and Tire in this section.

NOTICE: **Do not allow the tire beads to move beyond the wheel mid-plane (middle of the wheel) when separating the beads from the wheels, damage to the Tire Pressure Monitoring System (TPMS) sensor may occur.**

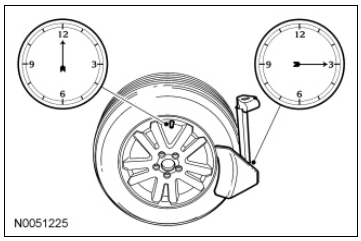


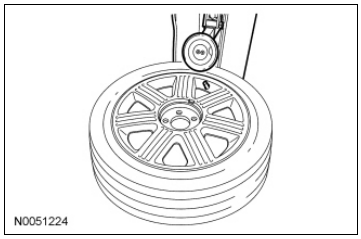
2. *NOTICE:* **Tire and valve stem position is critical to prevent damage to the Tire Pressure Monitoring System (TPMS) sensor when using a paddle-type bead separator. An animated version of this procedure is available on-line.**

   NOTE: Some machines may have a nylon roller bead separator at the 12 o'clock position instead of the paddle-type bead separator at the 3 o'clock position. An animated version of this procedure is available on-line.

   Position the wheel and tire assembly on a suitable tire machine and separate both beads of the tire from the wheel.

   - For a paddle-type tire machine, position the valve stem at the 12 o'clock or 6 o'clock position and the paddle at the 3 o'clock position.
   - For a roller-type tire machine, align the valve stem with the roller at any position.

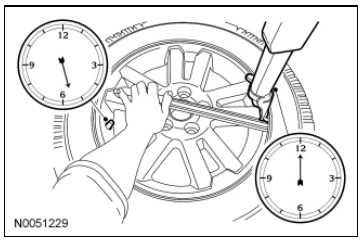




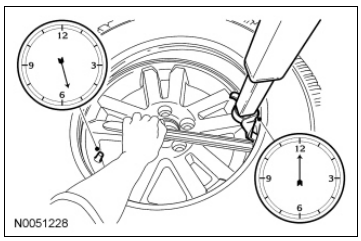
3. **NOTE:** A video version of this procedure is available on-line.

   NOTE: Index-mark the valve stem and wheel weight positions on the tire.

   Place the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 o'clock and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the outer bead from the wheel.



4. Reset the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 o'clock and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the inner bead from the wheel.



5. Inspect the TPMS sensor, cradle and strap for damage. Install new parts as necessary.
    - For information on removal and installation of the TPMS sensor, refer to Tire Pressure Monitoring System (TPMS) Sensor in this section.
    - When installing a new wheel, reuse the TPMS sensor from the previous wheel if possible. The TPMS will not have to be trained if the sensor is reused. The new wheel will not come with a sensor strap. A sensor strap kit will need to be ordered with the new wheel.

Assembly

NOTICE: **Damage to the Tire Pressure Monitoring System (TPMS) sensor may result if the tire mounting is not carried out as instructed.**

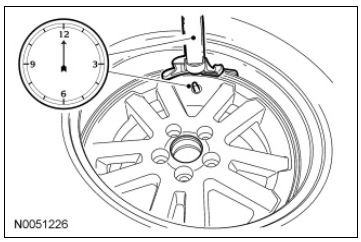
1. ***NOTICE:*** **Lubricate the tire beads using a suitable fast drying, corrosion-inhibiting tire bead lubricant. Use of anything other than tire bead lubricant may result in damage to the Tire Pressure Monitoring System (TPMS) sensor.**

   NOTE: Do not mount the tire at this time.

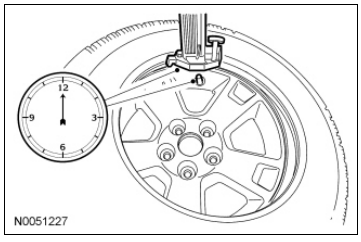
   NOTE: A video version of this procedure is available on-line.

   Position the wheel on the turntable of the tire machine, then lubricate and position the bottom bead of the tire on the wheel.

2. Position the wheel to align the valve stem with the machine arm at the 12 o'clock position and mount the bottom bead of the tire. A video version of this procedure is available on-line.



3. Reposition the wheel to align the valve stem with the machine arm at the 12 o'clock position and mount the top bead of the tire.



4. **NOTE:** Use only the Digital Tire Pressure Gauge any time tire pressures are measured to make sure that accurate values are obtained.

   Using the Digital Tire Pressure Gauge, inflate the tire to the pressure specified on the Vehicle Certification (VC) label located on the driver door or door pillar.

   - Proceed to Step 5 if the tire beads do not seat at the specified inflation pressure.

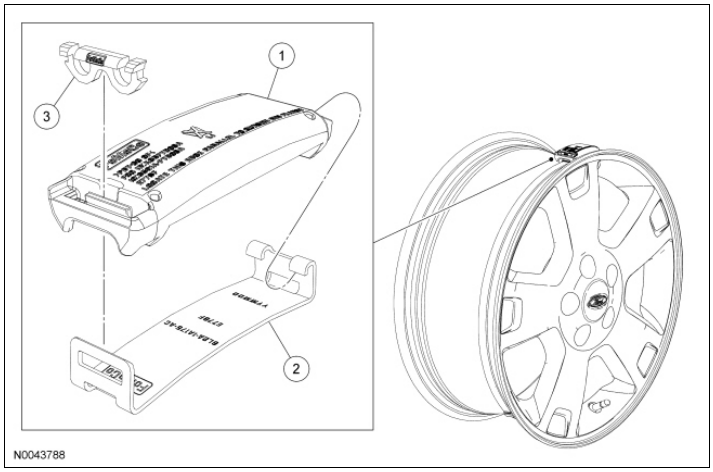
5. ⚠ **WARNING: If there is a need to exceed the maximum pressure indicated on the sidewall of the tire, in order to seat the beads, follow ALL the steps listed below. Failure to follow these steps may result in serious personal injury.**

   The following steps should only be carried out if the tire beads cannot be seated by inflating the tire up to the maximum inflation pressure listed on the tire sidewall.

   1. Relubricate the tire bead and wheel bead seat area.
   2. Install a remote valve and pressure gauge.
   3. Wear eye and ear protection and stand at a minimum of 3.65 m (12 ft) away from the wheel and tire assembly.
   4. Inflate tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 138 kPa (20 psi) more than maximum inflation pressure on tire sidewall. If beads have not seated, deflate the tire and proceed to the next step.
   5. Place the wheel and tire assembly in an OSHA-approved tire safety cage.
   6. Inflate the tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 276 kPa (40 psi) more than maximum inflation pressure on the tire sidewall. **Do not exceed 276 kPa (40 psi) above the maximum pressure on tire sidewall. Install a new tire if the beads do not seat at this pressure.**

6. Install the wheel and tire. For additional information, refer to Wheel and Tire in this section.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle
3	14C202	Locking clip (also part of 1A189)

Disassembly

⚠ **WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.**

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are **not** interchangeable.

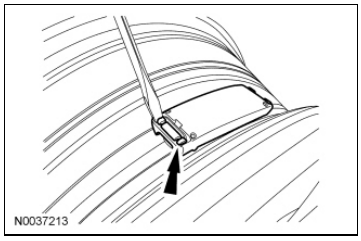
NOTE: The sensor can be removed and installed without removing the strap or the cradle.

1. ***NOTICE:*** **The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as instructed.**

   Remove the tire from the wheel. For additional information, refer to Wheel and Tire in this section.

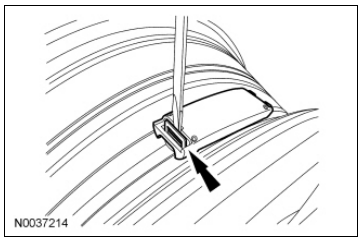
2. ***NOTICE:*** **Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.**

   Using a pocket screwdriver or similar tool, remove the sensor locking clip. An animated version of this procedure is available on-line.



3. ***NOTICE:*** **Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.**

   Using a pocket screwdriver or similar tool, detach the sensor from the cradle. An animated version of this procedure is available on-line.



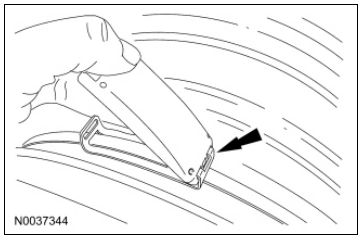
4. Remove the sensor.

Assembly

1. ***NOTICE:*** **Damage to the sensor may occur if excessive force is applied during sensor installation.**

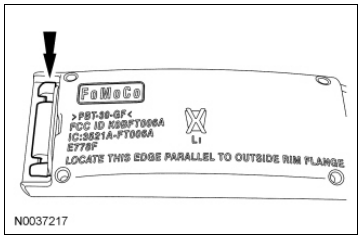
   NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

   Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.



2. **NOTE:** The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

   Insert a new locking clip into the sensor.



3. *NOTICE:* **The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

   Install the tire onto the wheel. For additional information, refer to Wheel and Tire in this section.

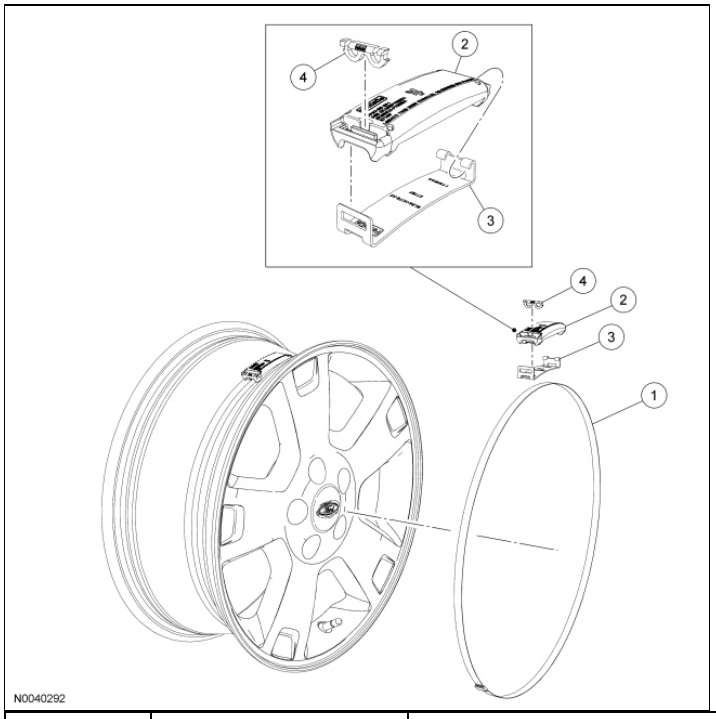
4. **NOTE:** A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

   Train the tire pressure sensor(s). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Material

Item	Specification
Motorcraft® Wheel and Tire Cleaner ZC-37-A	-



Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Disassembly

⚠ WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing

a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are **not** interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter, but all strap kits share the same base part number.

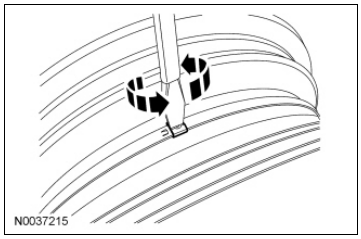
1. Remove the Tire Pressure Monitoring System (TPMS) sensor. For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor in this section.

2. ⚠ **WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

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

   Remove a factory-installed strap in the following sequence:

   1. Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item on both sides of the buckle, approximately 25 mm (0.98 in) from the buckle.
   2. Using a large screwdriver and a twisting motion, unbuckle the strap.
   3. Discard the strap.



3. To remove a dealer-installed strap, turn the worm gear screw until the strap is fully released from the worm gear.
   - Discard the strap.

4. **NOTE:** To aid assembly, mark the location of the cradle prior to disassembly.

   Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up. An animated version of this procedure is available on-line.

Assembly

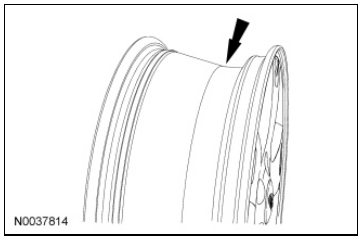
1. **NOTE:** Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

   Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. ***NOTICE:*** **Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.**

   NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

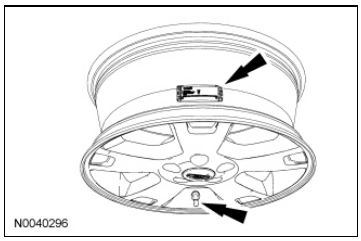
   Using wheel and tire cleaner, clean the area where the sensor and cradle are to be installed.



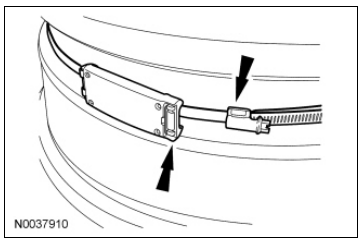
3. **NOTE:** The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side) of the wheel.

   NOTE: The sensor has raised markings indicating how to position the sensor.

   Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem. A video version of this procedure is available on-line.



4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the locking clip side of the sensor. An animated version of this procedure is available on-line.

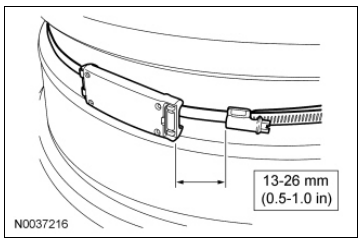


5. ***NOTICE:*** **Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot possible to avoid damaging the sensor during wheel and tire disassembly and assembly.**

   NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

   Position the worm gear 13-26 mm (0.5-1.0 in) away from the sensor and tighten the worm gear.

   - Tighten to 3 Nm (27 lb-in).



6. ***NOTICE:*** **The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

Install the tire onto the wheel. For additional information, refer to Wheel and Tire in this section.

7. **NOTE:** A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

   Train the tire pressure sensor(s). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Training in this section.

Material

Item	Specification	Fill Capacity
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-	-
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

Driveline Maximum Runout

Description	Specification
Circular flange runout	0.203 mm (0.008 in)
Front driveshaft	0.381 mm (0.015 in)
Rear driveshaft (all)	0.508 mm (0.020 in)

Driveline System

The driveline consists of the following:

- Front driveshaft
- CV joints
- Front drive axle
- Front axle halfshafts
- Rear driveshafts
- U-joints and flanges
- Center support bearings
- Rear drive axle
- Rear axle halfshafts

The source of the drivetrain's power is generated by the engine and delivered to the transmission. The driveline transfers the engine torque through the driveshaft to the axle and halfshafts. On Rear Wheel Drive (RWD) vehicles, power is transmitted through the transmission to the driveshaft, rear axle and halfshafts. On Four-Wheel Drive (4WD) vehicles, power is transmitted through the transmission and the transfer case. The transfer case directs the power to the rear driveshaft and then to the rear axle. When engaged, it also transmits power through the front driveshaft to the front axle and halfshafts. The axles are mounted to the vehicle in rubber isolators and the necessary changes in driveshaft length are provided in the CV joints or driveshaft slip joints. The engine torque enters the axle through the drive pinion, which rotates the ring gear. The ring gear is mounted to the differential case, which contains the gears that transmit power to the splined front or rear axle halfshafts or halfshafts and allow the halfshafts to turn at varying speeds as when cornering. These halfshafts rotate the drive wheels.

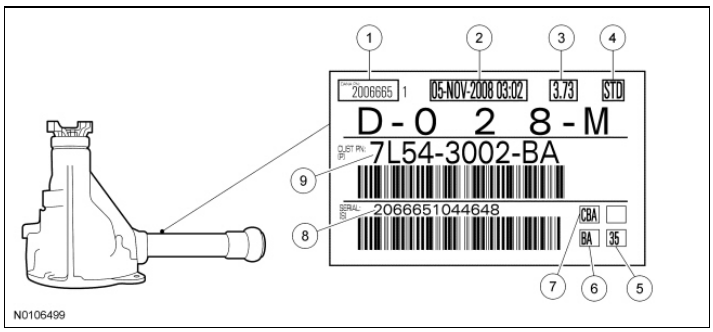
Axle Identification

The axle ratio may be verified by checking the printed label on the axle housing. If worn or not visible, the Vehicle Identification Number (VIN) can be typed in the service parts ordering system or the Vehicle Certification (VC) label may be used to correctly identify the axle and ratio. The VC label is located in the driver door jamb. The first 2 digits of the axle code indicate the rear axle and the third digit refers to the front axle, if so equipped. For information on the VC label, refer to Section 100-01 .

Vehicle Certification (VC) Label Example

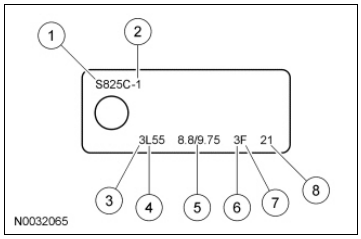


Front Axle Identification Tag



Item	Description
1	Dana part number
2	Build date and time
3	Axle ratio
4	Differential type
5	Model number
6	Build level
7	Assembly plant
8	Serial number
9	Customer part number

Rear Axle Identification Tag



Item	Description
1	Plant code
2	Denotes interchangeability affected internally
3	Axle ratio
4	Denotes conventional or limited slip
5	Ring gear diameter (in)
6	Build year
7	Build month
8	Build day

Driveline System

Special Tool(s)

 ST1268-A	Clamp Plate, Driveshaft 205-320 (T92L-4851-C)
 ST1266-A	Dial Indicator Gauge with Holding Fixture 100-D002 (D78P-4201-B) or equivalent
 ST1267-A	Runout Gauge, Drive Pinion Flange 205-319 (T92L-4851-B)

Material

Item	Specification
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-
Threadlock and Sealer TA-25	WSK-M2G351-A5

Principles of Operation

The driveline system enables the power generated by the engine and transferred through the transmission and, if applicable, transfer case, to place the vehicle in motion. Rotational torque received from the transmission or transfer case is delivered to the front and rear drive axles by way of the driveshafts. The U-joints or CV joints at the ends of the shafts allow the shafts to rotate smoothly in an allowable angle plane. The rotational torque is introduced into the axle drive pinion which drives the differential ring gear. The ring gear is bolted to the differential case flange on the differential. The differential divides the torque between the right and left halfshaft while permitting the halfshafts to turn at different speeds when required, such as when cornering.

Inspection and Verification

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

Visual Inspection Chart

Mechanical

- U-joints
- CV joints
- Center bearings
- Driveshaft tubes
- Mounting brackets
- Flanges
- Housing and cover damage
- Differential bearings
- Differential gear sets
- Pinion bearings

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, verify the symptom and GO to Symptom Chart - Driveline or GO to Symptom Chart - NVH .

Symptom Chart - Driveline

Symptom Chart - Driveline

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Axle howling or whine - front or rear axle
- Axle lubricant low
- CHECK the lubricant level. FILL the axle to specification. REFER to Section 205-02 or Section 205-03 .
- Axle housing damage
- INSPECT the axle housing for damage. REPAIR or INSTALL a new axle as necessary. REFER to Section 205-02 or Section 205-03 .
- Damaged or worn wheel hub bearings

- CHECK for abnormal wheel hub bearing play or roughness. REFER to Section 204-01A , Section 204-01B or Section 204-02 .
- Damaged or worn differential ring and pinion
- INSPECT and INSTALL a new differential ring and pinion as necessary. REFER to Section 205-02 or Section 205-03 .
- Damaged or worn differential side or pinion bearings
- INSPECT and INSTALL new differential side or pinion bearings as necessary. REFER to Section 205-02 or Section 205-03 .
- Driveline clunk - loud clunk when shifting from REVERSE to DRIVE
- Incorrect axle lubricant level
- CHECK the lubricant level. FILL the axle to specification. REFER to Section 205-02 or Section 205-03 .
- Excessive backlash in the axle
- CHECK the ring gear backlash. REPAIR as necessary. REFER to Section 205-02 or Section 205-03 .
- Damaged or worn pinion bearings
- REPAIR or INSTALL new pinion bearings as necessary. REFER to Section 205-02 or Section 205-03 .
- Damaged or worn U-joints
- INSPECT the U-joints for wear or damage. INSTALL new U-joints or driveshaft as necessary. REFER to Section 205-01 .
- Driveline clunk - occurs as the vehicle starts to move forward following a stop
- Worn driveshaft CV joint or U-joints with excessive play
- INSPECT the CV joint and U-joints for a worn condition. INSTALL a new driveshaft or U-joints as necessary. REFER to Section 205-01 .
- Loose axle mount
- CHECK the axle for loose bolts. TIGHTEN to specification. REFER to Section 205-02 or Section 205-03 .
- Driveline clunk - occurs during acceleration or from cruise to coast/deceleration
- Damaged or worn CV joint
- INSPECT the CV joint and boot. INSTALL a new CV joint as necessary. REFER to Section 205-04 or Section 205-05 .
- Clicking, popping or grinding - occurs while the vehicle is turning

- Inadequate or contaminated lubrication in the CV joints
- CHECK the CV boots and joints for wear or damage. INSTALL new components as necessary. REFER to Section 205-04 or Section 205-05 .
- Another component contacting the halfshaft
- CHECK the halfshafts and the area around the halfshafts. REPAIR as necessary.
- High pitched chattering - noise from the axle when the vehicle is turning
- Incorrect or contaminated lubricant
- CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). FLUSH and REFILL the axle to specification. REFER to Section 205-02 or Section 205-03 .
- Damaged or worn differential (differential side gears and pinion gears)
- REPAIR or INSTALL new differential side gears or pinion gears as necessary. REFER to Section 205-02 or Section 205-03 .
- Buzz - buzzing noise is the same at cruise or coast/deceleration
- Incorrect driveline angles
- CHECK for correct driveline angles. REPAIR as necessary. REFER to Driveline Angle Measurement in this section.
- Rumble or boom - noise occurs at coast/deceleration, usually driveshaft speed-related and noticeable over a wide range of speeds
- Driveshaft is out-of-balance
- CHECK the driveshaft for damage, missing balance weights or undercoating. REFER to Driveshaft Runout and Balancing in this section.
- U-joints are binding or seized
- ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL new U-joints or driveshaft as necessary. REFER to Section 205-01 .
- Grunting - normally associated with a shudder experienced during acceleration from a complete stop
- Driveshaft CV joint binding
- CLEAN the CV joint and INSTALL a new driveshaft as necessary. REFER to Section 205-01 .
- Loose axle mount bolts or suspension fasteners
- INSPECT the rear suspension and axle. TIGHTEN the fasteners to specification. REFER to Section 205-02 or Section 205-03 .
- Howl - can occur at various speeds and driving conditions. Affected by acceleration and deceleration

- Incorrect ring and pinion contact, incorrect bearing preload or gear damage
- INSPECT and REPAIR as necessary. REFER to Section 205-02 or Section 205-03 .
- Chuckle - heard at coast/deceleration. Also described as a knock
- Incorrect ring and pinion contact or damaged teeth on the coast side of the ring and pinion
- INSPECT and REPAIR as necessary. REFER to Section 205-02 or Section 205-03 .
- Knock - noise occurs at various speeds. Not affected by acceleration or deceleration
- Gear tooth damage to the drive side of the ring and pinion
- INSTALL a new ring and pinion. REFER to Section 205-02 or Section 205-03 .
- Scraping noise - a continuous low pitched noise starting at low speeds
- Worn or damaged pinion bearings
- INSPECT and REPAIR or INSTALL new pinion bearings. REFER to Section 205-02 or Section 205-03 .
- Driveline shudder - occurs during acceleration from a slow speed or stop
- Drive axle assembly mispositioned
- CHECK the axle mounts and the rear suspension for damage or wear. REPAIR as necessary. REFER to Section 205-02 or Section 205-03 .
- Loose axle bolts
- CHECK the axle for loose bolts. TIGHTEN the bolts to specification. REFER to Section 205-02 or Section 205-03 .
- Driveline angles out of specification
- CHECK for correct driveline angles. REFER to Driveline Angle Measurement in this section.
- U-joints binding or seized
- ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL new U-joints or driveshaft as necessary. REFER to Section 205-01 .
- Binding or damaged driveshaft CV joint
- INSPECT the driveshaft CV joint and coupling shaft for wear or damage. INSTALL a new driveshaft as necessary. REPAIR as necessary. REFER to Section 205-01 .
- Transfer case
- REFER to Section 308-07A .
- Driveline vibration - occurs at cruising speeds

- Worn U-joints
- CHECK for wear or incorrect seating. INSTALL new U-joints or driveshaft as necessary. REFER to Section 205-01 .
- Worn or damaged driveshaft center bearing support
- CHECK the insulator for damage or wear. ROTATE the driveshaft and CHECK for rough operation. INSTALL a new driveshaft as necessary. REFER to Section 205-01 .
- Loose axle pinion flange bolts
- INSPECT the axle pinion flange. TIGHTEN the pinion flange bolts to specification. REFER to Section 205-01 .
- Excessive axle pinion flange runout
- CARRY OUT a Pinion Flange Runout Check. REPAIR as necessary. REFER to Pinion Flange Runout Check in this section.
- Driveshaft is out-of-balance
- CHECK the driveshaft for damage, missing balance weights or undercoating. CHECK the driveshaft balance. CARRY OUT a driveline vibration test. REFER to Driveshaft Runout and Balancing in this section.
- Binding or damaged driveshaft CV joint
- INSPECT the driveshaft CV joint for wear or damage. INSTALL a new driveshaft as necessary. REFER to Section 205-01 .
- Excessive driveshaft runout
- CARRY OUT a runout check. REFER to Driveshaft Runout and Balancing in this section.
- Driveline angles out of specification
- CHECK for correct driveline angles. REPAIR as necessary. REFER to Driveline Angle Measurement in this section.
- Incorrectly seated CV joint in the wheel hub
- CHECK the outer CV joint for correct seating into the hub. REPAIR as necessary. REFER to Section 205-04 for the front CV joints or Section 205-05 for the rear CV joints.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source.

A plugged axle housing vent can cause excessive pinion seal lip wear due to internal pressure buildup.

Verify the lubricant level is at specification.

Axle Vent

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. If the vent cannot be cleared, install a new vent.

Drive Pinion Seal

Leaks at the drive pinion seal originate from the following causes:

- Damaged seal
- Worn seal journal surface

Any damage to the seal bore (dings, dents, gouges or other imperfections) distorts the seal casing and allows leakage past the outer edge of the drive pinion seal.

The drive pinion seal can be torn, cut or gouged if it is not installed correctly. The spring that holds the drive pinion seal against the pinion flange may be knocked out and allow fluid to pass the lip.

Metal chips trapped at the sealing lip can cause oil leaks. These can cause a wear groove on the drive pinion flange and result in pinion seal wear.

When a seal leak occurs, install a new drive pinion seal and check the vent to make sure it is clean and free of foreign material.

A new drive pinion flange must be installed if any of these conditions exist.

Drive Pinion Nut

NOTICE: **Install the drive pinion nut to the correct torque specifications or damage to the differential components may occur.**

On some high-mileage vehicles, oil may leak through the threads of the drive pinion nut. This condition can be corrected by installing a new nut and applying threadlock and sealer on the threads and nut face.

Differential Seals

NOTICE: **When installing shafts, do not allow splines to contact seals during installation or damage to the seals may occur.**

Halfshaft pilot bearing housing seals are susceptible to the same types of damage as drive pinion seals if incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

For information on differential seals, refer to Section 205-02 .

Component Tests

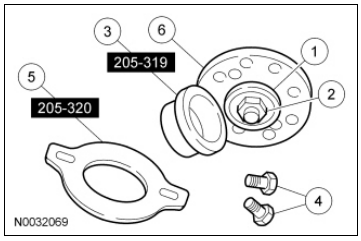
Pinion Flange Runout Check - Circular

NOTICE: **Pinion bearing preload must be reset if the pinion nut has been loosened or removed for pinion flange reindexing or replacement or damage to the component may occur.**

1. Remove the driveshaft. Refer to Section 205-01 .

2. Check the pinion flange for damage.

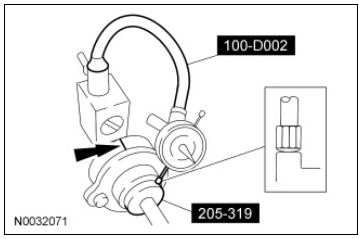
3. Position the Drive Pinion Flange Runout Gauge and Driveshaft Clamp Plate on the pinion flange.



Item	Part Number	Description
1	-	Pilot (part of 205-319) (T92L-4851-B)
2	354845	Pinion nut
3	205-319	Drive Pinion Flange Runout Gauge (T92L-4851-B)
4	-	Bolts (part of 205-320) (2 required) (T92L-4851-C)
5	205-320	Driveshaft Clamp Plate (T92L-4851-C)
6	4851	Pinion flange

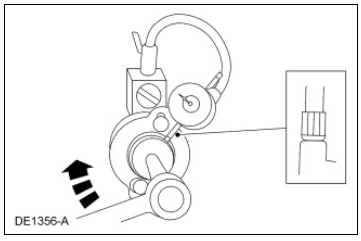
4. Align the holes on the clamp plate with the holes in the pinion flange and install the bolts. Snug the bolts evenly.

5. Position the Dial Indicator Gauge with Holding Fixture as shown. Turn the Drive Pinion Flange Runout Gauge, and locate and mark the high spot on the pinion flange with yellow paint.



If the flange runout exceeds 0.203 mm (0.008 in), remove the pinion flange, reindex the flange one-half turn on the pinion, and reinstall it. Refer to Section 205-02 or Section 205-03 for the flange removal and installation procedures.

6. Check the runout again. If necessary, rotate the flange until an acceptable runout is obtained. If the flange runout is still more than 0.203 mm (0.008 in), install a new pinion flange.



7. If excessive runout is still evident after replacement of the pinion flange, install a new ring and pinion. Repeat the above checks until the runout is within specifications.

8. Install the driveshaft. Refer to Section 205-01 .

Tooth Contact Pattern Check - Gearset

1. To check the gear tooth contact, paint the gear teeth with the special marking compound. A mixture that is too wet will run and smear; a mixture that is too dry cannot be pressed out from between the teeth.

2. Use a box wrench on the ring gear bolts as a lever to rotate the ring gear several complete revolutions in both directions or until a clear tooth contact pattern is obtained.

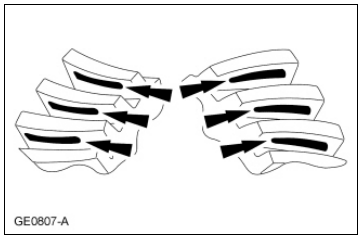
3. Certain types of gear tooth contact patterns on the ring gear indicate incorrect adjustment. Incorrect adjustment can be corrected by readjusting the ring gear or the pinion.

Contact Pattern Location

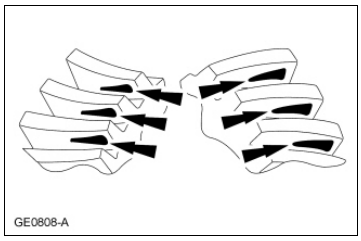
In general, desirable ring gear tooth patterns must have the following characteristics:

- Drive pattern on the drive side ring gear well centered on the tooth
- Coast pattern on the coast side ring gear well centered on the tooth
- Clearance between the pattern and the top of the tooth
- No hard lines where the pressure is high

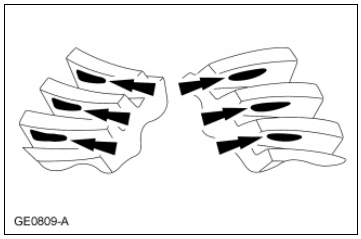
Acceptable ring gear tooth patterns for all axles.



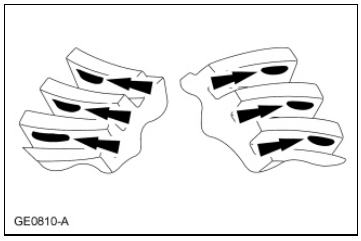
Correct backlash with a thinner pinion position shim required.



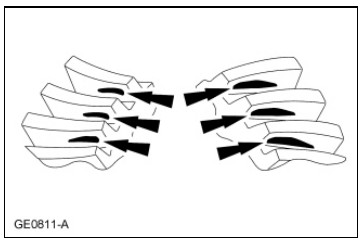
Correct backlash with a thicker pinion position shim required.



Correct pinion position shim that requires a decrease in backlash.

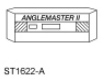


Correct pinion position shim that requires an increase in backlash.



Driveline Angle Measurement

Special Tool(s)

 ST1622-A	Anglemaster II Driveline Inclinometer/Protractor 164-R2402 or equivalent

NOTE: This procedure does not apply to CV joints, flex couplers or double cardan joints that are used in some driveshafts. This check is for single-cross and roller-style joints found in the driveshafts.

NOTE: Prior to checking driveline angularity, inspect the U-joints for correct operation.

NOTE: An incorrect driveline angle can cause a vibration or shudder. For additional information, refer to Section 100-04 .

NOTE: Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft and the rear axle pinion. Factors determining driveline angularity include ride height, rear spring and engine mounts.

All vehicles

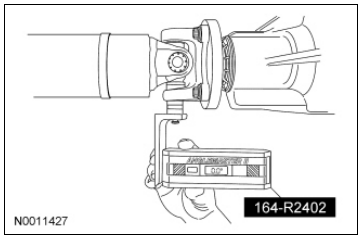
1. Carry out the following preliminary setup steps:
   - Inspect the U-joints for correct operation.
   - Park the vehicle on a level surface such as a drive-on hoist, or back onto a front end alignment rack.
   - Verify the curb position ride height is within specifications with the vehicle unloaded and all of the tires are inflated to their normal operating pressures.
   - Calibrate the Anglemaster II Driveline Inclinometer/Protractor by placing it on a clean, flat level section of the frame rail and press the ALT-ZERO button.

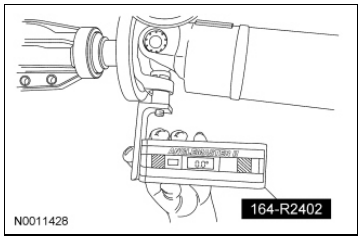
Vehicles with flat-flanged, split-pin or slip-flanged U-joints

2. **NOTE:** If equipped, remove the snap ring to allow access to the base of the U-joint cup. Make sure the Anglemaster II Driveline Inclinometer/Protractor is seated against the U-joint cup.

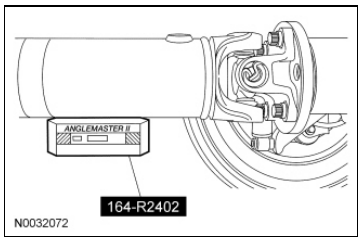
   NOTE: Rotate the driveshaft until the flange U-joint cup is parallel with the floor. This will simplify taking measurements.

   To check the U-joint operating angle, install the Anglemaster II Driveline Inclinometer/Protractor. Check and record the flange angle as angle A.





3. Using the Anglemaster II Driveline Inclinometer/Protractor, measure the slope of the connecting component. Record the measurement of the component angle as angle B.

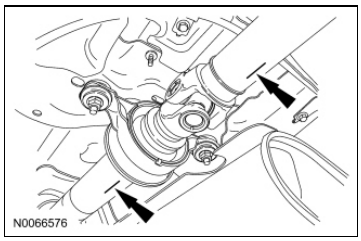


Multiple piece driveshafts

4. **NOTE:** Repeat this step for each center support bearing on the driveshaft.

   NOTE: It is not necessary to remove the U-joint snap ring, if equipped, for these measurements.

   Using the Anglemaster II Driveline Inclinometer/Protractor, measure the slope of the components in front and behind the center support bearing U-joint in the area indicated. Record the front component as angle A and the rear component as angle B.



All vehicles

5. **NOTE:** When 2 connected components slope in the same direction, subtract the smallest number from the larger number to find the U-joint operating angle. When 2 connected components slope in the opposite direction, add the measurements to find the U-joint operating angle.

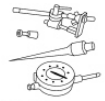
   Calculate the difference in the slope of the components to determine the U-joint operating angle.

   - The U-joint operating angle is the angle formed by 2 yokes connected by a cross and bearing kit. Ideally, the operating angles on each connection of the driveshaft must:
     - be equal or within one degree of each other.
     - have a 3 degree maximum operating angle.
     - have at least one-half of one degree continuous operating angle.

6. If the angle is not within specifications, repair or adjust to obtain the correct angle. Inspect the engine mounts, transmission mounts, center support bearing mounting, rear suspension, rear axle, rear axle mounting or the frame for wear or damage.

Driveshaft Runout and Balancing

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST3025-A	Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018 or equivalent

Driveshaft Inspection

NOTE: Driveline vibration exhibits a higher frequency and lower amplitude than high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is noticed at various speeds. Driveline vibration can be perceived as a tremor in the floorpan or heard as a rumble, hum or boom.

NOTE: Refer to Specifications in this section for all runout specifications.

1. **NOTE:** Do not make any adjustments before carrying out a road test. Do not change the tire pressure or the vehicle load.

   Carry out a visual inspection of the vehicle. Operate the vehicle and verify the condition by reproducing it during the road test.

   - The concern should be directly related to vehicle road speed, not affected by acceleration or deceleration or could not be reduced by coasting in NEUTRAL.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
   - The driveshaft should be kept at an angle equal to or close to the curb-weighted position. Use a twin-post hoist or a frame hoist with jackstands.

3. Inspect the driveshaft for damage, undercoating or incorrectly seated U-joints. Rotate the driveshaft slowly by hand and feel for binding or end play in the U-joint trunnions. Remove the driveshaft. For additional information, refer to Section 205-01 . Inspect the slip yoke splines for any galling, dirt, rust or incorrect lubrication. Clean the driveshaft or install new U-joints as necessary. Install a new driveshaft if damaged. After any corrections or new components are installed, recheck for the vibration at the road test speed.
   - If the vibration is gone, test drive the vehicle.
   - If the vibration persists or the driveshaft passes visual inspection, measure the driveshaft runout.

Driveshaft Runout

1. Install the Dial Indicator Gauge with Holding Fixture. Rotate the driveshaft by turning the axle and measure the runout at the front, the center and the rear of the driveshaft.

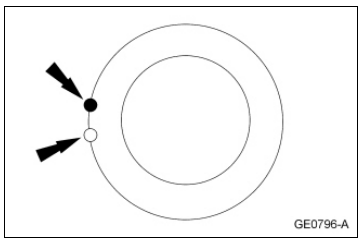
- If the runout exceeds 1 mm (0.040 in) at the front or center, install a new driveshaft.
- If the front and center is within 1 mm (0.040 in), but the rear runout is not, index-mark the rear runout high point and proceed to Step 2.
- If the runout is within 1 mm (0.040 in) at all points, recheck for vibration at road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to Driveshaft Balancing in this procedure.

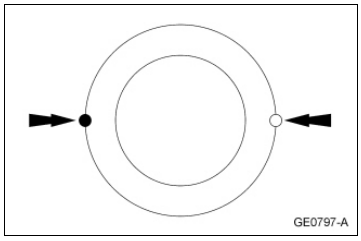
2. **NOTE:** Circular pinion flanges can be turned in 90 degree or one-fourth increments. Half-round pinion flanges are limited to 2 positions.

   Index-mark the driveshaft to the pinion flange. Disconnect the driveshaft and rotate it 180 degrees. Reconnect the driveshaft. Recheck the runout at the rear of the driveshaft.

   - If the runout is still over specification, mark the high point and proceed to Step 3.
   - If the runout is within specification, check for the vibration at the road test speed. If the vibration is still present, balance the driveshaft. For additional information, refer to Driveshaft Balancing in this procedure.

3. Excessive driveshaft runout can originate in the driveshaft itself or from the pinion flange. To find the source, compare the 2 high points previously determined.
   - If the index marks are close together, within 25 mm (1 in), the driveshaft is eccentric. Install a new driveshaft.
   - If the marks are on opposite sides of the driveshaft, 180 degrees apart, the slip yoke or pinion flange is responsible. Check the pinion flange runout. If the pinion flange runout exceeds specifications, a bent pinion is indicated.
   - If the pinion flange and pinion runouts are within specifications, road test and check for the vibration at the road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to Driveshaft Balancing in this procedure.





Driveshaft Balancing - Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)

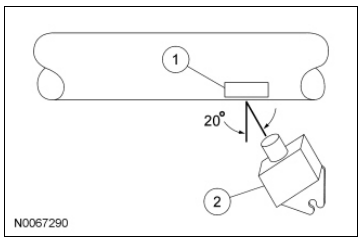
All vehicles

1. Install the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) to the vehicle.

2. Working under the vehicle, install an accelerometer. The accelerometer can be attached and mounted

near either the transmission or differential end of the driveshaft.

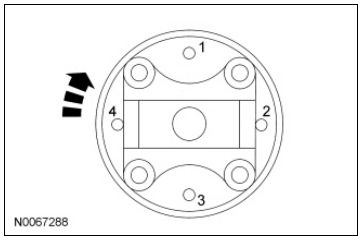
3. Clean an area of the driveshaft and install the reflective tape, then install the photo-tachometer sensor. The sensor should be placed at approximately a 20-degree angle from perpendicular to the surface of the reflective tape. Make sure the sensor does not get moved during the balance procedure.
    1. Reflective tape.
    2. Photo-tachometer sensor.



4. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a driveshaft balance test with the driveshaft unmodified.

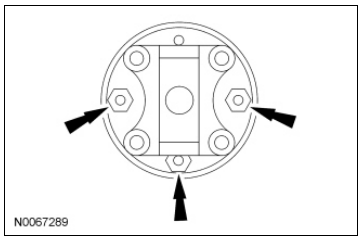
Vehicles with tapped pinion flanges

5. Label the tapped holes in the pinion flange numerically, starting at the top hole as 1. Mark the remaining holes 2, 3 and 4. Label in the direction of rotation.



6. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with the 12 mm (0.47 in) test weight set screw in the No. 1 hole, previously marked on the pinion flange.

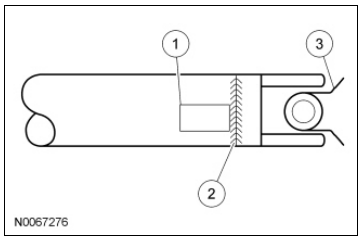
7. Remove the test weight, then install the weight combination directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix).



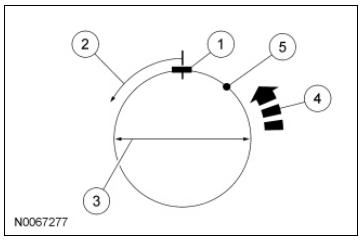
Vehicles without tapped pinion flanges

8. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with a test weight. Using a metal band, secure the test weight to the end of the driveshaft. The weight should be placed at the end of the driveshaft tube, as close to the tube-to-yoke weld seam as possible. Mark the location of the test weight on the driveshaft, as shown in the figure below.
    1. Test weight.
    2. Tube-to-yoke weld seam.
    3. Driveshaft pinion flange.

- Select the test weight based on driveshaft size. Larger driveshafts use 10 g (0.353 oz). Smaller driveshafts use 5 g (0.176 oz).



9. Remove the test weight, then install the recommended weight at the position directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix). Using a metal band and epoxy, secure the test weight to the driveshaft, as shown in the figure below.
    1. Test weight.
    2. Measure in this direction.
    3. Driveshaft diameter.
    4. Directional rotation.
    5. Balance weight relative to test weight centerline.
    - The results are displayed with respect to the location to where the test weight was placed.



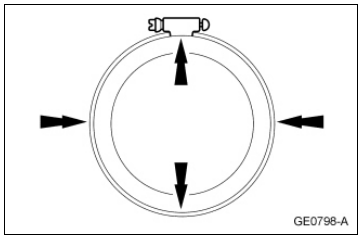
All vehicles

10. Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a third test to verify the repair.

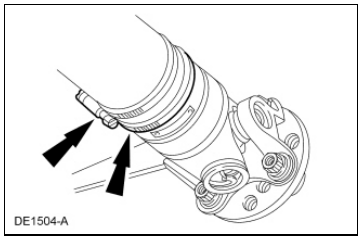
Driveshaft Balancing - Hose Clamp Method

1. Install 1 or 2 hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined through trial and error.

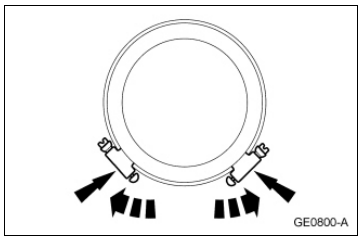
2. Mark the rear of the driveshaft into 4 approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1, as shown in the figure below. Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If 2 adjacent positions show equal improvement, position the clamp head between them.



3. If the vibration persists, add a second clamp at the same position and recheck for vibration.



4. If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 2. Separate the clamp heads about 13 mm (1/2 in) and recheck for vibration at the road speed.



5. Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

Material

Item	Specification	Fill Capacity
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

Torque Specifications

Description	Nm	lb-ft	lb-in
CV flange bolts	30	22	-
Driveshaft center bearing bracket nuts	55	41	-
Driveshaft flange bolts	112	83	-
Driveshaft yoke bolt	37	27	-
U-joint strap bolts	19	-	168

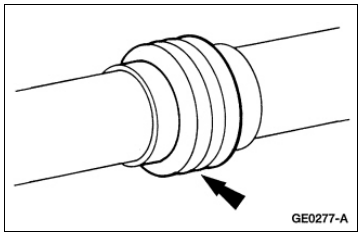
Driveshaft

The driveshafts consist of the following:

- U-joint flanges
- U-joints
- Nylon thrust washers, located at each base of the bearing cup, which control end play, position the needle bearings and improve grease movement
- Lubed-for-life design and require no lubrication
- CV joint flanges
- CV joints
- Slip-yoke
- Slip-joint boots
- Traditional welded-on balance weights

Vehicles have the following types of driveshafts:

- One-piece rear driveshaft with 2 U-joints and a front slip-yoke
- One-piece front driveshaft with a front U-joint, a slip-yoke and a rear CV joint
- Two-piece rear driveshaft with 3 U-joints
- Two-piece rear driveshaft with 2 CV joints and one U-joint



NOTE: Whenever the vehicle is raised on a hoist, inspect the U-joint slip-yoke boot for rips or holes. Install new if required.

NOTE: All driveshafts are balanced. If undercoating the vehicle, protect the driveshaft and U-joints to prevent application of any undercoating material.

The driveshaft transfers input from the transmission or transfer case to the front or rear drive axles. The driveshaft is composed of the U-joints or CV joints, connecting shafts and attaching yokes. The driveshaft accommodates the change in length in the driveline system by sliding on the transmission output shaft with a slip-yoke or a slip-joint which is integral to the driveshaft. The shafts vary in diameter, length, number of coupling shafts and U-joints or CV joints, depending on vehicle application. The U-joints and CV joints allow the driveshaft to rotate smoothly through the changing angles between the transmission output shaft and the driveshaft, plus the changes between the rear axle pinion angle and the driveshaft. On 2-wheel drive vehicles, power is transmitted through the transmission to the driveshaft and then to the rear axle. On All-Wheel Drive (AWD) vehicles, power is transmitted from the transmission to the front and rear axles through the transfer case.

The engine angle is built into the engine mounts. If the driveshaft angles are out of specification, the engine mounts must be inspected for damage.

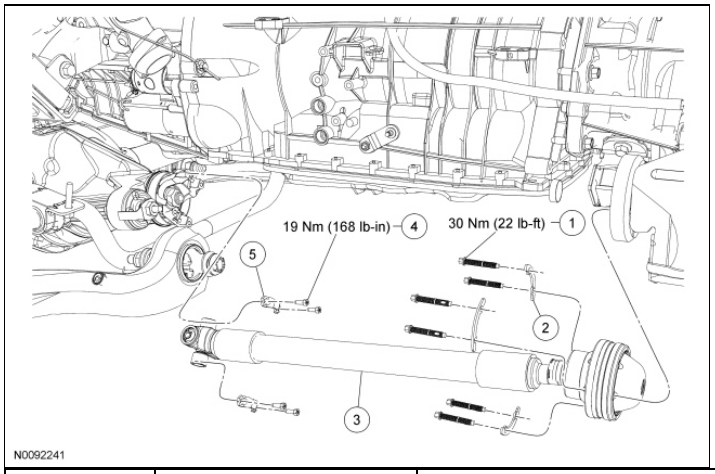
Driveshaft

Refer to Section 205-00 .

Driveshaft - Front

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5



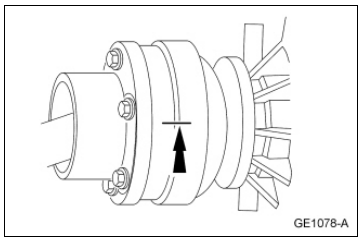
Item	Part Number	Description
1	211982	CV joint bolt (6 required)
2	232715	CV joint bolt washer (3 required)
3	4602	Driveshaft assembly
4	389665-S	U-joint strap bolt (4 required)
5	4639	U-joint strap (2 required)

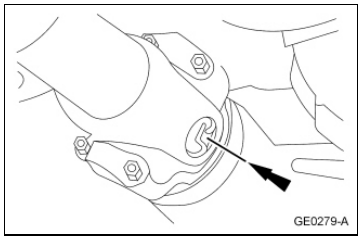
Removal and Installation

NOTICE: **Always disconnect the front driveshaft from the transfer case first. Otherwise, the weight of the driveshaft may pinch the boot between the driveshaft and damage the Constant Velocity (CV) joint flange which may cause the boot to tear.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Index-mark the front driveshaft at both ends to maintain driveshaft balance.



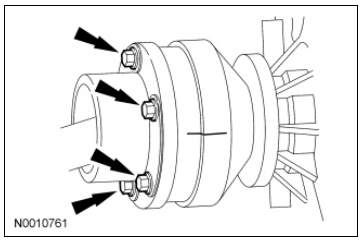


3. **NOTE:** The new CV flange bolts and washers are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

   NOTE: If new U-joint strap bolts are not available and the original bolts are not damaged, they can be reused if the threads are coated with threadlock and sealer.

   Remove and discard the 6 CV flange bolts and 3 CV joint washers.

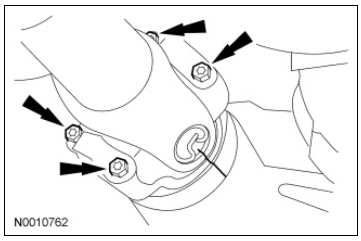
   - To install, tighten the new bolts to 30 Nm (22 lb-ft).



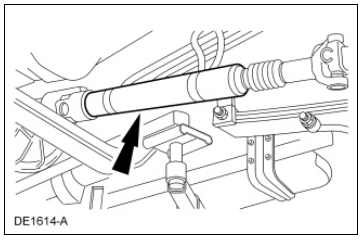
4. **NOTE:** If new U-joint strap bolts are not available and the original bolts are not damaged, they can be reused if the threads are coated with threadlock and sealer.

   Remove the 4 U-joint strap bolts and remove the 2 U-joint straps.

   - Discard the bolts.
   - To install, tighten the new bolts to 19 Nm (168 lb-in).



5. Remove the front driveshaft.

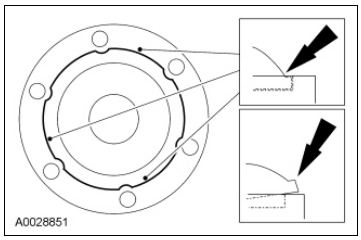


6. ***NOTICE:*** **Tighten the Constant Velocity (CV) joint bolts evenly in a cross pattern or damage will occur to the CV joint.**

NOTE: The can (domed CV joint housing cover) is pressed into the CV joint housing at the factory. When housed correctly, the can will appear as shown in the cut-away illustration (top box). Do not reseat the can in the CV joint housing if the can's flange is above the CV joint housing as shown in the cut-away illustration (bottom box), install a new driveshaft.

NOTE: The CV joint is not serviceable. Install a new driveshaft if damaged.

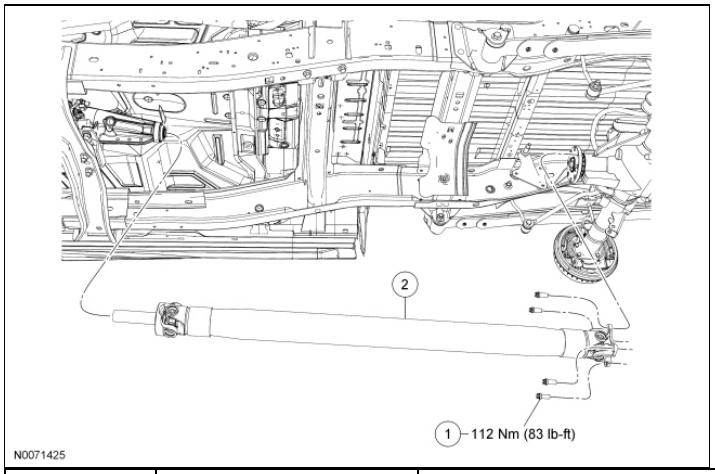
To install, reverse the removal procedure.



Driveshaft - Rear, One-Piece, 4.0L SOHC

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5



Item	Part Number	Description
1	N800594-S	Bolt-to-pinion flange (4 required)
2	4602	Driveshaft

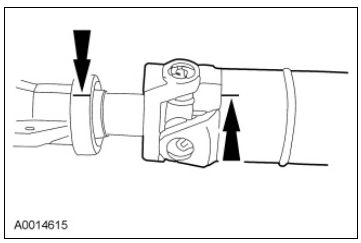
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

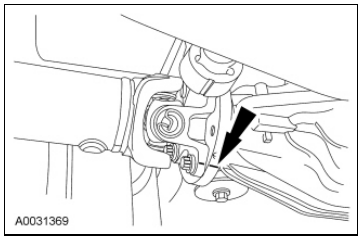
2. **NOTE:** Make sure the index marks on the extension housing and driveshaft are aligned before separation.

   NOTE: After removing the driveshaft, place an index mark on the transmission output shaft that matches the transmission extension housing mark.

   Index-mark the driveshaft and the extension housing to maintain driveshaft balance.



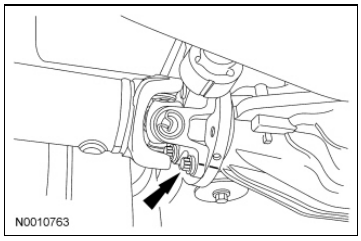
3. Index-mark the driveshaft flange to the pinion flange to maintain driveshaft balance.



4. **NOTE:** If new pinion flange bolts are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

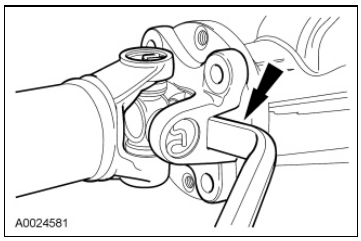
   Remove and discard the 4 driveshaft pinion flange bolts.

   - To install, tighten the new bolts to 112 Nm (83 lb-ft).



5. **NOTE:** The driveshaft flange yoke fits tightly on the pinion flange pilot. Never hammer on the driveshaft, or any of its components, to disconnect the driveshaft flange from the pinion flange.

   Using a suitable tool, pry only in the area shown to separate the driveshaft flange yoke from the pinion flange and remove the driveshaft from the extension housing.



6. **NOTE:** The driveshaft flanges fit tightly on the pinion flange pilot. To make sure that the driveshaft flange seats squarely on the pinion flange, tighten the driveshaft flange bolts evenly in a cross pattern.

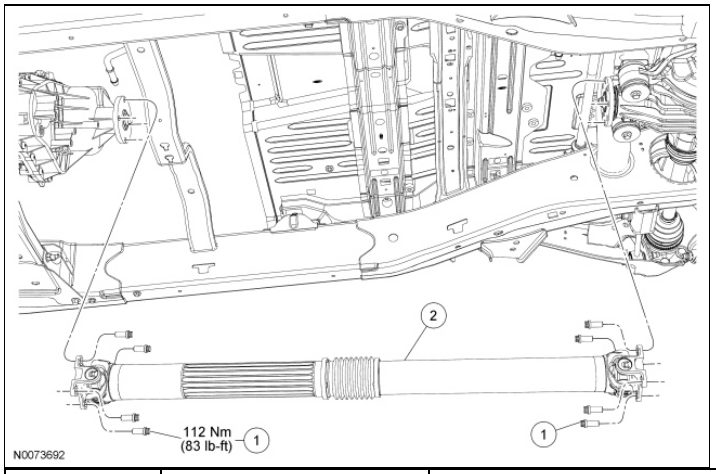
   NOTE: If new driveshaft flange bolts are not available, coat the threads of the original driveshaft flange bolts with threadlock and sealer.

   To install, reverse the removal procedure.

Driveshaft - Rear, One-Piece, 4.6L (3V)

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5



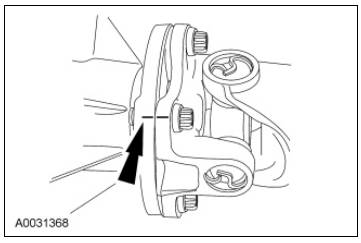
Item	Part Number	Description
1	N800594	U-joint flange bolts (8 required)
2	4602	Driveshaft assembly

Removal and Installation

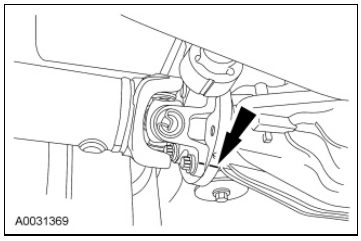
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. If equipped, remove the skid plate.

3. Index-mark the driveshaft flange to the transfer case rear output flange to maintain driveshaft balance.



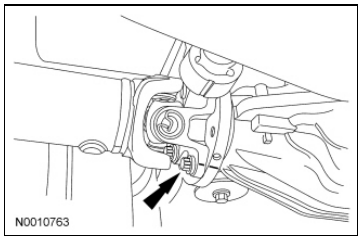
4. Index-mark the driveshaft flange to the pinion flange to maintain driveshaft balance.



5. **NOTE:** If new pinion flange bolts are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

   Remove and discard the 4 driveshaft flange bolts.

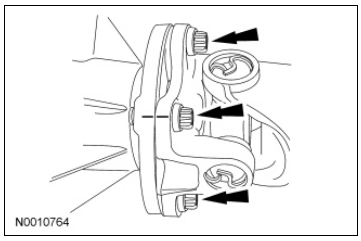
   - To install, tighten the 4 new bolts to 112 Nm (83 lb-ft).



6. **NOTE:** If new pinion flange bolts are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

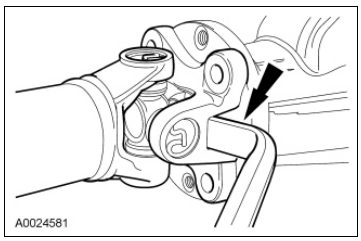
   Remove and discard the 4 transfer case rear output flange bolts.

   - To install, tighten the 4 new bolts to 112 Nm (83 lb-ft).



7. **NOTE:** The driveshaft flange fits tightly on the axle pinion flange pilot and the transfer case output flange. Never hammer on the driveshaft, or any of its components, to disconnect the driveshaft flanges from the mating flanges. Pry only in the area shown with a suitable tool.

   Using a suitable tool as shown, disconnect the driveshaft flanges and remove the driveshaft.



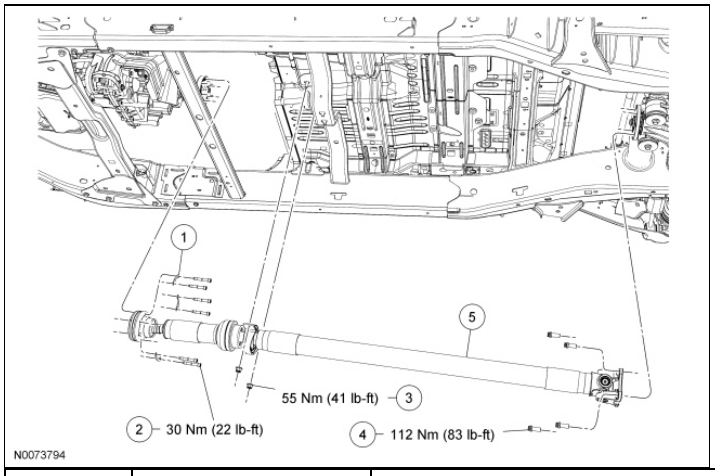
8. **NOTE:** The driveshaft flanges fit tightly on the pinion flange pilots. To make sure that the driveshaft flanges seat squarely on the pinion flanges, tighten the driveshaft flange bolts evenly in a cross pattern.

To install, reverse the removal procedure.

Driveshaft - Rear, Two-Piece, Four Wheel Drive (4WD)

Material

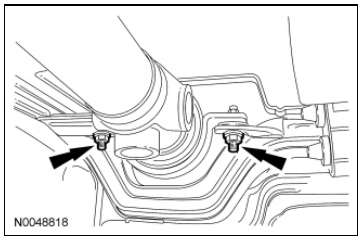
Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5



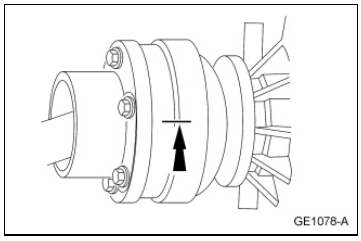
Item	Part Number	Description
1	4A467	Washer (3 required)
2	-	Bolt (part of 4A467) (6 required)
3	W520213-S	Center bearing support nut (2 required)
4	N800594	Driveshaft flange bolt (4 required)
5	4685	Driveshaft

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

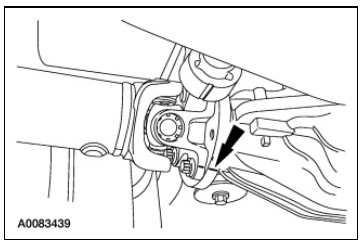
2. Remove the 2 nuts from the driveshaft center bearing bracket.
   - To install, tighten to 55 Nm (41 lb-ft).



3. Index-mark the CV joint to the transfer case output flange.



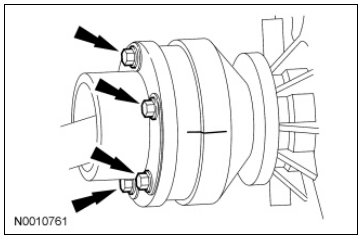
4. Index-mark the rear U-joint flange to the differential pinion flange.



5. **NOTE:** If new CV flange bolts and washers are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

   Remove and discard the 6 CV joint bolts and 3 CV joint washers.

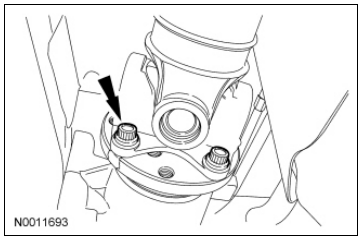
   - To install, tighten the 6 new bolts to 30 Nm (22 lb-ft).



6. **NOTE:** If new flange bolts are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

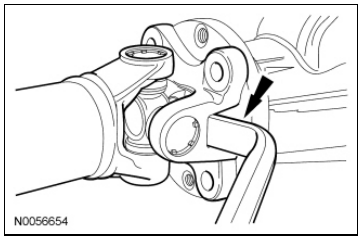
   Remove and discard the 4 driveshaft flange bolts.

   - To install, tighten the 4 new bolts to 112 Nm (83 lb-ft).



7. **NOTE:** Never hammer on the driveshaft, or any of its components, to disconnect the driveshaft flange from the differential pinion flange.

   Using a suitable tool, pry only in the area shown to separate the driveshaft flange and the differential pinion flange.



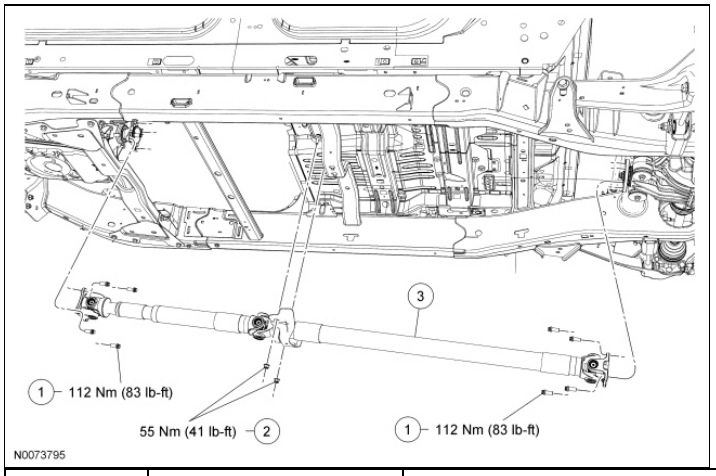
8. Slide the driveshaft toward the rear of the vehicle, while maneuvering the front section over the top of the vehicle frame crossmember and remove the driveshaft.

9. To install, reverse the removal procedure.

Driveshaft - Rear, Two-Piece, Rear Wheel Drive (RWD)

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

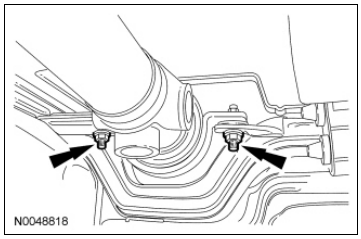


Item	Part Number	Description
1	N800594	Driveshaft flange bolts (8 required)
2	W520213-S	Center bearing support nuts
3	4685	Driveshaft assembly

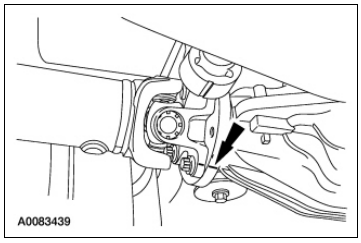
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the 2 nuts from the driveshaft center bearing bracket.
   - To install, tighten to 55 Nm (41 lb-ft).



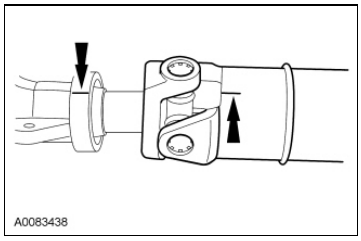
3. Index-mark the rear U-joint flange to the differential pinion flange.



4.0L engine

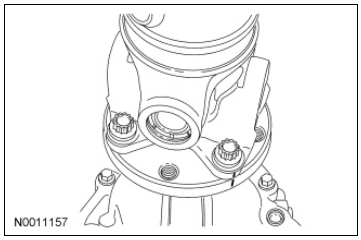
4. **NOTE:** After removing the driveshaft, without rotating the driveshaft, place an index mark on the transmission output shaft that matches the transmission extension housing mark.

   Index-mark the driveshaft and the extension housing.



4.6L engine

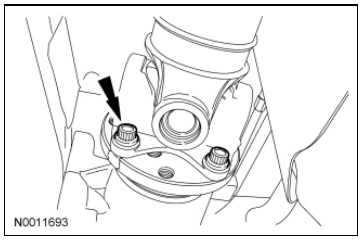
5. Index-mark the front U-joint flange to the transmission output flange.



6. **NOTE:** If new flange bolts are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

   Remove and discard the 4 driveshaft flange bolts from the transmission output shaft flange.

   - To install, tighten the 4 new bolts to 112 Nm (83 lb-ft).

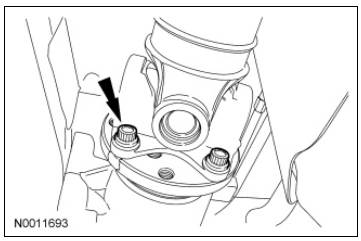


All vehicles

7. **NOTE:** If new flange bolts are not available and the originals are not damaged, they can be reused if the threads are coated with threadlock and sealer.

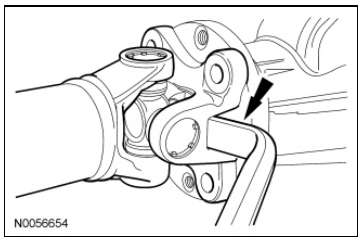
   Remove and discard the 4 driveshaft flange bolts from the drive pinion flange.

- To install, tighten the 4 new bolts to 112 Nm (83 lb-ft).



8. **NOTE:** Never hammer on the driveshaft, or any of its components, to disconnect the driveshaft flange from the differential pinion flange.

   Using a suitable tool, pry only in the area shown to separate the driveshaft flange and the differential pinion or transmission output flange.



9. Slide the driveshaft toward the rear of the vehicle, while maneuvering the front section over the top of the vehicle frame crossmember and remove the driveshaft.

10. To install, reverse the removal procedure.

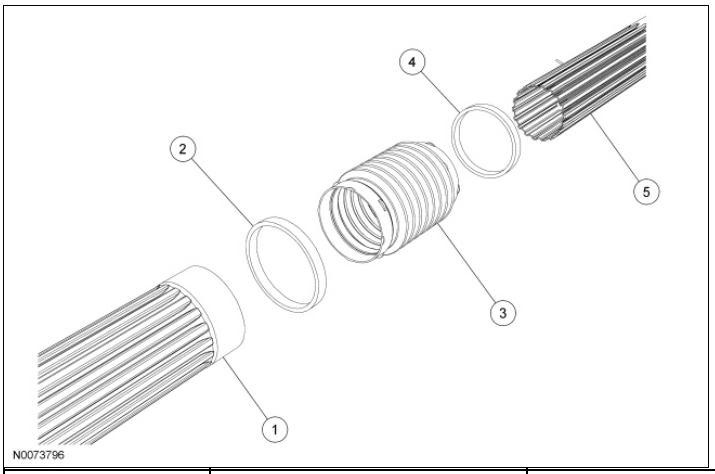
Driveshaft Slip Yoke Boot

Special Tool(s)

 ST1173-A	Installer, Keystone Clamp 211-002 (T63P-9171-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

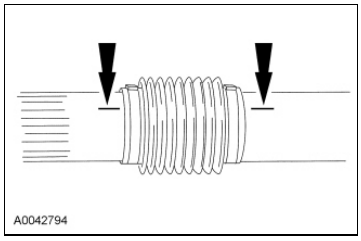


Item	Part Number	Description
1	4685	Driveshaft tube
2	3B478	Slip boot clamp
3	4421	Driveshaft slip boot
4	3B478	Slip boot clamp
5	4685	Driveshaft tube

Removal

1. Remove the driveshaft. For additional information, refer to Driveshaft - Rear, One-Piece, 4.6L (3V) in this section.

2. Index-mark the driveshaft on both sides of the driveshaft slip yoke boot.



3. Remove and discard the 2 driveshaft slip yoke boot clamps.

4. Separate the driveshaft.

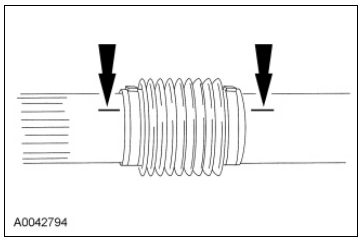
5. Remove the driveshaft slip yoke boot.

Installation

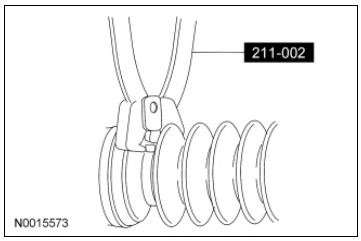
1. **NOTE:** Grease both ends of the driveshaft.

   Position the driveshaft slip yoke boot and the 2 driveshaft slip yoke boot clamps on one end of the driveshaft.

2. Align the index marks and connect the driveshaft.



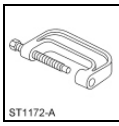
3. Using the Keystone Clamp Installer, install the new driveshaft slip yoke boot.

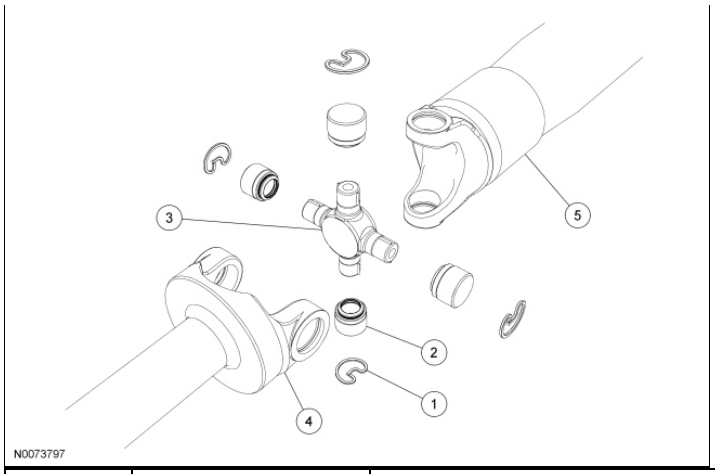


4. Install the driveshaft. For additional information, refer to Driveshaft - Rear, One-Piece, 4.6L (3V) in this section.

Driveshaft Universal Joint - Snap Ring Type

Special Tool(s)

 ST1172-A	Installer/Remover, C-Frame and Screw 205-086 (T74P-4635-C)



Item	Part Number	Description
1	-	Snap ring (part of 4635) (4 required)
2	-	Bearing cup (part of 4635) (4 required)
3	4635	U-joint
4	4841	Driveshaft slip yoke
5	4602	Driveshaft

Disassembly and Assembly

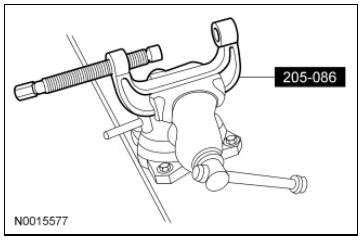
NOTE: The front driveshaft CV joint is not repairable.

1. Remove the driveshaft. For additional information, refer to Driveshaft - Rear, One-Piece, 4.0L SOHC , Driveshaft - Rear, One-Piece, 4.6L (3V) or Driveshaft - Front in this section.

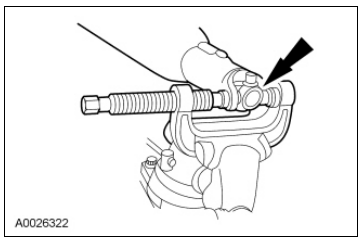
2. Index-mark the components at the U-joints for reassembly.

3. Remove and discard the 4 snap rings.

4. Position the driveshaft in the C-Frame and Screw Installer/Remover. Using the C-Frame and Screw Installer/Remover, press out a bearing cup.



5. If necessary, use a pair of pliers to remove the bearing cup if it cannot be pressed all the way out.
6. Rotate the driveshaft and press on the spider to remove the remaining bearing cup.
7. Remove the driveshaft flange.
8. Position the driveshaft in the C-Frame and Screw Installer/Remover. Using the C-Frame and Screw Installer/Remover, press out the bearing cup.



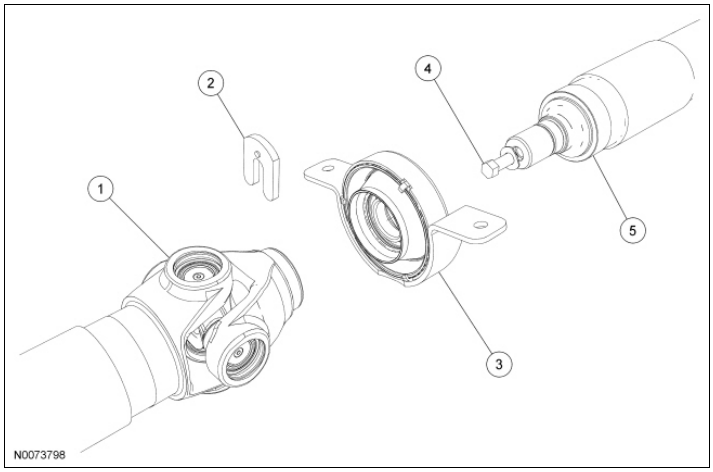
9. If necessary, use a pair of pliers to remove the bearing cup if it cannot be pressed all the way out.
10. Rotate the driveshaft and press on the spider to remove the remaining bearing cup.
11. Remove the spider.
12. **NOTE:** Clean the bearing cup bores.

    NOTE: Check the U-joints for freedom of movement. If binding, strike the driveshaft flange with a brass or plastic hammer. Do not strike the U-joint.

    To assemble, reverse the disassembly procedure.

    - Use the yellow snap rings supplied in the kit to install the U-joint. If difficulty is encountered with the yellow snap rings, install the black snap rings, as required.

Driveshaft Center Bearing



Item	Part Number	Description
1	248-0014	Shaft end yoke
2	207-0171	C-washer
3	4K145	Driveshaft center bearing
4	105-0045	C-washer bolt
5	278-0470	Mid-ship stub shaft

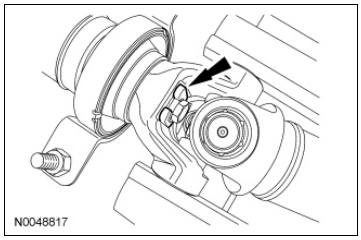
Disassembly

NOTE: The driveshaft center bearing on driveshafts with CV joint flanges are not serviced. If the driveshaft center bearing is worn or damaged, install a new driveshaft.

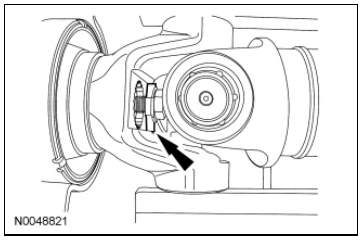
1. Remove the driveshaft. For additional information, refer to Driveshaft - Rear, Two-Piece, Four Wheel Drive (4WD) or Driveshaft - Rear, Two-Piece, Rear Wheel Drive (RWD) in this section.

2. ***NOTICE:*** **Do not clamp the driveshaft tube in a vise. Denting or localized fracturing may result causing driveshaft failure during vehicle operation.**

   Position the center U-joint yoke ears in a vise so that the C-washer is pointing up and the front section is free to move.



3. Loosen the bolt inside the center cardan joint enough to allow the C-washer to fall from under the bolt head.
   - To install, tighten to 37 Nm (27 lb-ft).

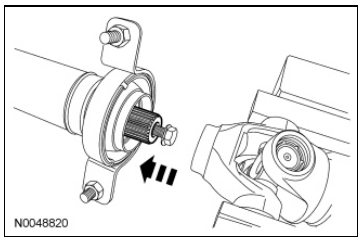


4. **NOTE:** Index-mark the front and rear driveshaft sections.

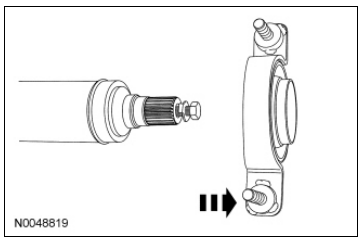
   NOTE: The rear section has a master splined shaft and yoke.

   NOTE: The bolt head will fit through the internal spline of the center cardan.

   Using a rubber mallet, separate the driveshaft sections.



5. Using a suitable puller, remove the driveshaft center bearing from the rear section.



6. **NOTE:** Install the new center bearing with the 3 bend tabs and dust seal lip facing the front of the vehicle.

   To install, reverse the removal process.

Driveshaft Universal Joint - Stake Type

1. The staked driveshaft U-joints are not serviced separately within the warranty period. Install a new driveshaft if worn or damaged.

2. U-joint service kits with instructions are available through a Ford authorized dealer for a high mileage repair.

Material

Item	Specification	Fill Capacity
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-	-
Motorcraft® SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A and GL-5	-
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-

General Specifications

Item	Specification
Rear Axle	
Available drive pinion bearing adjustment shim in steps of 0.25 mm (0.010 in)	0.254 mm (0.010 in)- 0.965 mm (0.038 in)
Backlash between ring gear and pinion teeth	0.208-0.305 mm (0.008-0.012 in)
Differential case maximum runout	0.076 mm (0.03 in)
Maximum carrier spread	0.75 mm (0.030 in)
Pinion bearing preload	1.2-3.3 Nm (11-29 lb-in)
Pinion flange maximum radial runout in assembly	0.25 mm (0.010 in)
Ring gear maximum variation between teeth	0.102 mm (0.004 in)

Rear Axle Backlash Shim Adjustment Table

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002

0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Torque Specifications

Description	Nm	lb-ft	lb-in
Differential bearing cap bolt	111	82	-
Differential front lower insulator bolt	103	76	-
Differential housing cover bolt	32	24	-
Differential pinion shaft lock bolt	30	22	-
Differential rear insulator bolts	150	111	-
Drain plug	34	25	-
Driveshaft flange bolts	112	83	-
Fill plug	34	25	-
Handle (adapter)	2.2	-	20
Ring gear bolts [a]	-	-	-

[a] Refer to the procedure in this section.

Rear Drive Axle and Differential

The rear drive axle and differential consist of the following:

- Cast aluminum differential housing and cover
- Differential housing cover that uses silicone sealant as a gasket
- Hypoid-design gearset that consists of an 8.8-inch differential ring gear and a drive pinion gear
- Two opposed pinion bearings that support the drive pinion gear in the differential housing
- Differential drive pinion collapsible spacer, located on the drive pinion gear shaft, that maintains pinion bearing preload
- Pinion nut that adjusts the preload
- Differential bearing shims between the differential bearing cups and the differential housing which adjust the differential ring gear backlash and the differential bearing preload
- Differential case with 2 openings to allow for assembly of the internal components and lubricant flow. Removable differential bearing caps retain the differential assembly in the differential housing
- Two opposed differential bearings that support the differential assembly in the differential housing
- Inside the differential assembly, the differential pinion shaft supports 2 differential pinion gears. The pinion gears engage the differential side gears to which the halfshafts are splined
- The differential pinion shaft lock bolt retains the differential pinion shaft in the differential assembly
- An embossed metal tag, bolted to the differential housing cover, contains rear axle identification. Refer to Section 205-00

The rear axle assembly receives rotational input from the driveshaft through a piloted pinion flange. The drive pinion drives the ring which is bolted to the differential case. The design of the differential allows the side gears in the case to rotate at different speeds. The axle halfshafts are splined to the side gears permitting the vehicle to manipulate corners without sliding the inside tire.

The axle identification tag identifies a particular axle design and specific ratio. In addition, the plant code will not change as long as that particular axle assembly never undergoes an external design change. If, however, an internal design change takes place during the production life of the axle and that internal change affects parts interchangeability, a dash and numerical suffix is added to the plant code. This means that as an assembly, both axles are interchangeable; however, internally they are different. Therefore, each requires different internal parts at the time of repair.

Rear Drive Axle and Differential

Refer to Section 205-00 .

Differential Draining and Filling

Material

Item	Specification
Motorcraft® SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A and GL-5

Fluid Drain and Fill

1. Remove both the fill plug and the drain plug.
   - Drain the axle assembly.

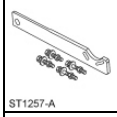
2. Clean and install the drain plug.
   - Tighten to 34 Nm (25 lb-ft).

3. Fill the axle with 1.65L (3.5 pt) of axle lubricant to the bottom of the fill plug hole.

4. Clean and install the fill plug.
   - Tighten to 34 Nm (25 lb-ft).

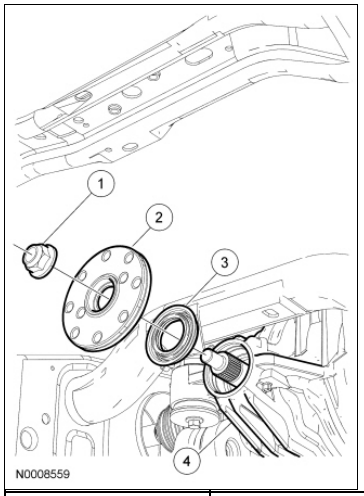
Drive Pinion Flange and Drive Pinion Seal

Special Tool(s)

 ST2026-A	2 Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E)
 ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Item	Part Number	Description
1	389546	Pinion nut
2	4851	Pinion flange
3	4676	Pinion seal
4	4010	Differential housing

Removal

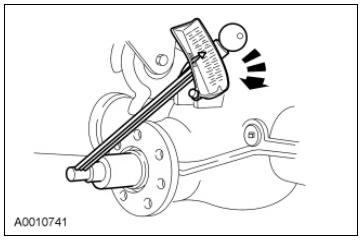
1. ***NOTICE:*** **The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation. If a new collapsible spacer must be installed for pinion bearing preload reduction, install the nut supplied with the new spacer kit or damage to the component may occur.**

   With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the brake disc. For additional information, refer to Section 206-04 .

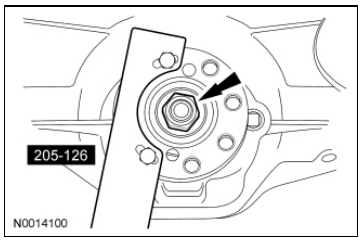
3. Remove the rear driveshaft. For additional information, refer to Section 205-01 .

4. Install a Nm (lb-in) torque wrench on the pinion nut and record the torque necessary to maintain rotation of the drive pinion gear through several revolutions.

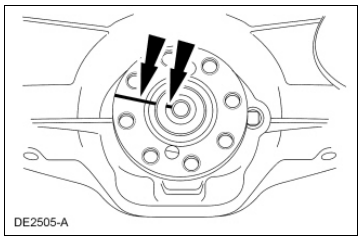


NOTICE: **The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation or damage to the component may occur.**

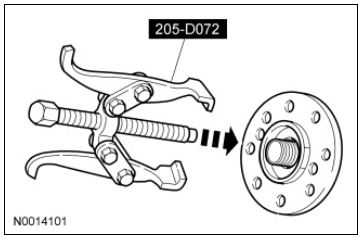
5. Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, remove and discard the pinion nut.



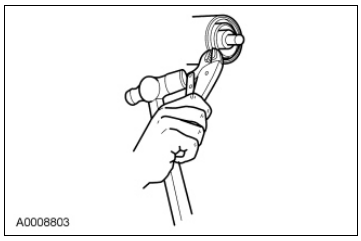
6. Index-mark the pinion flange and drive pinion gear to maintain initial balance during installation.



7. Using the 2 Jaw Puller, remove the pinion flange.



8. Use a screwdriver to force up the metal flange of the pinion seal. Install gripping pliers and strike with a hammer to remove the drive pinion seal.

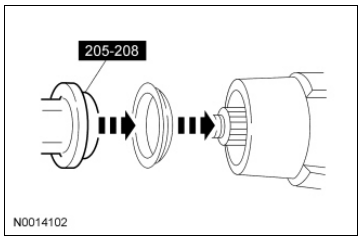


Installation

1. If removed, lubricate the lips of the new drive pinion seal with grease.

2. **NOTE:** If the drive pinion seal becomes misaligned during installation, remove the drive pinion seal and install a new drive pinion seal.

   If the drive pinion seal was removed, use the Drive Pinion Oil Seal Installer to install a new drive pinion seal.

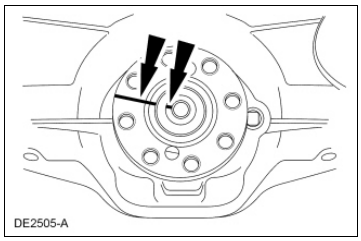


3. Inspect the pinion flange seal journal for rust, nicks and scratches prior to installing the pinion flange. Polish the seal journal with fine crocus cloth, if necessary.

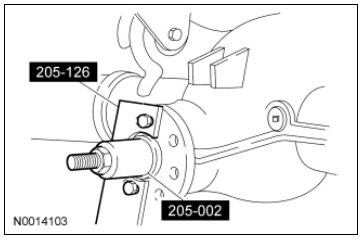
4. Lubricate the pinion flange splines with grease.

5. **NOTE:** Disregard the index marks if installing a new pinion flange.

   Position the pinion flange.



6. Using the Drive Pinion Flange Holding Fixture and Drive Pinion Flange Installer, install the pinion flange.



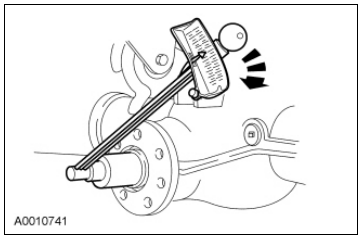
7. ***NOTICE:*** **The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation or damage to the component may occur.**

   Select the new pinion nut for installation. Install and hand-tighten the pinion nut.

8. ***NOTICE:*** **Do not, under any circumstance, loosen the pinion nut to reduce drive pinion bearing preload. If it is necessary to reduce drive pinion bearing preload, install a new differential drive pinion collapsible spacer and pinion nut or component damage may occur. Install the new pinion nut that is included in the collapsible spacer kit.**

   Tighten the new pinion nut to set the drive pinion bearing preload.

   - Rotate the drive pinion gear occasionally to make sure the drive pinion bearings seat correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.
   - Rotational torque must be at least the recorded original torque plus a maximum of 5 lb-in.

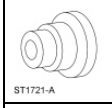
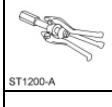
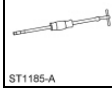


9. Install the brake disc. For additional information, refer to Section 206-04 .

10. Install the rear driveshaft. For additional information, refer to Section 205-01 .

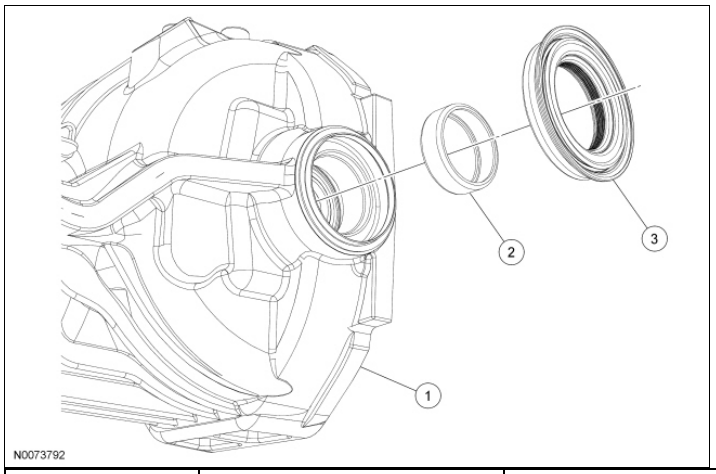
Stub Shaft Pilot Bearing and Seal

Special Tool(s)

 ST1326-A	Handle 205-D055 (D81L-4000-A) or equivalent
 ST1721-A	Installer, Halfshaft Pilot Bearing 205-504
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A and GL-5



Item	Part Number	Description
1	4010	Rear axle housing
2	4B413	Stub shaft bearing
3	4B416	Stub shaft bearing seal

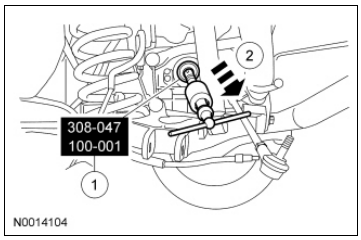
Removal

1. Remove the halfshaft assembly. For additional information, refer to Section 205-05 .

2. **NOTE:** If removing the stub shaft pilot bearing oil seal only, engage the tangs of the Bearing Cup Remover on the stub shaft pilot bearing oil seal.

   Using the Bearing Cup Remover and Slide Hammer, remove the stub shaft pilot bearing and stub shaft pilot bearing oil seal.

   1. Firmly engage the tangs of the Bearing Cup Remover on the stub shaft pilot bearing.
   2. Remove the stub shaft pilot bearing and stub shaft pilot bearing oil seal.

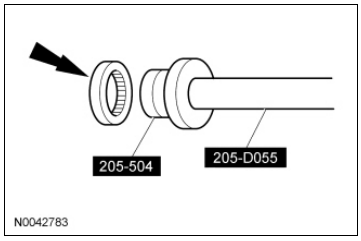


Installation

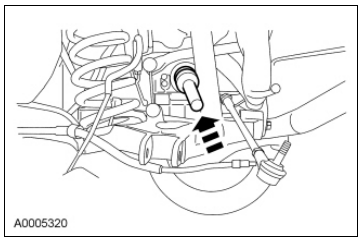
1. Using rear axle lubricant, lubricate the new stub shaft pilot bearing.

2. *NOTICE:* **Installation of the stub shaft pilot bearing or stub shaft pilot bearing oil seal without the correct tools can result in early stub shaft pilot bearing or stub shaft pilot bearing oil seal failure. If the stub shaft pilot bearing becomes cocked in the bore during installation, remove it and install a new stub shaft pilot bearing.**

   Place the stub shaft pilot bearing onto the Halfshaft Pilot Bearing Installer and Handle.



3. Install the stub shaft pilot bearing into the rear axle housing bore.

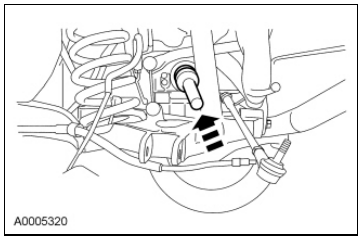


4. **NOTE:** Do not disassemble the new oil seal.

   NOTE: Use a tool like the Lisle LIS17850 to avoid interference with the suspension components.

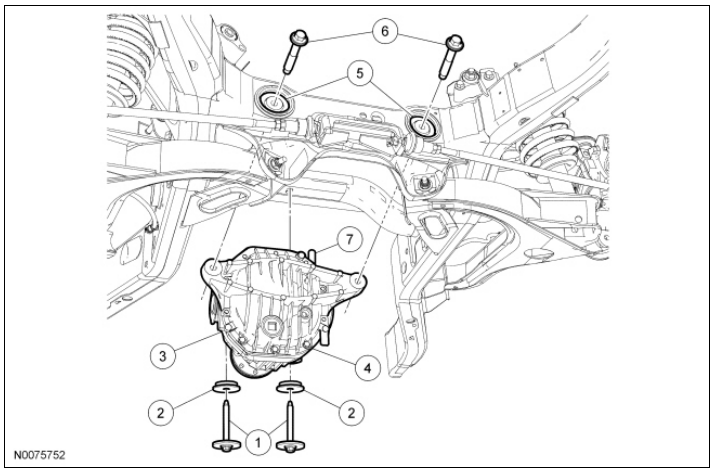
   Install the stub shaft pilot bearing oil seal onto a suitable seal installer.

5. Carefully align the stub shaft pilot bearing oil seal with the housing bore and install the stub shaft pilot bearing oil seal flush in the differential housing.



6. Install the halfshaft assembly. For additional information, refer to Section 205-05 .

Axle Assembly



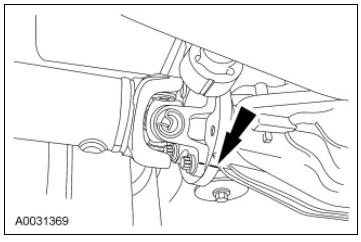
Item	Part Number	Description
1	W707356	Differential front lower insulator bolts
2	4B425	Lower differential bolt snubbers (2 required)
3	4000	Axle assembly
4	4B424	Differential front lower insulator (2 required)
5	4B425	Differential rear insulators (2 required)
6	W708096	Differential rear insulator bolts
7	4338	Axle vent tube

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the rear halfshafts. For additional information, refer to Section 205-05 .

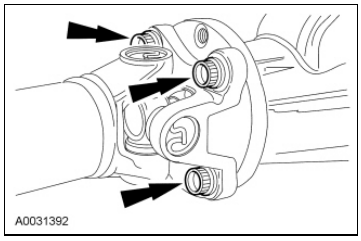
3. Index-mark the driveshaft flange to the pinion flange.



4. **NOTE:** Align the index marks when installing the driveshaft.

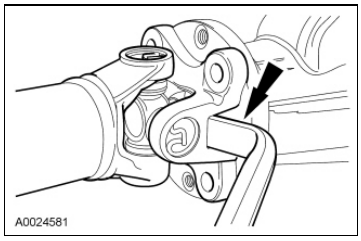
   Remove and discard the 4 driveshaft flange bolts.

   - To install, tighten to 112 Nm (83 lb-ft).



5. ***NOTICE:*** **The driveshaft flange fits tightly on the pinion flange pilot. Never hammer on the driveshaft or any of its components to disconnect the driveshaft flange from the pinion flange or damage to the component may occur.**

   Using a suitable tool as shown, disconnect the driveshaft flange from the pinion flange, then using mechanic's wire, position aside the driveshaft.



6. Position a suitable transmission jack to the axle housing.
   - Securely strap the jack to the axle.

7. Remove the 2 differential front lower insulator bolts.
   - To install, tighten to 103 Nm (76 lb-ft).

8. Remove the 2 differential rear insulator bolts.
   - To install, tighten to 150 Nm (111 lb-ft).

9. Disconnect the axle vent hose from the axle cover vent.

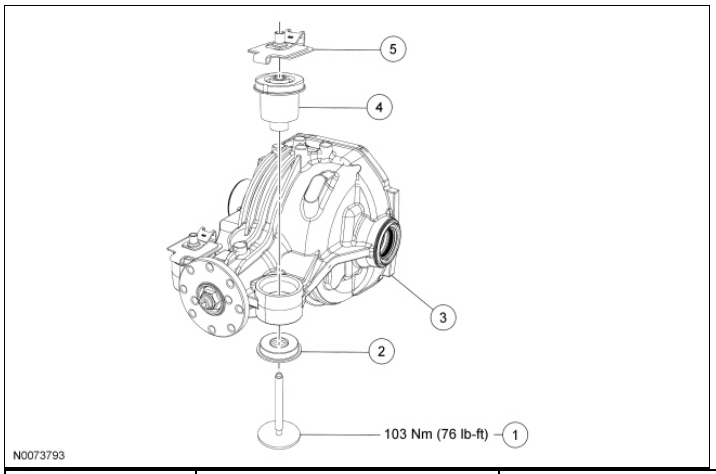
10. Lower the axle assembly from the vehicle.

11. To install, reverse the removal procedure.

Rear Axle Housing Support Insulator

Special Tool(s)

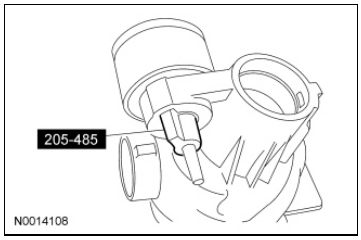
 ST2543-A	Remover/Installer, Differential Bushing 205-485



Item	Part Number	Description
1	W712269-S	Lower insulator bolt
2	4B424	Lower isolator
3	4010	Axle housing
4	4B431	Upper isolator
5	W712984	Spring nut (Explorer)
5	W713381	Spring nut (Sport Trac)

Removal

1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.
2. Using the Differential Bushing Remover/Installer, remove and discard the differential front lower insulator.

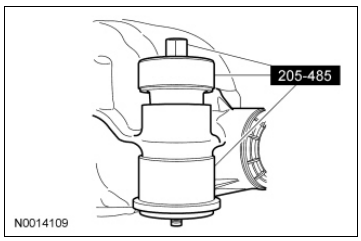


3. Using the Differential Bushing Remover/Installer, draw the differential rear insulator from the frame pocket.

Installation

1. Using the Differential Bushing Remover/Installer, draw the differential rear insulator into the frame pocket.
    - There is no orientation requirement for the frame mounted differential rear insulator.

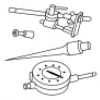
2. Using the Differential Bushing Remover/Installer, install the differential front lower insulator.

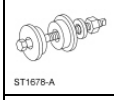
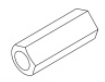


3. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

Differential Ring And Pinion

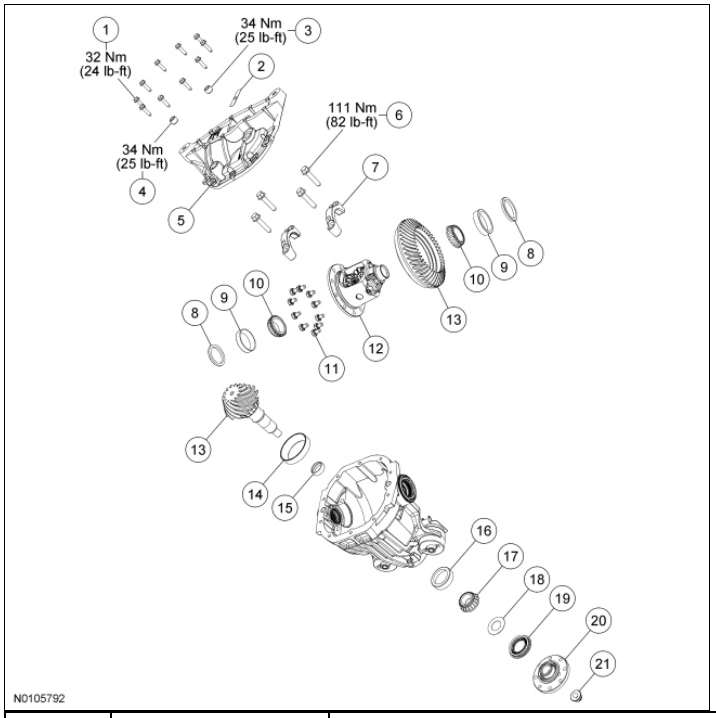
Special Tool(s)

 ST2026-A	2 Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1743-A	Adapter for 205-S127 205-105 (T76P-4020-A3)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
 ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1743-A	Adapter for 205-S127 205-129 (T79P-4020-A18)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1375-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
 ST1367-A	Installer, Drive Pinion Bearing Cone 205-834

 ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
 ST1545-A	Installer, Drive Pinion Bearing Cup 205-835
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent
 ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
 ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1744-A	Protector, Drive Pinion Thread 205-460
 ST1220-A	Remover, Differential Bearing 205-116 (T77F-4220-B1)
 ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E) or equivalent
 ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A)
 ST1725-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent

Material

Item	Specification
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



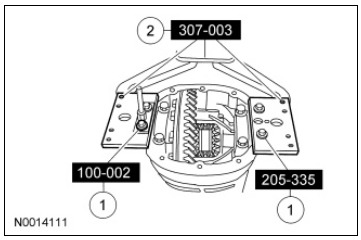
Item	Part Number	Description
1	390919	Differential housing cover bolt (10 required)
2	4121	Axle identification tag
3	19G406	Fill plug
4	19G406	Drain plug
5	4033	Differential housing cover
6	56187-S	Differential bearing cap bolt (4 required)
7	4224	Differential bearing cap (2 required)
8	4067	Differential bearing shims
9	4222	Differential bearing cups
10	4221	Differential bearings
11	4216	Ring gear bolt (10 required)
12	4205	Differential carrier assembly
13	4209	Differential ring gear and pinion set
14	4628	Inner pinion bearing cup
15	4662	Collapsible spacer
16	4616	Outer pinion bearing cup
17	4621	Outer pinion bearing
18	4670	Drive pinion shaft oil slinger
19	4676	Drive pinion oil seal
20	4851	Drive pinion flange
21	389546	Drive pinion nut

Removal

1. Remove the drain plug and drain the lubricant.
2. Remove the rear axle assembly. For additional information, refer to Axle Assembly in this section.
3. Remove the 10 differential housing cover bolts and cover.

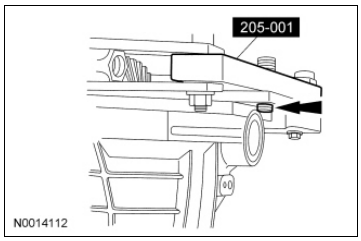
4. Install the drain plug.
    - Tighten to 34 Nm (25 lb-ft).

5. Using the Transmission Holding Fixture, mount the differential housing to a work bench.
    1. Attach the Differential Housing Spreader Plate and Dial Indicator Gauge with Holding Fixture to the differential housing with 4 differential housing cover bolts.
    2. Attach the Transmission Holding Fixture and Differential Housing Spreader Plates together with two 3/8-inch x 1-1/2-inch bolts.

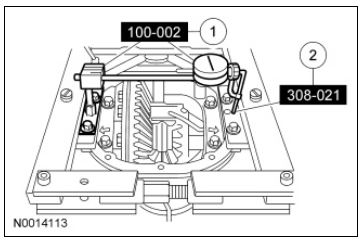


6. ***NOTICE:*** **RH spreader set screw must not be adjusted further down than flush or the spreader rocks and damages the seal and the housing.**

    Install the Differential Carrier Spreader by placing the spreader pins in the hole in the housing spreader adapters.



7. Assemble the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.
    1. Install the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.
    2. Attach the Clutch Housing Gauge and position the tip in the housing spreader adapter hole.

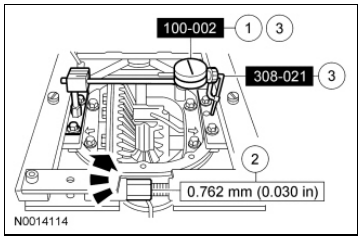


8. ***NOTICE:*** **Overspreading may damage the differential housing.**

    NOTE: Tighten and loosen the Differential Carrier Spreader screw to normalize the housing spreader adapters prior to taking the final Dial Indicator Gauge reading.

    Spread the differential housing to the specification.

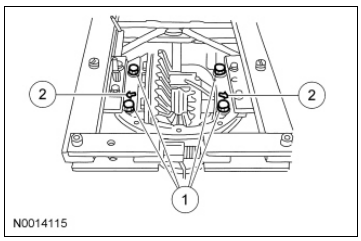
    1. Adjust the Dial Indicator Gauge to zero.
    2. Tighten the screw until the differential housing is spread to the specification.
    3. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



9. ***NOTICE:*** **Mark the position and location of the differential bearing caps. Always install the differential bearing caps in their original locations and positions or damage to the component may occur.**

   Remove the differential bearing caps.

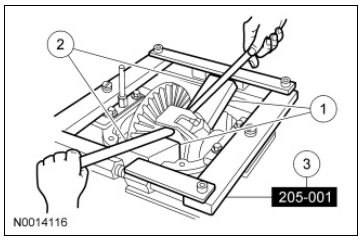
   1. Remove the 4 differential bearing cap bolts.
   2. Remove the 2 differential bearing caps.



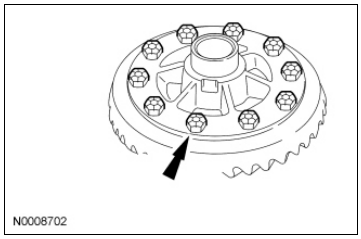
10. ***NOTICE:*** **Use wood blocks to avoid damaging the differential housing.**

    Remove the differential assembly.

    1. Position wood blocks at the top and bottom of the differential assembly.
    2. Pry the differential assembly and the 2 differential bearing shims out of the differential housing.
    3. Remove the Differential Carrier Spreader.



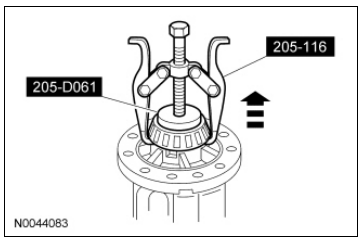
11. Remove and discard the 10 ring gear bolts.



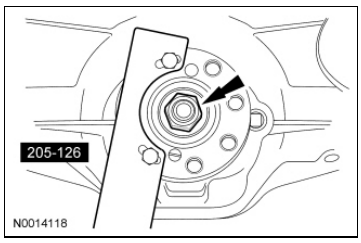
12. ***NOTICE:*** **Do not damage the ring gear bolt hole threads.**

    Insert a punch in the ring gear bolt holes and drive the differential ring gear off.

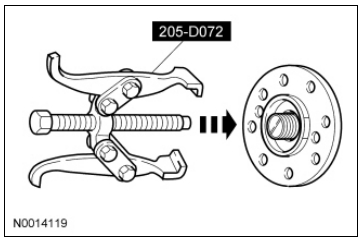
13. Using the Differential Bearing Remover and Step Plate, remove the 2 differential bearings.



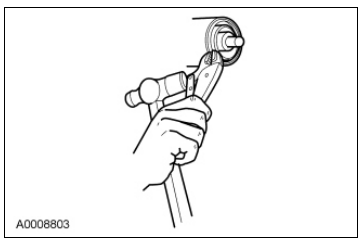
14. Using the Driver Pinion Flange Holding Fixture, hold the pinion flange to remove and discard the pinion nut.



15. Using the 2 Jaw Puller, remove the pinion flange.

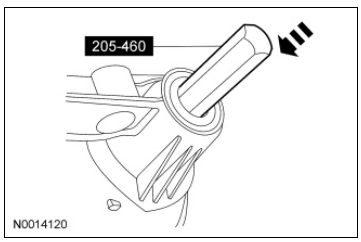


16. Use a screwdriver to force up the metal flange of the drive pinion oil seal. Install gripping pliers and strike with a hammer to remove the drive pinion oil seal.

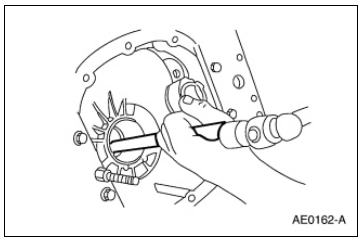


17. Remove the drive pinion oil seal deflector, drive pinion oil seal slinger, the outer pinion bearing and the drive pinion collapsible spacer.

18. Using the Drive Pinion Thread Protector and a soft-faced hammer, remove the differential pinion gear from the differential housing.



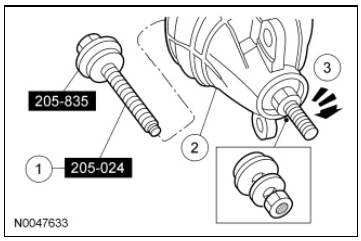
19. Using a brass drift and a hammer, remove the 2 differential drive pinion bearing cups from the differential housing. Tap alternately on each side of the cup to prevent them from cocking in the bore.



20. Inspect the differential case for wear or damage. If necessary, disassemble the differential case. For additional information, refer to Differential Case and Ring Gear in this section.

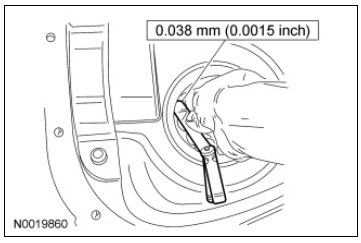
Installation

1. Using the Drive Pinion Bearing Cup Installers, install the inner and outer differential drive pinion bearing cups.
    1. Position the 2 bearing cups on the Drive Pinion Bearing Cup Installer.
    2. Position the Drive Pinion Bearing Cup Installer and the 2 differential drive pinion bearing cups in the differential housing.
    3. Tighten the Drive Pinion Bearing Cup Installer to fully seat the 2 differential drive pinion bearing cups in the bores.



2. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

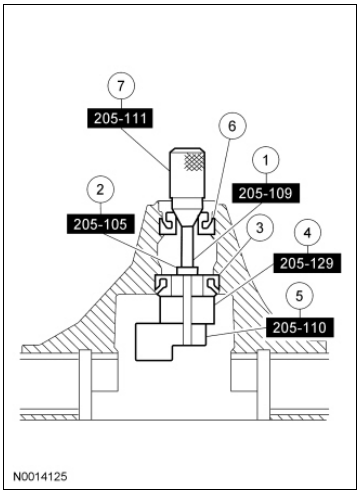
   Make sure the 2 differential pinion bearing cups are correctly seated.



3. **NOTE:** Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.

   NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

   Install the new drive pinion bearings and Adapters as shown.

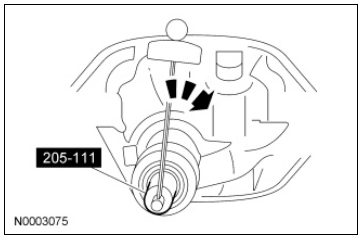


Item	Part Number	Description
1	205-109	Adapter for 205-S127
2	205-105	Adapter for 205-S127
3	4630	Inner (rear) pinion bearing
4	205-129	Adapter for 205-S127
5	205-110	Adapter for 205-S127
6	4621	Outer (front) pinion bearing
7	205-111	Adapter for 205-S127

4. **NOTE:** This step duplicates drive pinion bearing preload.

   Thread the Adapter onto the screw and tighten to the specification.

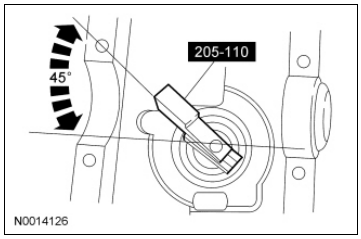
   - Tighten to 2.2 Nm (20 lb-in) rotational torque.



5. **NOTE:** Position the Adapter so it does not contact the housing.

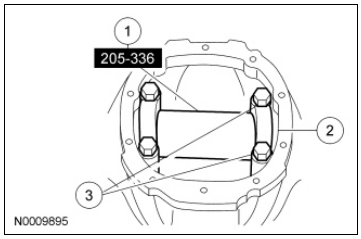
   NOTE: Offset the Adapter to obtain an accurate reading.

   Rotate the Adapter several half turns to seat the drive pinion bearings. Position the Adapter as shown.

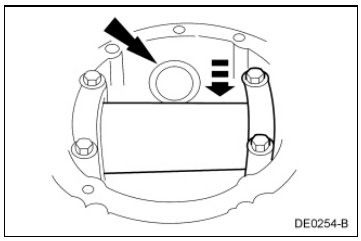


6. Install the Drive Pinion Gauge Tube.
   1. Position the Drive Pinion Gauge Tube on the differential housing differential bearing seat.

2. Install the 2 differential bearing caps.
3. Install the 4 differential bearing cap bolts.
    - Tighten to 111 Nm (82 lb-ft).



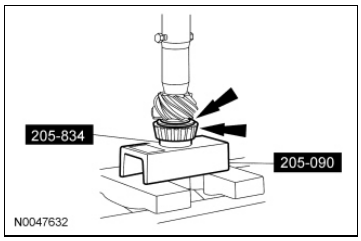
7. Use a drive pinion bearing adjustment shim as a gauge for shim selection. Check the drive pinion bearing adjustment shim thickness between the Adapter and the gauge tube. A slight drag indicates correct shim selection.



8. Remove the Drive Pinion Gauge Tube and Adapters.

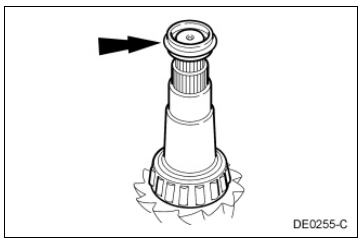
9. Position the selected drive pinion bearing adjustment shim and the inner pinion bearing on the drive pinion gear stem.

10. Using the Bearing/Oil Seal Plate and Drive Pinion Bearing Cone Installer and a suitable press, firmly seat the drive pinion bearing adjustment shim and inner pinion bearing on the drive pinion gear stem.

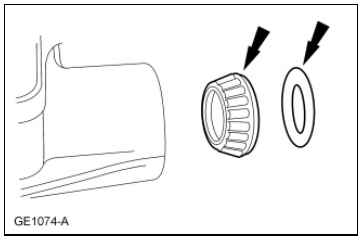


11. **NOTE:** Make sure the splines on the drive pinion gear stem are free of burrs. If burrs are evident, remove them using a fine crocus cloth.

    Place a new differential drive pinion collapsible spacer on the drive pinion gear stem against the pinion stem shoulder.

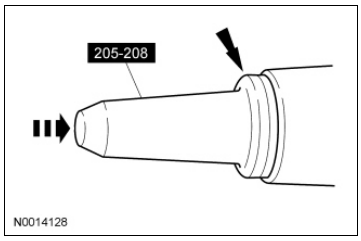


12. Install the outer pinion bearing and the drive pinion oil seal slinger.

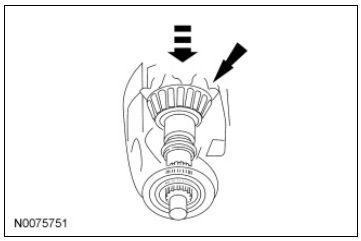


13. **NOTE:** Coat the drive pinion seal lips with grease.

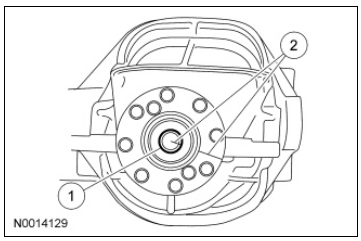
    Using the Drive Pinion Oil Seal Installer, install the new drive pinion seal.



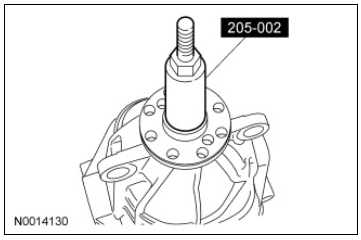
14. Install the drive pinion gear with the differential drive pinion collapsible spacer in the differential housing.



15. Position the pinion flange.
    1. Lubricate the pinion flange splines with grease.
    2. Position the pinion flange.



16. Using the Drive Pinion Flange Installer, install the pinion flange.

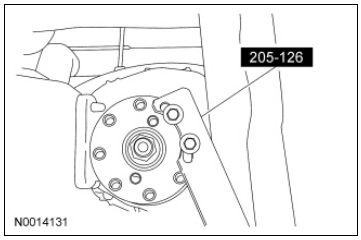


17. ***NOTICE:*** **Do not, under any circumstance, loosen the pinion nut to reduce drive pinion bearing preload. If it is necessary to reduce drive pinion bearing preload, install a new differential drive pinion collapsible spacer and pinion nut or damage to the component may occur.**

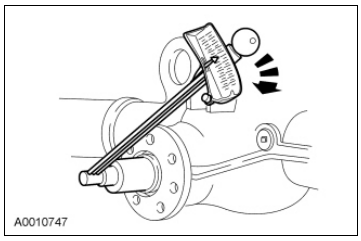
NOTE: Remove the Drive Pinion Flange Holding Fixture while taking drive pinion bearing preload readings with the Nm (lb-in) torque wrench.

Use the Drive Pinion Flange Holding Fixture to hold the pinion flange while tightening the new pinion nut.

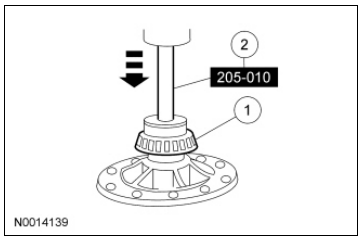
- Rotate the drive pinion gear occasionally to make sure the drive pinion bearings seat correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.



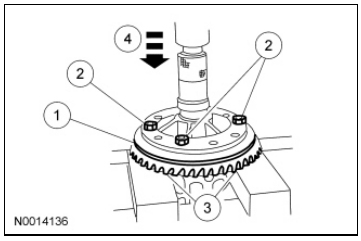
18. Tighten the pinion nut to set the drive pinion bearing preload. Refer to the torque specification for drive pinion bearings in the Specifications portion of this section.



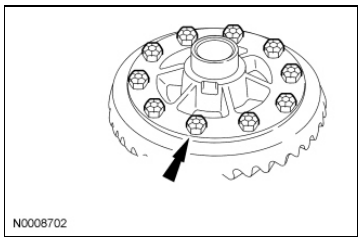
19. Press the left and right differential bearing on the differential assembly.
    1. Position the 2 differential bearings.
    2. Using the Differential Side Bearing Installer, press the differential bearing on the differential assembly.



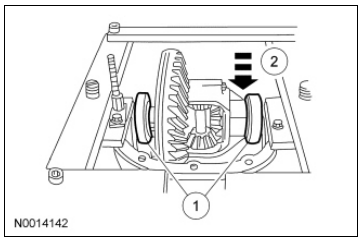
20. Install the differential ring gear.
    1. Place the differential ring gear on the differential assembly.
    2. Hand-start 3 new ring gear bolts to align the holes in the differential ring gear and the differential assembly.
    3. Place the differential assembly and differential ring gear onto the press bed blocks with the differential ring gear teeth facing downward.
    4. Press the differential ring gear into place.



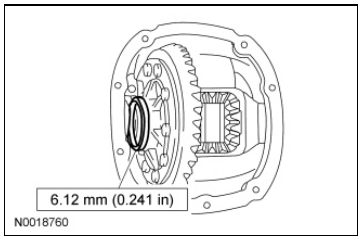
21. Install the 7 new ring gear bolts.
    - Tighten the 10 bolts to 127 Nm (94 lb-ft).



22. Install the differential assembly.
    1. Position the 2 differential bearing cups on the 2 differential bearings.
    2. Lower the differential assembly in place.

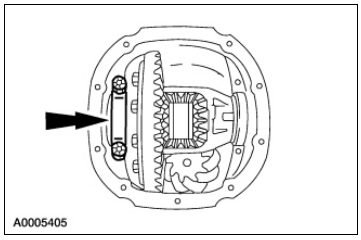


23. Install a differential bearing shim of the thickness shown on the LH side of the differential case.



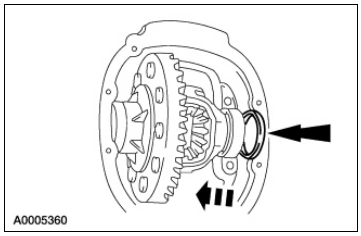
24. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install the left bearing cap and loosely install the 2 bearing cap bolts.



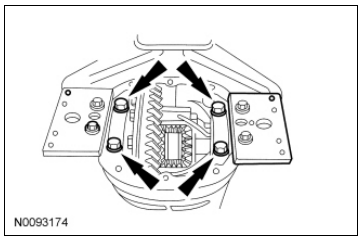
25. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install progressively thicker differential bearing shims on the right side until the thickest differential bearing shim can be inserted by hand.

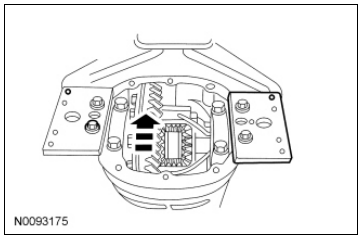


26. Install the right bearing cap and 2 bolts.

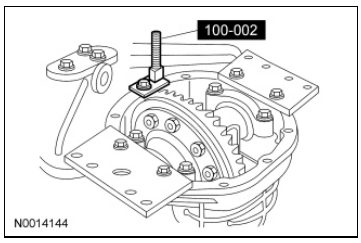
27. Tighten the 4 differential bearing cap bolts.
    - Tighten to 111 Nm (82 lb-ft).



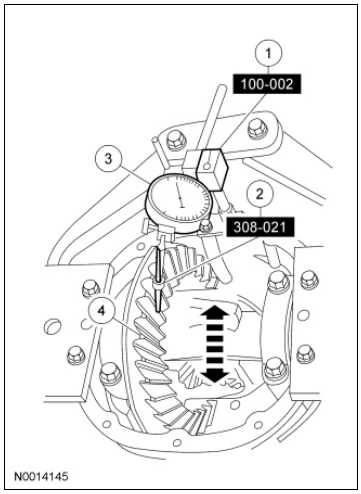
28. Rotate the differential case to make sure it turns freely.



29. Install the Dial Indicator Gauge with Holding Fixture at the 12 o'clock position.



30. Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, measure the differential ring gear backlash at 4 equally spaced points.
    1. Attach the Dial Indicator Gauge with Holding Fixture.
    2. Position the Clutch Housing Gauge tip centrally on a drive tooth.
    3. Zero the Dial Indicator Gauge.
    4. Turn the differential ring gear without turning the drive pinion gear. Record the Dial Indicator Gauge reading. The allowable backlash is 0.203 mm (0.008 in) to 0.305 mm (0.012 in) and must not vary more than 0.101 mm (0.004 in) between points measured. A backlash variation of more than 0.101 mm (0.004 in) between points checked indicates gear/case runout.
        - ♦ To correct for a high or low backlash, proceed as follows.



31. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount. Refer to the following tables when adjusting the backlash.

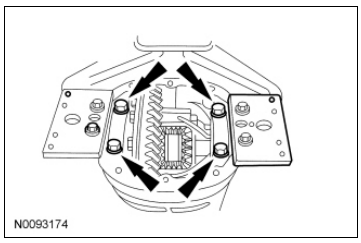
Backlash Change Required		Thickness Change Required	
mm	**Inch**	**mm**	**Inch**
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart - 4067

Numbers of Stripes and Color Code	Dimension A	
	mm	**Inch**
2 - C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 - C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 - BLU	7.6962- 7.7089	0.3030- 0.3035

4 - BLU	7.6454- 7.6581	0.3010- 0.3015
3 - BLU	7.5946- 7.6073	0.2990- 0.2995
2 - BLU	7.5458- 7.5565	0.2970- 0.2975
1 - BLU	7.493- 7.505	0.2950- 0.2955
5 - PINK	7.4422- 7.4549	0.2930- 0.2935
4 - PINK	7.3914- 7.4041	0.2910- 0.2915
3 - PINK	7.3406- 7.3533	0.2890- 0.2895
2 - PINK	7.2898- 7.3025	0.2870- 0.2875
1 - PINK	7.2390- 7.2517	0.2850- 0.2855
5 - GRN	7.1882- 7.2009	0.2830- 0.2835
4 - GRN	7.1374- 7.1501	0.2810- 0.2815
3 - GRN	7.0866- 7.0993	0.2790- 0.2795
2 - GRN	7.0358- 7.0485	0.2770- 0.2775
1 - GRN	6.9850- 7.0485	0.2750- 0.2755
5 - WH	6.9342- 6.9469	0.2730- 0.2735
4 - WH	6.8834- 6.8961	0.2710- 0.2715
3 - WH	6.8326- 6.8453	0.2690- 0.2695
2 - WH	6.7818- 6.7945	0.2670- 0.2675
1 - WH	6.7310- 6.7437	0.2650- 0.2655
5 - YEL	6.6802- 6.6929	0.2630- 0.2635
4 - YEL	6.6294- 6.6421	0.2610- 0.2615
3 - YEL	6.5786- 6.5913	0.2590- 0.2595
2 - YEL	6.5278- 6.5405	0.2570- 0.2575
1 - YEL	6.4770- 6.4897	0.2550- 0.2555
5 - ORNG	6.4262- 6.4389	0.2530- 0.2535
4 - ORNG	6.3754- 6.3881	0.2510- 0.2515
3 - ORNG	6.3246- 6.3373	0.2490- 0.2495
2 - ORNG	6.2738- 6.2865	0.2470- 0.2475
1 - ORNG	6.2223- 6.2357	0.2450- 0.2455
2 - RED	6.1722- 6.1849	0.2430- 0.2435
1 - RED	6.1214- 6.1341	0.2410- 0.2415

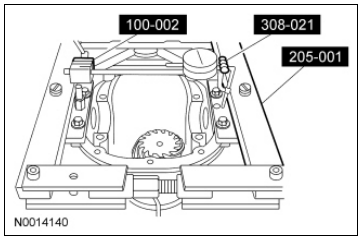
32. Remove the 4 differential bearing cap bolts.
    - Remove the differential assembly.



33. Measure the thickness of the selected right and left bearing shims.

34. To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.203 mm (0.008 in).

35. Install the Differential Carrier Spreader, Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.

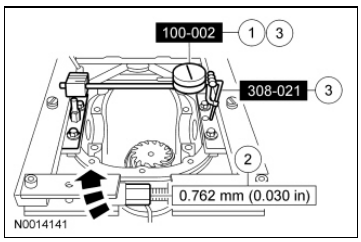


36. ***NOTICE:*** **Overspreading may damage the differential housing.**

    NOTE: Tighten and loosen the differential carrier spreader screw to normalize the housing spreader adapters prior to taking the final Dial Indicator Gauge reading.

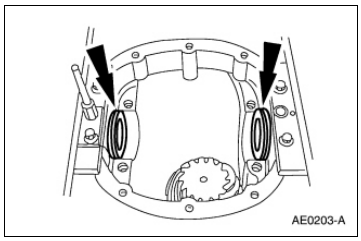
    Spread the differential housing to the specification.

    1. Adjust the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge to zero.
    2. Tighten the screw until spreading the differential housing to the specification.
    3. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.

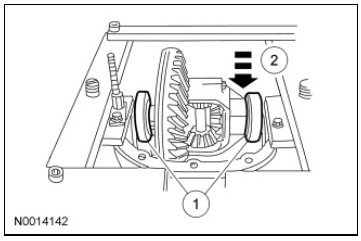


37. **NOTE:** To avoid galling the case, insert shims with a light coating of grease before installing the differential assembly.

    Place the 2 differential bearing shims in the differential housing.

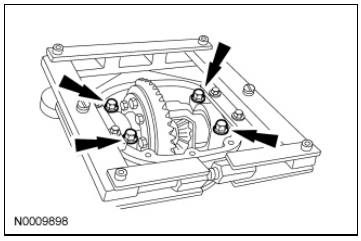


38. Install the differential assembly.
    1. Position the 2 differential bearing cups on the 2 differential bearings.
    2. Lower the differential assembly in place between the 2 differential bearing shims.

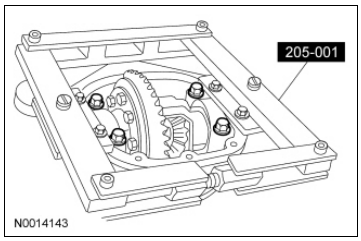


39. **NOTE:** Hand-tighten the 4 differential bearing cap bolts prior to releasing the carrier spreader.

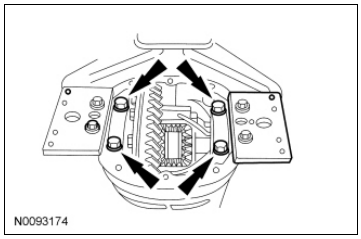
    Install the 2 differential bearing caps and the 4 differential bearing cap bolts in their original locations and positions.



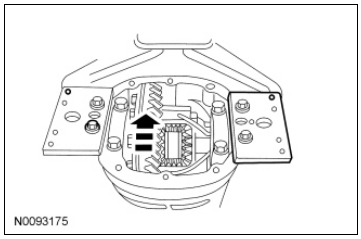
40. Loosen and remove the Differential Carrier Spreader.



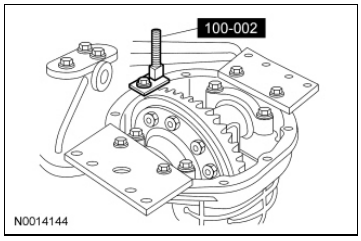
41. Tighten the 4 differential bearing cap bolts.
    - Tighten to 111 Nm (82 lb-ft).



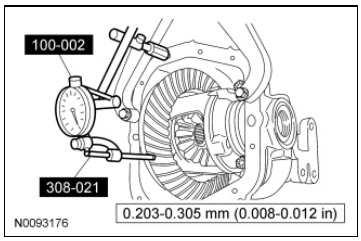
42. Rotate the differential case to make sure it turns freely.



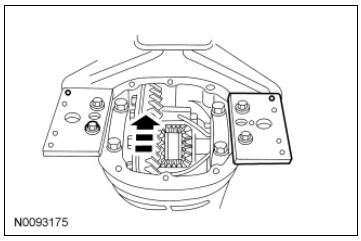
43. Install the Dial Indicator Gauge with Holding Fixture at the 12 o'clock position.



44. Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, recheck the ring gear backlash.



45. Apply marking compound and rotate the differential assembly 5 complete revolutions.



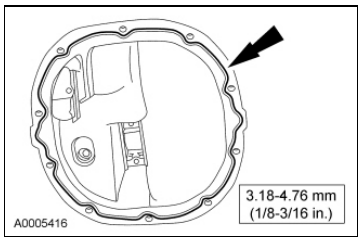
46. Verify an acceptable pattern check.

47. **NOTE:** The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.

    NOTE: Install the differential housing cover within 15 minutes of applying the silicone material.

    NOTE: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of silicone gasket and sealant, of the specified thickness, to the differential housing cover mounting surface as shown.



48. Install the differential housing cover and 10 differential cover bolts.
    - Tighten to 32 Nm (24 lb-ft).

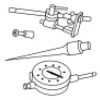
49. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

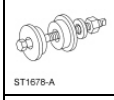
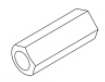
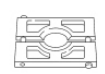
50. Remove the fill plug. Fill the axle assembly with the specified lubricant.

51. Install the fill plug.
    - Tighten to 34 Nm (25 lb-ft).

Differential Bearings

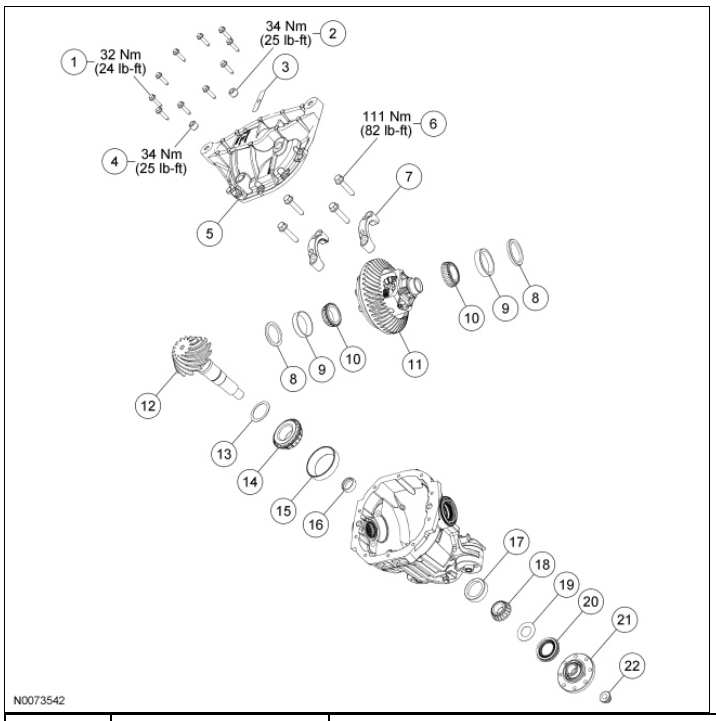
Special Tool(s)

 ST2026-A	2 Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1743-A	Adapter for 205-S127 205-105 (T76P-4020-A3)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
 ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1743-A	Adapter for 205-S127 205-129 (T79P-4020-A18)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1434-A	Gauge Tube, Drive Pinion 205-336 (T93P-4020-A)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1375-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
 ST1367-A	Installer, Drive Pinion Bearing Cone 205-834

 ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
 ST1545-A	Installer, Drive Pinion Bearing Cup 205-835
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent
 ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
 ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1744-A	Protector, Drive Pinion Thread 205-460
 ST1310-A	Remover, Bearing 205-055 (T71P-4621-B)
 ST1220-A	Remover, Differential Bearing 205-116 (T77F-4220-B1)
 ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E) or equivalent
 ST1344-A	Spreader, Differential Housing (Plate) 205-335 (T93P-4000-A)
 ST1725-A	Step Plate 205-D061 (D83T-4205-C2) or equivalent

Material

Item	Specification
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-
Motorcraft® SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A and GL-5
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



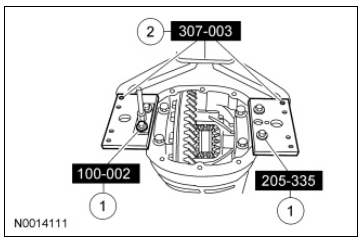
Item	Part Number	Description
1	390919	Differential housing cover bolt (10 required)
2	19G406	Fill plug
3	4121	Axle identification tag
4	19G406	Drain plug
5	4033	Differential housing cover
6	3912583	Differential bearing cap bolt (4 required)
7	4224	Differential bearing cap (2 required)
8	4067	Differential bearing shims
9	4222	Differential bearing cups
10	4221	Differential bearings
11	-	Differential carrier assembly
12	-	Differential pinion (part of 4209)
13	4663	Inner pinion bearing adjustment shim
14	4630	Inner pinion bearing
15	4628	Inner pinion bearing cup
16	4662	Collapsible spacer
17	4616	Outer pinion bearing cup
18	4621	Outer pinion bearing
19	386989	Outer pinion bearing oil slinger
20	4676	Drive pinion oil seal
21	4858	Drive pinion flange
22	389546	Drive pinion nut

Removal

1. Remove the drain plug and drain the lubricant.
2. Remove the rear axle assembly.

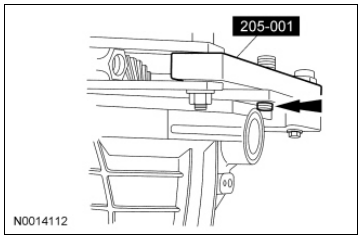
3. Remove the 10 differential housing cover bolts and the cover.

4. Using the Transmission Holding Fixture, mount the differential housing to a work bench.
    1. Attach the Differential Housing Spreader Plates and Dial Indicator Gauge with Holding Fixture to the differential housing with 4 differential housing cover bolts.
    2. Attach the Transmission Holding Fixture and Differential Housing Spreader Plates together with two 3/8-inch x 1-1/2-inch bolts.

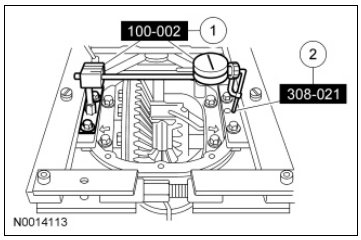


5. ***NOTICE:*** **RH spreader set screw must not be adjusted further down than flush or the spreader rocks and damages the seal and the housing.**

    Install the Differential Carrier Spreader by placing the spreader pins in the hole in the housing spreader adapters.



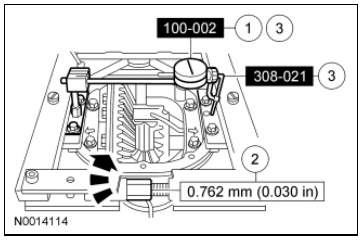
6. Assemble the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.
    1. Install the Dial Indicator Gauge with Holding Fixture.
    2. Attach the Clutch Housing Gauge and position the tip in the housing spreader adapter hole.



7. **NOTE:** Tighten and loosen the differential carrier spreader screw to normalize the housing spreader adapters prior to taking the final Dial Indicator Gauge reading.

    Spread the differential housing to the specification.

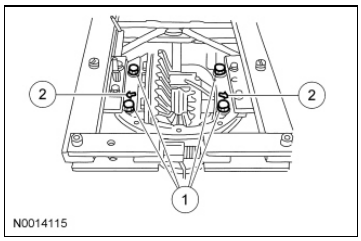
    1. Adjust the Dial Indicator Gauge to zero.
    2. Tighten the screw until the differential housing is spread to the specification.
    3. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



8. **NOTE:** Mark the position and location of the differential bearing caps. Always install the differential bearing caps in their original locations.

   Remove the 2 differential bearing caps.

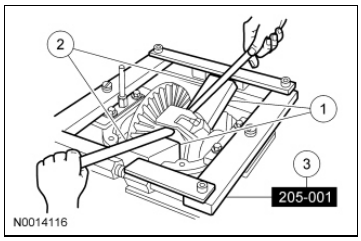
   1. Remove the 4 differential bearing cap bolts.
   2. Remove the 2 differential bearing caps.



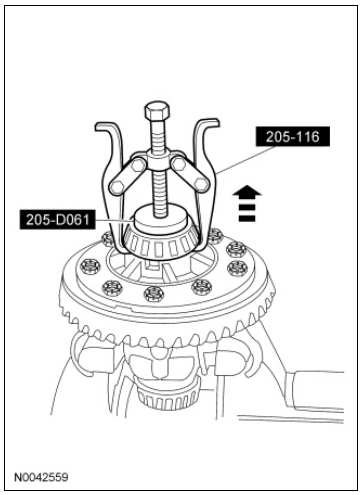
9. ***NOTICE:*** **Use wood blocks to avoid damaging the differential housing.**

   Remove the differential assembly.

   1. Position wood blocks at the top and bottom of the differential assembly.
   2. Pry the differential assembly and the differential bearing shims out of the differential housing.
   3. Remove the Differential Carrier Spreader.

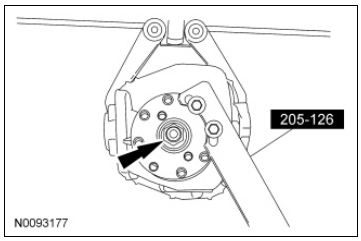


10. Using the Differential Bearing Remover and Step Plate, remove the 2 differential bearings.

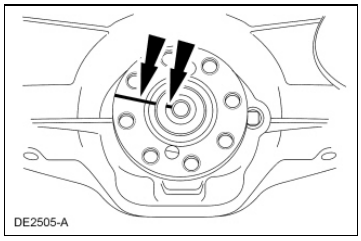


11. If necessary, disassemble the differential assembly.

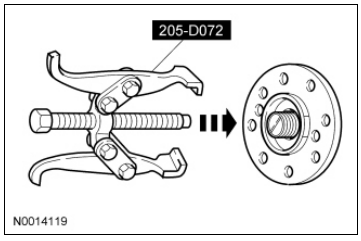
12. Using the Drive Pinion Flange Holding Fixture, hold the pinion flange to remove and discard the pinion nut.



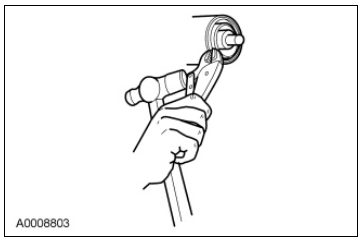
13. Index-mark the pinion flange to the drive pinion stem.



14. Using the 2 Jaw Puller, remove the pinion flange.

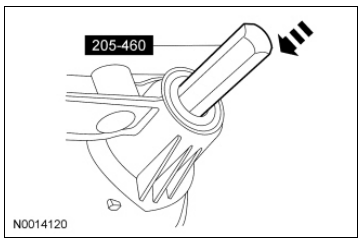


15. Use a screwdriver to force up the metal flange of the drive pinion oil seal. Install gripping pliers and strike with a hammer to remove the drive pinion oil seal.

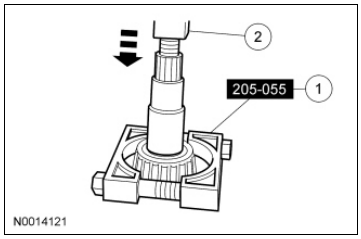


16. Remove the drive pinion oil seal deflector, drive pinion oil seal slinger, the outer pinion bearing and the drive pinion collapsible spacer.

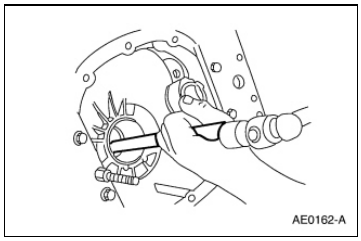
17. Using the Drive Pinion Thread Protector and a soft-faced hammer, remove the differential pinion gear from the differential housing.



18. Using the Bearing Remover and a press, remove the drive pinion inner bearing.
    1. Position the Bearing Remover under the drive pinion inner bearing.
    2. Using a press, remove the inner drive pinion bearing and shim.



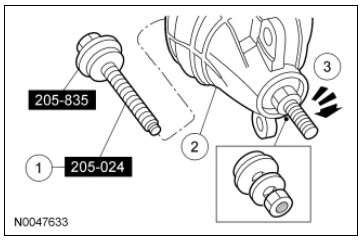
19. Using a brass drift and a hammer, remove the 2 differential drive pinion bearing cups from the differential housing. Tap alternately on each side of the cup to prevent them from cocking in the bore.



20. Inspect the differential case for wear or damage. If necessary, disassemble the differential case. For additional information, refer to Differential Case and Ring Gear in this section.

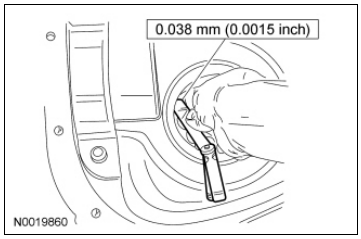
Installation

1. Using the Drive Pinion Bearing Cup Installers, install the 2 differential drive pinion bearing cups.
    1. Position the bearing cups on the Drive Pinion Bearing Cup Installers.
    2. Position the Drive Pinion Bearing Cup Installers and the 2 differential drive pinion bearing cups in the differential housing.
    3. Tighten the Drive Pinion Bearing Cup Installers to fully seat the differential drive pinion bearing cups in the bores.



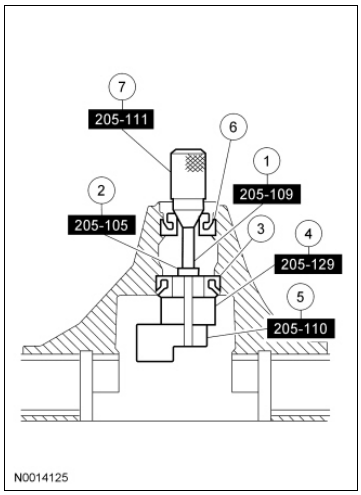
2. **NOTE:** If a feeler gauge of the specification shown can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not correctly seated.

   Make sure the 2 differential pinion bearing cups are correctly seated.



3. **NOTE:** Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the drive pinion bearing preload settings.

   Install the drive pinion bearings and Adapters as shown.

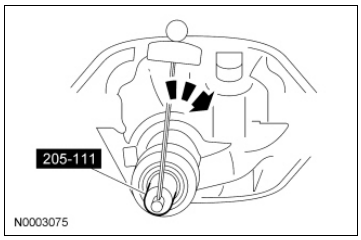


Item	Part Number	Description
1	205-109	Adapter for 205-S127
2	205-105	Adapter for 205-S127
3	4630	Inner (rear) pinion bearing
4	205-129	Adapter for 205-S127
5	205-110	Adapter for 205-S127
6	4621	Outer (front) pinion bearing
7	205-111	Adapter for 205-S127

4. **NOTE:** This step duplicates drive pinion bearing preload.

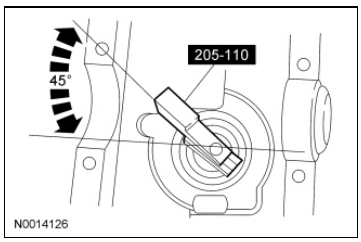
   Thread the Adapter onto the screw and tighten to the specification.

   - Tighten to 2.2 Nm (20 lb-in) rotational torque.

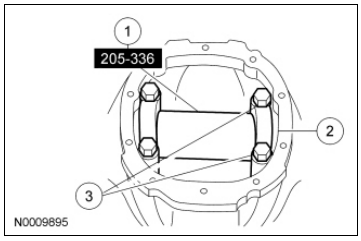


5. **NOTE:** Offset the Adapter to obtain an accurate reading.

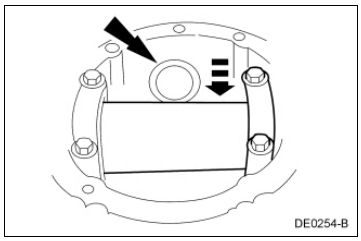
   Rotate the Adapter several half turns to seat the drive pinion bearings. Position the Adapter as shown.



6. Install the Drive Pinion Gauge Tube.
    1. Position the Drive Pinion Gauge Tube on the differential housing differential bearing seat.
    2. Install the 2 differential bearing caps.
    3. Install the 4 differential bearing cap bolts.
        - Tighten to 111 Nm (82 lb-ft).



7. Use a drive pinion bearing adjustment shim as a gauge for shim selection. Check the drive pinion bearing adjustment shim thickness between the gauge block and the gauge tube. A slight drag indicates correct shim selection.

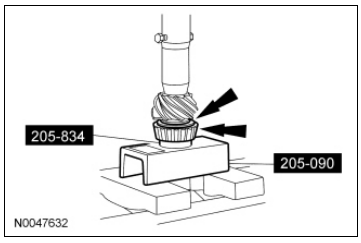


8. Remove the Adapters and Drive Pinion Gauge Tube.

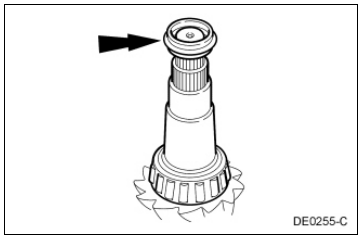
9. **NOTE:** Use the same drive pinion bearings and the drive pinion bearing adjustment shim from the drive pinion bearing adjustment shim selection procedure for final assembly.

   Position the drive pinion bearing adjustment shim and the inner pinion bearing on the drive pinion gear stem.

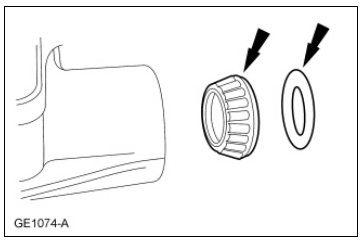
10. Using the Bearing/Oil Seal Plate and Drive Pinion Bearing Cone Installer and a suitable press, firmly seat the selected drive pinion bearing adjustment shim and inner pinion bearing on the drive pinion gear stem.



11. Place a new differential drive pinion collapsible spacer on the drive pinion gear stem against the pinion stem shoulder.



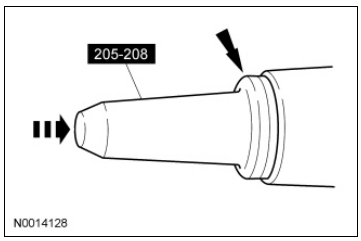
12. Install the outer pinion bearing and the drive pinion oil seal slinger.



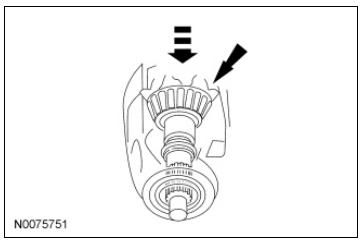
13. **NOTE:** If the drive pinion seal becomes misaligned during installation, remove it and install a new drive pinion seal.

    NOTE: Coat the drive pinion seal lips with grease.

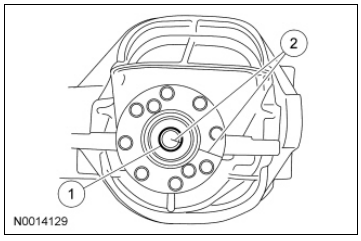
    Using the Drive Pinion Oil Seal Installer, install the new drive pinion seal.



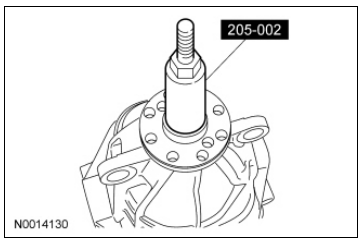
14. Install the drive pinion gear with the differential drive pinion collapsible spacer in the differential housing.



15. Position the pinion flange.
    1. Lubricate the pinion flange splines with grease.
    2. Align the pinion flange.



16. Using the Drive Pinion Flange Installer, install the pinion flange.

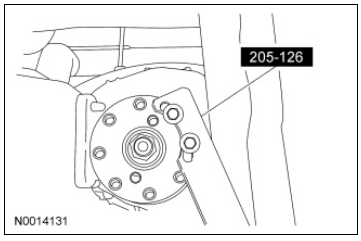


17. ***NOTICE:*** **Do not, under any circumstance, loosen the pinion nut to reduce drive pinion bearing preload or damage to the component may occur. If it is necessary to reduce drive pinion bearing preload, install a new differential drive pinion collapsible spacer and pinion nut.**

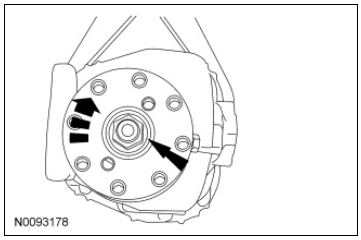
    NOTE: Remove the Drive Pinion Flange Holding Fixture while taking drive pinion bearing preload readings with the Nm (lb-in) torque wrench.

    Use the Drive Pinion Flange Holding Fixture to hold the pinion flange while tightening the pinion nut.

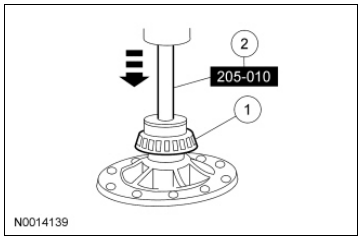
    - Rotate the drive pinion gear occasionally to make sure the drive pinion bearings seat correctly. Take frequent drive pinion bearing preload readings by rotating the drive pinion gear with a Nm (lb-in) torque wrench.



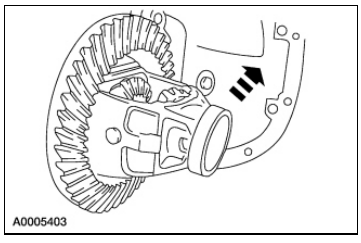
18. Tighten the pinion nut to set the drive pinion bearing preload. Refer to the torque specification for drive pinion bearings in the Specifications portion of this section.



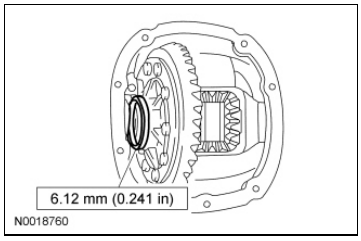
19. Press the left and right differential bearing on the differential assembly.
    1. Position the differential bearings.
    2. Using the Differential Side Bearing Installer, press the differential bearing on the differential assembly.



20. Install the differential assembly.

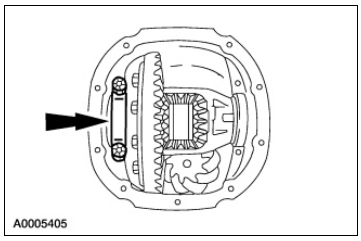


21. Install a differential bearing shim of the thickness shown on the LH side of the differential case.



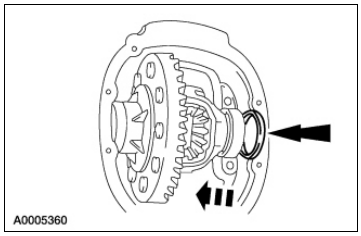
22. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install the left bearing cap and loosely install the 2 bearing cap bolts.



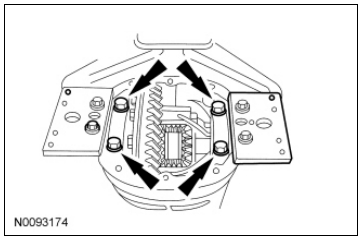
23. **NOTE:** Apply pressure toward the left side to make sure the left bearing cap is seated.

    Install progressively thicker differential bearing shims on the right side until the thickest differential bearing shim can be inserted by hand.

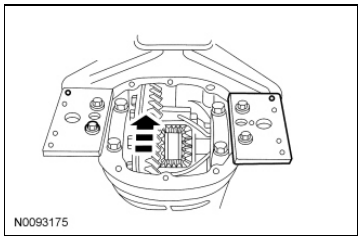


24. Install the right bearing cap and 2 bolts.

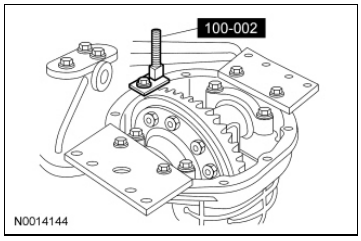
25. Tighten the 4 differential bearing cap bolts.
    - Tighten to 111 Nm (82 lb-ft).



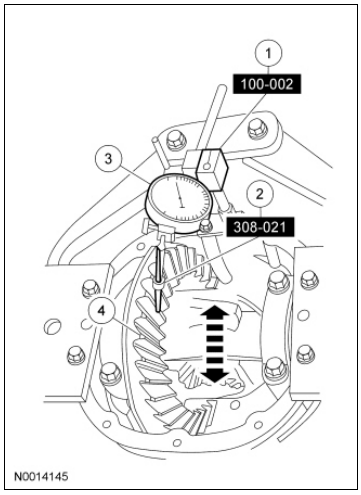
26. Rotate the differential case to make sure it turns freely.



27. Install the Dial Indicator Gauge with Holding Fixture at the 12 o'clock position.



28. Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, measure the differential ring gear backlash at 4 equally spaced points.
    1. Attach the Dial Indicator Gauge.
    2. Position the Clutch Housing Gauge tip centrally on a drive tooth.
    3. Zero the Dial Indicator Gauge.
    4. Turn the differential ring gear without turning the drive pinion gear. Record the Dial Indicator Gauge reading. The allowable backlash is 0.203-0.305 mm (0.008-0.012 in) and must not vary more than 0.101 mm (0.004 in) between points measured. A backlash variation of more than 0.101 mm (0.004 in) between points checked indicates gear/case runout.
        - To correct for a high or low backlash, proceed as follows.



29. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount. Refer to the following tables when adjusting the backlash.

Backlash Change Required		Thickness Change Required	
mm	**Inch**	**mm**	**Inch**
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014

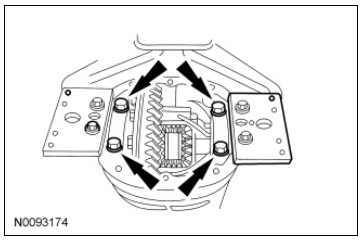
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

Differential Shim Size Chart - 4067

Numbers of Stripes and Color Code	Dimension A	
	mm	Inch
2 - C-COAL	7.7978- 7.8105	0.3070- 0.3075
1 - C-COAL	7.7470- 7.7597	0.3050- 0.3055
5 - BLU	7.6962- 7.7089	0.3030- 0.3035
4 - BLU	7.6454- 7.6581	0.3010- 0.3015
3 - BLU	7.5946- 7.6073	0.2990- 0.2995
2 - BLU	7.5458- 7.5565	0.2970- 0.2975
1 - BLU	7.493- 7.505	0.2950- 0.2955
5 - PINK	7.4422- 7.4549	0.2930- 0.2935
4 - PINK	7.3914- 7.4041	0.2910- 0.2915
3 - PINK	7.3406- 7.3533	0.2890- 0.2895
2 - PINK	7.2898- 7.3025	0.2870- 0.2875
1 - PINK	7.2390- 7.2517	0.2850- 0.2855
5 - GRN	7.1882- 7.2009	0.2830- 0.2835
4 - GRN	7.1374- 7.1501	0.2810- 0.2815
3 - GRN	7.0866- 7.0993	0.2790- 0.2795
2 - GRN	7.0358- 7.0485	0.2770- 0.2775
1 - GRN	6.9850- 7.0485	0.2750- 0.2755
5 - WH	6.9342- 6.9469	0.2730- 0.2735
4 - WH	6.8834- 6.8961	0.2710- 0.2715
3 - WH	6.8326- 6.8453	0.2690- 0.2695
2 - WH	6.7818- 6.7945	0.2670- 0.2675
1 - WH	6.7310- 6.7437	0.2650- 0.2655
5 - YEL	6.6802- 6.6929	0.2630- 0.2635
4 - YEL	6.6294- 6.6421	0.2610- 0.2615
3 - YEL	6.5786- 6.5913	0.2590- 0.2595
2 - YEL	6.5278- 6.5405	0.2570- 0.2575
1 - YEL	6.4770- 6.4897	0.2550- 0.2555
5 - ORNG	6.4262- 6.4389	0.2530- 0.2535
4 - ORNG	6.3754- 6.3881	0.2510- 0.2515
3 - ORNG	6.3246- 6.3373	0.2490- 0.2495
2 - ORNG	6.2738- 6.2865	0.2470- 0.2475
1 - ORNG	6.2223- 6.2357	0.2450- 0.2455

2 - RED	6.1722- 6.1849	0.2430- 0.2435
1 - RED	6.1214- 6.1341	0.2410- 0.2415

30. Remove the 4 differential bearing cap bolts.
    - Remove the differential assembly.

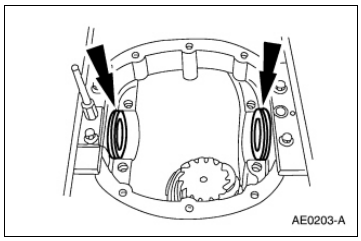


31. Measure the thickness of the selected right and left bearing shims.

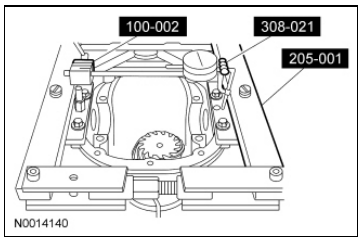
32. To establish differential bearing preload, increase both the left and right differential bearing shim thickness by 0.203 mm (0.008 in).

33. ***NOTICE:*** **To avoid galling the case, insert shims with a light coating of grease before installing the differential assembly. If not carried out in this order, the aluminum housing can be damaged.**

    Place the 2 differential bearing shims in the differential housing.



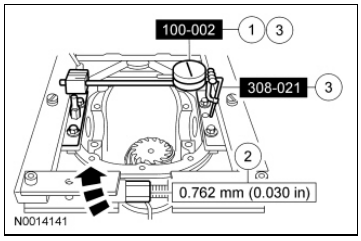
34. Install the Differential Carrier Spreader, Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



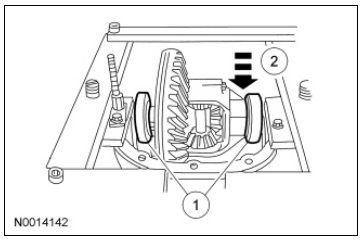
35. **NOTE:** Tighten and loosen the differential carrier spreader screw to normalize the housing spreader adapters prior to taking the final Dial Indicator Gauge reading.

    Spread the differential housing to the specification.

    1. Adjust the Dial Indicator Gauge to zero.
    2. Tighten the screw until spreading the differential housing to the specification.
    3. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.

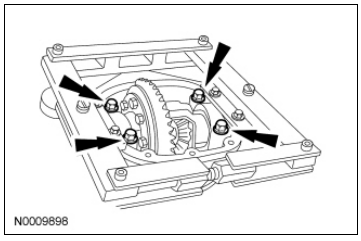


36. Install the differential assembly.
    1. Position the 2 differential bearing cups on the 2 differential bearings.
    2. Lower the differential assembly in place between the 2 differential bearing shims.

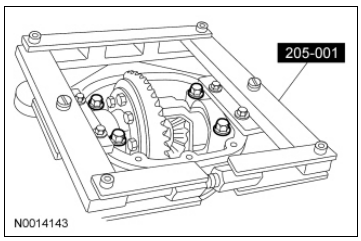


37. **NOTE:** Hand-tighten the differential bearing cap bolts prior to releasing the carrier spreader.

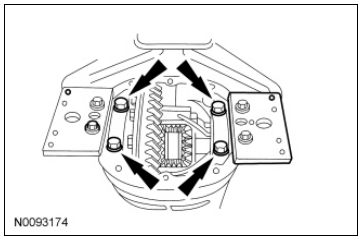
    Install the 2 differential bearing caps and the 4 differential bearing cap bolts in their original locations and positions.



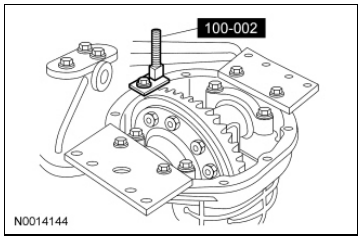
38. Loosen and remove the Differential Carrier Spreader.



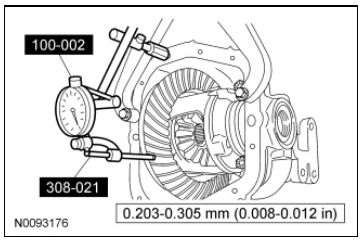
39. Tighten the 4 differential bearing cap bolts.
    - Tighten to 111 Nm (82 lb-ft).



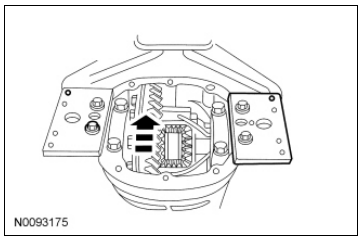
40. Install the Dial Indicator Gauge with Holding Fixture at the 12 o'clock position.



41. Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, recheck the ring gear backlash.



42. Apply marking compound and rotate the differential assembly 5 complete revolutions.



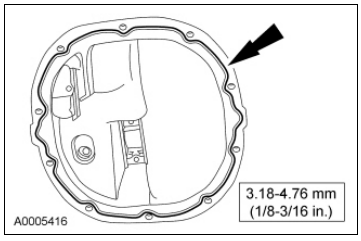
43. Verify an acceptable pattern check.

44. **NOTE:** Install the differential housing cover within 15 minutes of applying the silicone material.

    NOTE: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of silicone gasket and sealant, of the specified thickness, to the differential housing cover mounting surface as shown.

    - Use silicone gasket and sealant.



45. Install the differential housing cover and 10 housing cover bolts.

46. Install the rear axle assembly. For additional information, refer to Axle Assembly in this section.

47. Install the drain plug and remove the fill plug.
    - Tighten to 34 Nm (25 lb-ft).

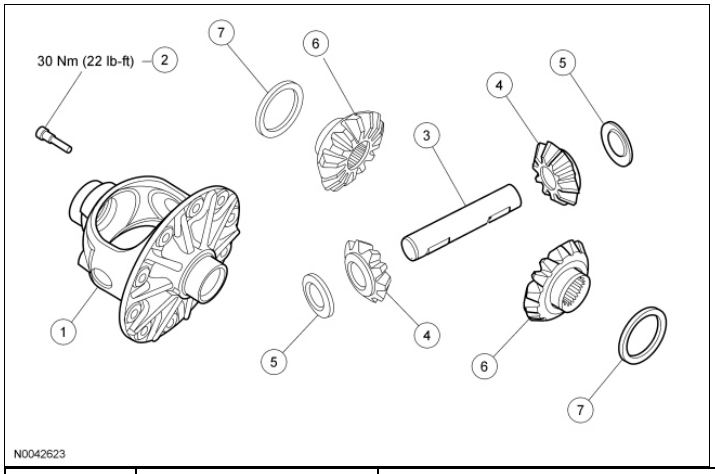
48. Fill the axle assembly with the specified lubricant.

49. Install the fill plug.
    - Tighten to 34 Nm (25 lb-ft).

Differential Case and Ring Gear

Material

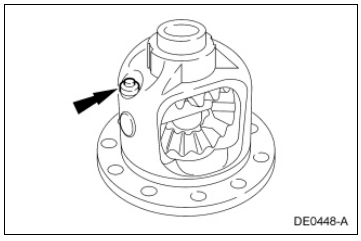
Item	Specification
Motorcraft® SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A and GL-5



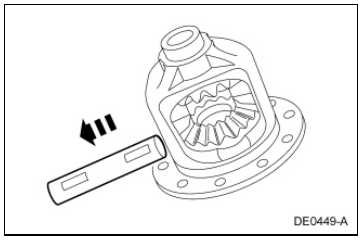
Item	Part Number	Description
1	4205	Differential assembly
2	387505	Differential pinion shaft lock bolt
3	4211	Differential pinion shaft
4	4215	Differential pinion gears
5	4230	Differential pinion gear thrust washers
6	4236	Differential side gears
7	4228	Differential side gear thrust washers

Disassembly

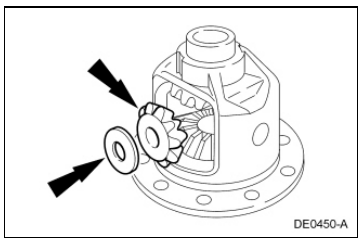
1. Remove and discard the differential pinion shaft lock bolt.



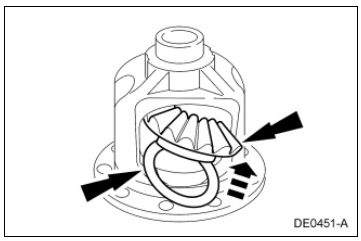
2. Remove the differential pinion shaft.



3. Rotate and remove the 2 differential pinion gears and 2 differential pinion gear thrust washers.



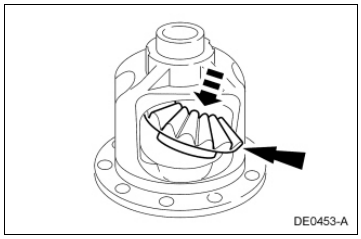
4. Remove the 2 differential side gears and the 2 differential side gear thrust washers.



Assembly

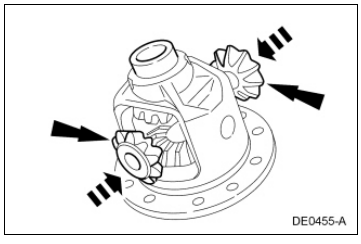
1. **NOTE:** Lubricate the differential side gears and differential side gear thrust washers with synthetic rear axle lubricant.

   Install the 2 differential side gears and the 2 differential side gear thrust washers.



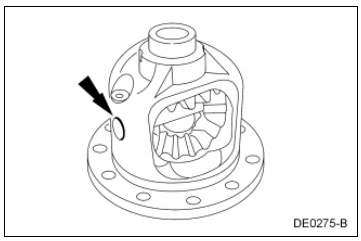
2. **NOTE:** Lubricate the differential pinion gears and the differential pinion gear thrust washers with synthetic rear axle lubricant.

   Install and rotate the 2 differential pinion gears and the 2 differential pinion gear thrust washers.

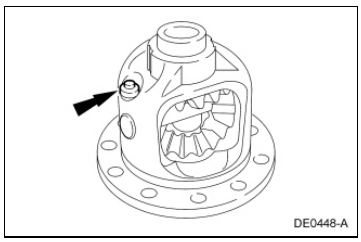


3. **NOTE:** Align the hole in the differential pinion shaft with the hole in the differential case.

Install the differential pinion shaft.



4. Install a new differential pinion shaft lock bolt.
   - Tighten to 30 Nm (22 lb-ft).



Material

Item	Specification	Fill Capacity
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-	-
Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A	1.3L (2.7 pt) to the bottom of the filler hole
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-

General Specifications

Item	Specification
Front Axle	
Available drive pinion bearing adjustment shim in steps of 0.05 mm (0.002 in)	1.35-1.85 mm (0.053-0.073 in)
Maximum backlash variation between points checked	0.050 mm (0.002 in)
Maximum spread of differential housing	0.381 mm (0.015 in)
Pinion bearing preload (original collapsible spacer)	0.56 Nm (5 lb-in) more than recorded disassembly torque
Pinion bearing preload (new collapsible spacer)	1.7-3.4 Nm (15-30 lb-in)
Ring gear backlash	0.13-0.20 mm (0.005-0.008 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Adapter	2.5	-	22
Axle insulator bolts	100	74	-
Brake caliper anchor bolts	165	122	-
Differential bearing cap bolts	61	45	-
Differential housing cover bolts	29	21	-
Differential ring gear bolts	122	90	-
Fill plug	27	20	-

Front Drive Axle and Differential

The front axle assembly contains the following:

- Full float axle design with turning capabilities
- Integral-type housing hypoid gear design
- Hypoid differential ring gear and pinion that consists of a 180.98 mm (7.125 in) ring gear and an overhung drive pinion, which is supported by 2 opposed tapered roller bearings
- Pinion bearing preload is maintained by a drive pinion collapsible spacer that is on the differential pinion shaft and adjusted by the pinion nut
- Axle housing assembly that is cast aluminum with a stamped differential housing cover
- Assembly that is mounted to the vehicle through 3 rubber isolators
- Differential housing cover that uses silicone sealant as a gasket
- Differential pinion shaft that is retained by a differential pinion shaft lock pin assembled to the differential case
- Differential case that is mounted in the rear axle housing between 2 opposing differential bearings that are retained in the rear axle housing by removable bearing caps
- Motorcraft 80W-90 Premium Rear Axle Lubricant XY-80W90-QL or equivalent meeting Ford specification WSP-M2C197-A is used in this assembly
- Differential bearing preload and ring gear backlash are adjusted by differential bearing shims that are located between the differential housing and the differential bearings
- Front axle identification that is on an mylar tag attached to differential housing

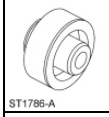
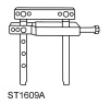
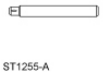
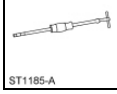
The front drive axle receives rotational torque from the front driveshaft. The direction of the rotation determines movement of the vehicle. The rotation enters the front drive axle through the drive pinion flange, turning the drive pinion and rotating the ring gear. The ring gear is bolted to the differential case. The differential case houses the pinion shaft upon which the differential pinion gears ride. The pinion gears are in mesh with the differential side gears with splined axle shafts. It is the unique arrangement of the differential that allows the axle shafts to be driven at different speed when needed, such as when driving around corners.

Front Drive Axle

Refer to Section 205-00 .

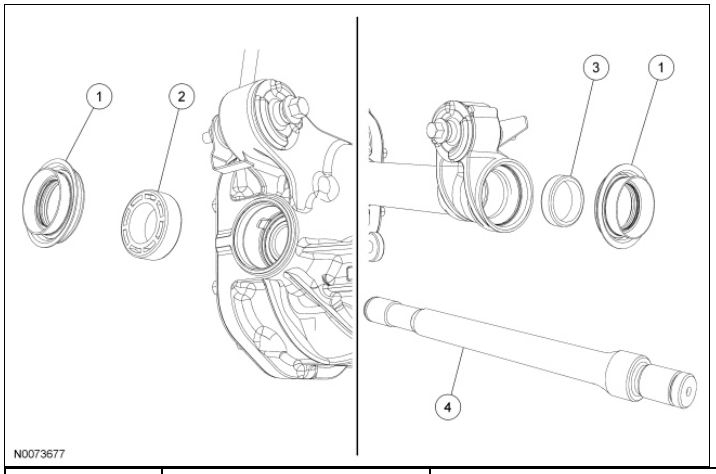
Stub Shaft Pilot Bearing and Seal

Special Tool(s)

 ST2472-A	Axle Bearing Replacer (RH) 205-345 (T95T-1175-B)
 ST1786-A	Axle Seal Replacer 205-350 (T95T-3010-A)
 ST1362-A	Bearing Remover 307-318 (T94P-77001-KH)
 ST1609A	Converter Oil Seal Remover 307-309 (T94P-77001-BH)
 ST1255-A	Handle 205-153 (T80T-4000-W)
 ST1768-A	Installer, Front Axle Bearing (LH) 205-347 (T95T-1175-D)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A



Item	Part Number	Description
1	4606	Stub shaft pilot bearing seal
2	2002806	Stub shaft pilot bearing bushing
3	2002805	Stub shaft pilot bearing
4	3A380	Axle shaft

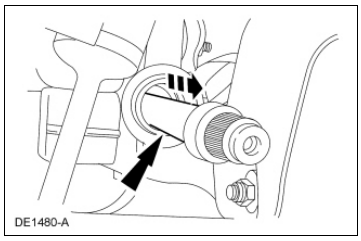
Removal

Both sides

1. Remove the halfshafts. For additional information, refer to Section 205-04 .

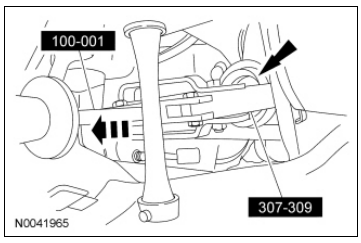
Right side

2. Remove the axle shaft.

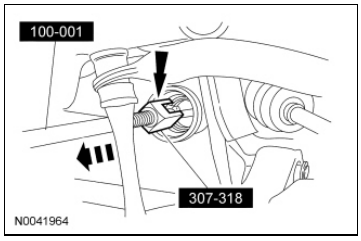


Both sides

3. Using the Converter Oil Seal Remover and a Slide Hammer, remove the stub shaft oil seals.



4. Using the Bearing Remover and a Slide Hammer, remove the stub shaft pilot bearings.

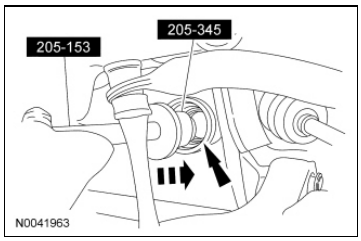


5. Clean the bearing and seal surfaces of any foreign material.

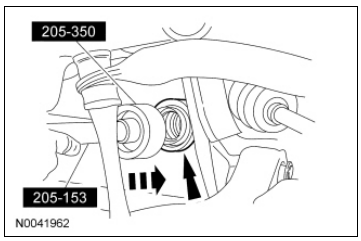
Installation

Right side

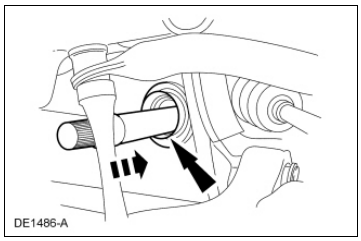
1. Using the Handle and Axle Bearing Replacer (RH), install the stub shaft pilot bearing.



2. Using the Handle and Axle Seal Replacer, install the stub shaft oil seals.

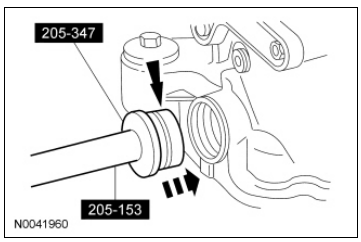


3. Install the axle shaft.

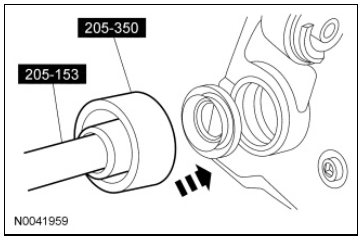


Left side

4. Using the Handle and Front Axle Bearing Installer (LH), install the stub shaft bearing.



5. Using the Handle and Axle Seal Replacer, install the stub shaft seal.



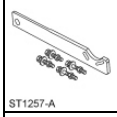
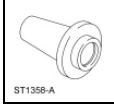
Both sides

6. Refill the front drive axle to the correct level with lubricant.

7. Install the halfshafts. For additional information, refer to Section 205-04 .

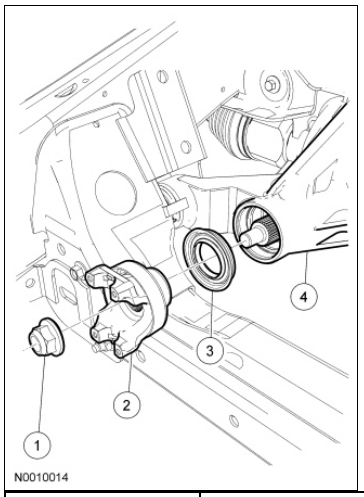
Drive Pinion Flange and Seal

Special Tool(s)

 ST2026-A	2 Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1600-A	Installer, Drive Pinion Flange 205-209 (T83T-4851-A)
 ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)

Material

Item	Specification
Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A



Item	Part Number	Description
1	3T222	Pinion nut and washer
2	4851	Pinion flange
3	4676	Drive pinion oil seal
4	3010	Differential housing

Removal

NOTE: This operation disturbs the pinion bearing preload. Carefully reset the pinion bearing preload during assembly.

1. **NOTE:** The front wheels and tires and brake calipers must be removed to prevent drag during the pinion bearing preload recording and adjustment.

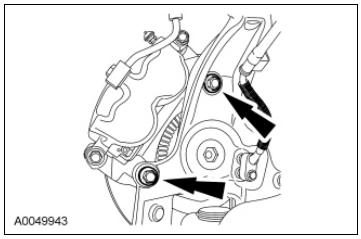
   Remove the wheels and tires. For additional information, refer to Section 204-04 .

2. Remove the front driveshaft. For additional information, refer to Section 205-01 .

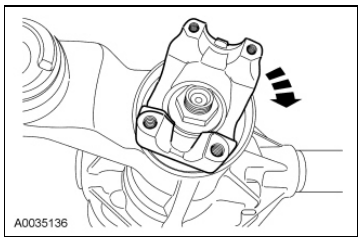
3. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the 4 brake caliper anchor bolts and position the caliper and anchor plate assemblies aside.

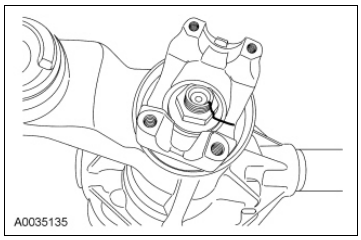
   - Support the caliper and anchor plate assembly using mechanic's wire.



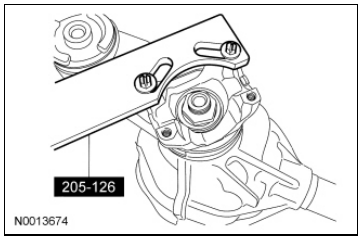
4. Measure and record the pinion bearing preload.
   - Using a Nm torque wrench, rotate the pinion gear. Measure the torque required to maintain pinion gear rotation.



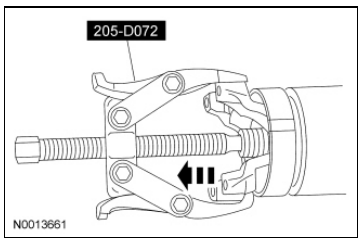
5. Index-mark the pinion flange and the pinion gear stem.



6. Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, remove and discard the pinion nut.

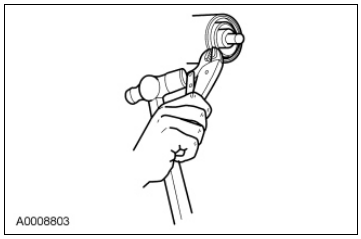


7. Using the 2 Jaw Puller, remove the pinion flange.

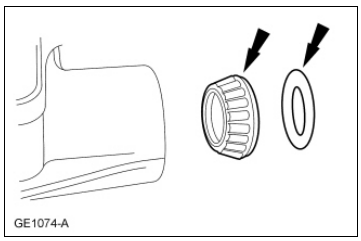


8. Inspect the pinion flange for burrs and damage. Inspect the end of the pinion flange that contacts the pinion bearing cone, pinion nut counterbore and drive pinion oil seal surface for nicks. Discard the pinion flange if damaged.

9. Use a screwdriver to force up the metal portion of the pinion seal. Using gripping pliers and a hammer, remove the drive pinion oil seal.



10. Remove the drive pinion oil slinger and the outer pinion bearing.



11. Remove and discard the collapsible spacer.

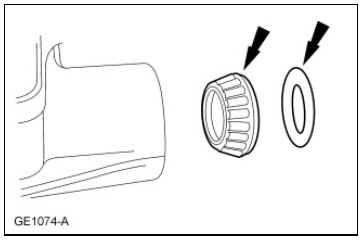
12. Verify the splines on the pinion stem are free of burrs. If burrs are evident, remove them with a fine crocus cloth.

13. Clean the drive pinion oil seal bore.

Installation

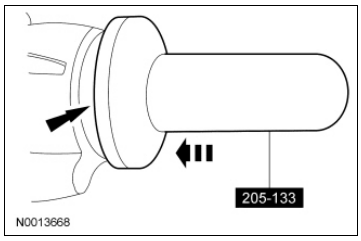
1. Install a new collapsible spacer.

2. Install the outer pinion bearing and the drive pinion oil slinger.



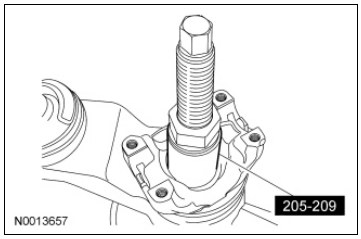
3. **NOTE:** Lubricate the drive pinion oil seal lips with axle lubricant.

   Using the Drive Pinion Oil Seal Installer, install the drive pinion oil seal.

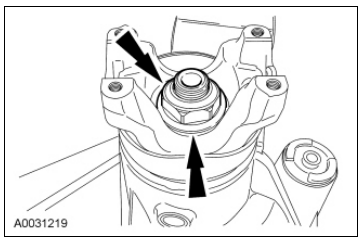


4. ***NOTICE:*** **Never install the pinion flange with power tools or damage to the component may occur.**

   Align the index marks and using the Drive Pinion Flange Installer, install the pinion flange.



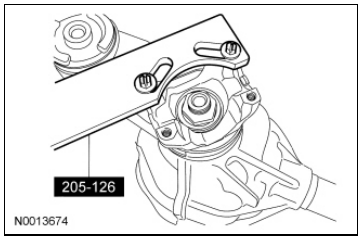
5. Install the new pinion nut. Only hand-tighten the pinion nut at this time.



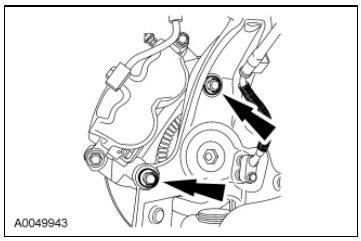
6. ***NOTICE:*** **Do not loosen the pinion nut to reduce pinion bearing preload. Install a new collapsible spacer and pinion nut if pinion bearing preload reduction is necessary or damage to the component may occur.**

   Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, tighten the pinion nut to set the pinion bearing preload.

   - Tighten the pinion nut, rotating the pinion occasionally to make sure the pinion bearings are seating correctly. Take frequent pinion bearing preload readings by rotating the pinion gear with a Nm torque wrench. The final reading must be 0.56 Nm (5 lb-in) more than the initial reading taken during removal.



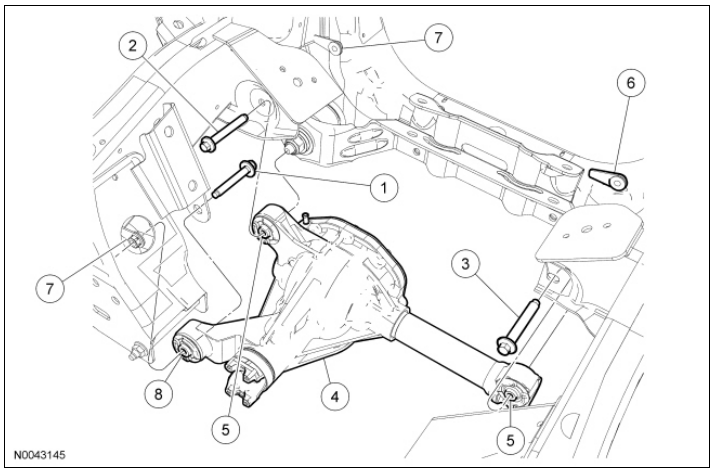
7. Position the brake caliper and anchor plate assemblies, then install the 4 bolts.
    - Tighten to 165 Nm (122 lb-ft).



8. Install the front driveshaft. For additional information, refer to Section 205-01 .

9. Install the wheels and tires. For additional information, refer to Section 204-04 .

Axle Assembly

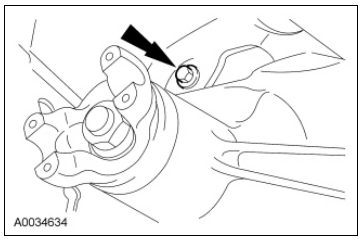


Item	Part Number	Description
1	W506549	Axle insulator bolt
2	W506549	Axle insulator bolt
3	W506549	Axle insulator bolt
4	3010	Axle assembly
5	3A443	Axle insulator bushings
6	W708348	Axle tube insulator bolt flag nut
7	W706348	Axle insulator bolt elbow flag nuts
8	3A443	Axle insulator bushing

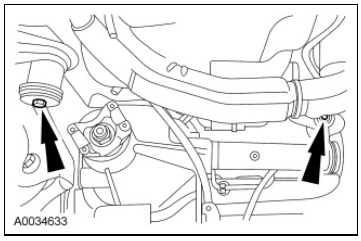
Removal and Installation

1. Remove the front halfshafts. For additional information, refer to Section 205-04 .
2. Remove the front driveshaft. For additional information, refer to Section 205-01 .
3. **NOTE:** Securely strap the jack to the axle.

   Position a suitable hydraulic jack under the front axle.

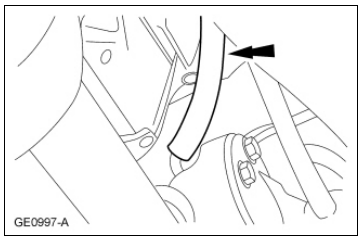


4. Remove and discard the 3 axle insulator bolts.
   - Tighten the 3 new bolts to 100 Nm (74 lb-ft).



5. **NOTE:** Lower the axle to gain access to the axle vent hose.

   Disconnect the axle vent hose.



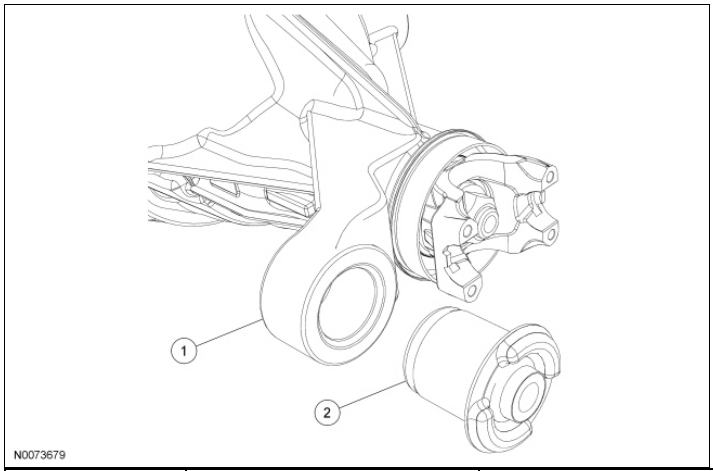
6. Lower the axle assembly from the vehicle.

7. To install, reverse the removal procedure.

Axle Carrier Bushing

Special Tool(s)

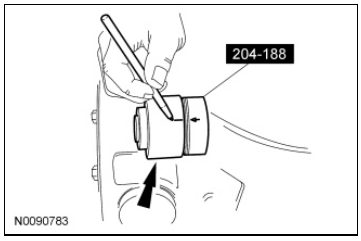
 ST2588-A	Aligner, Front Differential Housing Bushing 204-188 (T95T-5638-CH)
 ST1162-A	Installer, Front Axle Mounting Bushing Drawbolt 205-374 (T96T-5638-H)
 ST2664A	Installer, Upper Arm Pivot Bushing 204-157 (T89P-5638-E)
 ST1155-A	Remover, Front Axle Mounting Bushing 205-376 (T96T-5638-K)
 ST2587-A	Remover, Front Differential Housing Bushing 204-186 (T95T-5638-AH)
 ST1516-A	Remover/Installer, Front Wheel Hub 204-069 (T81P-1104-C)



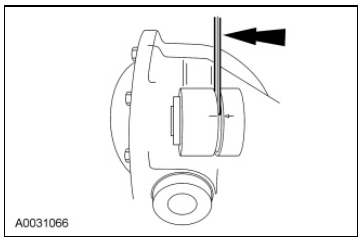
Item	Part Number	Description
1	3002	Front axle housing
2	46821	Front axle carrier bushing

Removal

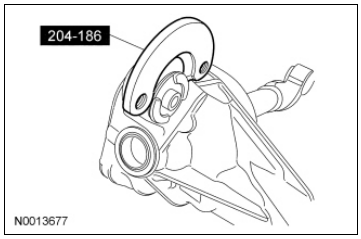
1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.
2. Place the Front Differential Housing Bushing Aligner on the insulator and index-mark the housing in line with the arrow on the special tool.



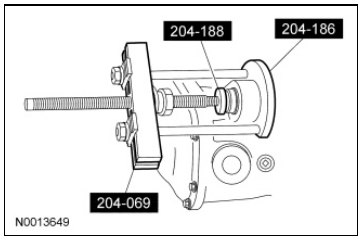
3. Using a feeler gauge, measure the gap between the insulator flange and the axle housing. Record the measurement.



4. Tap the Front Differential Housing Bushing Remover on between the axle housing and the insulator flange.

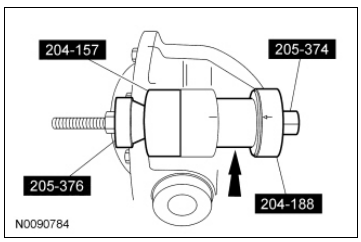


5. Assemble the Front Differential Housing Bushing, Front Differential Housing Bushing Remover and the Front Wheel Hub Remover/Installer. Remove and discard the insulator.

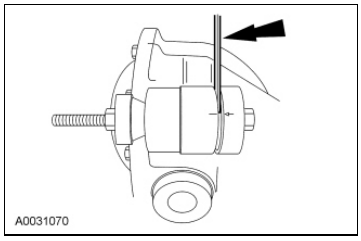


Installation

1. Set the new insulator in the housing bore and install the Front Axle Mounting Bushing Drawbolt, Front Differential Housing Bushing Aligner, Front Axle Mounting Bushing Remover and Upper Arm Pivot Bushing Installer. Align the arrow marks on the Front Differential Housing Bushing Aligner with the index mark on the axle housing.



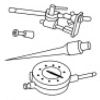
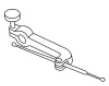
2. Draw the insulator into the housing to the measured gap earlier in this procedure.



3. Install the axle assembly. For additional information, refer to Axle Assembly in this section.

Differential Ring And Pinion

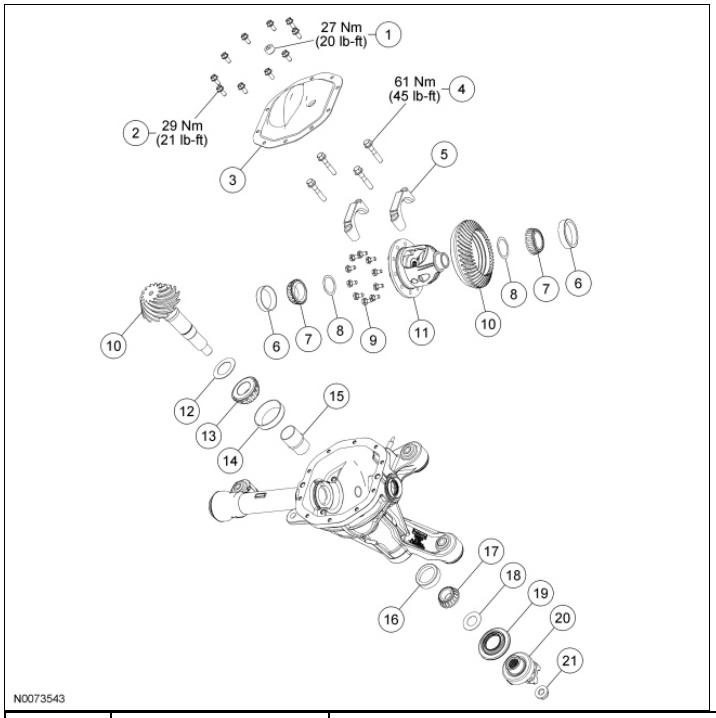
Special Tool(s)

 ST2026-A	2 Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1610-A	Adapter for 205-001 205-001-01
 ST1118-A	Adapter for 205-S127 205-093 (T75P-4020-A2)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
 ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1869-A	Drawbar, Rear Axle 205-098 (T75T-1176-A)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1548-A	Gauge, Differential Dummy Bearing 205-247 (T86T-4222-AH)
 ST1433-B	Gauge Disc (0.4782 inch) 205-D029 (D80T-4020-F44)
 ST1434-A	Gauge Tube (2.892 inch) 205-D034 (D80T-4020-F49) or equivalent
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)

 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1484-A	Installer, Drive Pinion Bearing Cone 205-834
 ST1361-A	Installer, Drive Pinion Bearing Cup 205-014 (T60K-4616-A)
 ST1851-A	Installer, Drive Pinion Bearing Cup 205-835
 ST1800-A	Installer, Drive Pinion Flange 205-209 (T83T-4851-A)
 ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)
 ST1347-A	Puller, Drive Pinion/Differential Carrier 205-D036 (D81L-4220-A)
 ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)

Material

Item	Specification
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-
Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

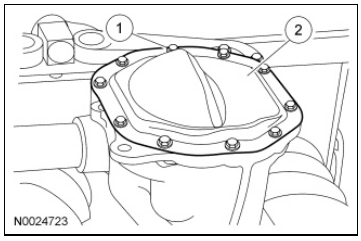


Item	Part Number	Description
1	2002748	Fill plug
2	40286-5	Differential housing cover bolt (10 required)
3	2002323	Differential housing cover
4	40284-1	Differential bearing cap bolt (4 required)
5	42769	Differential bearing cap (2 required)
6	550734	Differential carrier bearing cups
7	550433	Differential carrier bearing cones
8	30215	Differential carrier bearing shims
9	41221	Differential ring gear bolt (10 required)
10	3A410	Differential ring gear and pinion set
11	4205	Differential case
12	44453	Differential pinion bearing shim
13	NP310800	Differential pinion inner bearing cone
14	NP312191	Differential pinion inner bearing cup
15	2003879	Differential pinion collapsible spacer
16	2003899	Differential pinion outer bearing cup
17	2003898	Differential pinion outer bearing cone
18	42778	Differential oil slinger
19	3N296	Drive pinion seal
20	4851	Drive pinion flange
21	2002800	Drive pinion flange nut

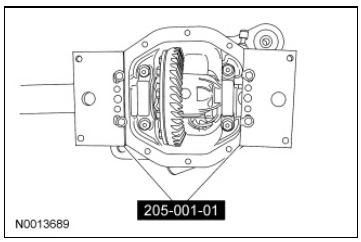
Removal

1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.

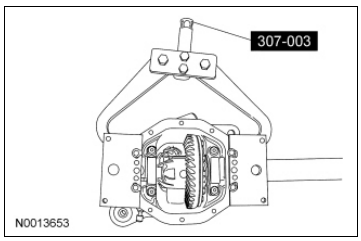
2. Drain the front axle assembly.
    1. Remove the 10 differential housing cover bolts.
    2. Remove the differential cover.



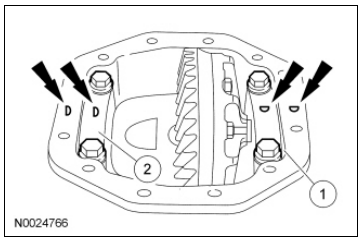
3. Install the Adapters on the differential housing.



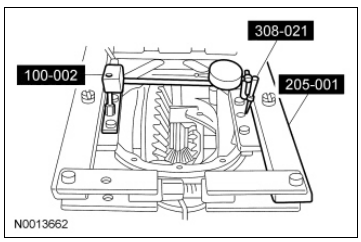
4. Install the Transmission Holding Fixture on the Adapters and mount the assembly to a bench.



5. Remove the 2 differential bearing caps.
    1. Remove the 4 differential bearing cap bolts.
    2. Remove and identify the 2 differential bearing caps.



6. Install the Differential Carrier Spreader, Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.

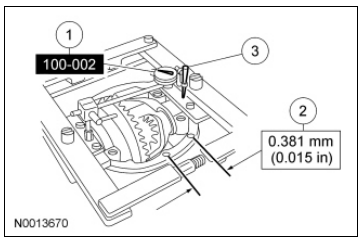


7. ***NOTICE:*** **Overspreading can damage the differential housing.**

    Spread the differential housing to the specification.

    1. Adjust the Dial Indicator Gauge to zero.
    2. Tighten the differential carrier spreader screw.

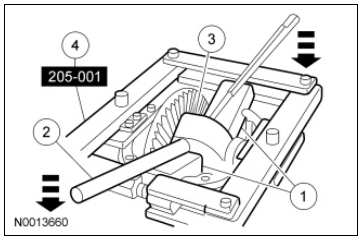
3. Remove the Dial Indicator Gauge.



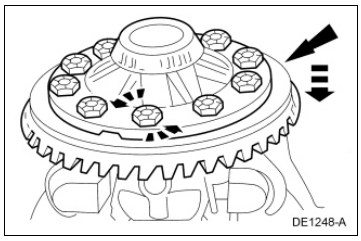
8. ***NOTICE:*** **Use wood blocks to avoid damaging the differential housing.**

Remove the differential assembly from the housing.

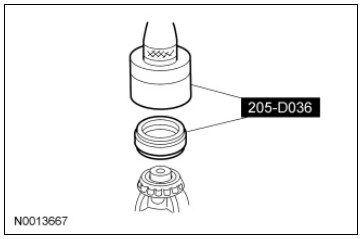
1. Position the wood blocks.
2. Push downward on the pry bars.
3. Remove the differential assembly.
4. Remove the Differential Carrier Spreader.



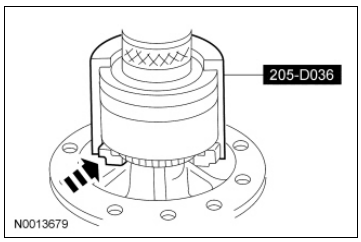
9. Remove and discard the 10 differential ring gear bolts and the differential ring gear.
   - Use a drift punch to separate the differential ring gear from the differential case.



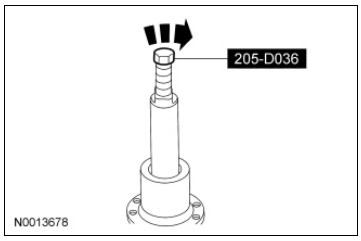
10. Assemble the Drive Pinion/Differential Carrier Puller.



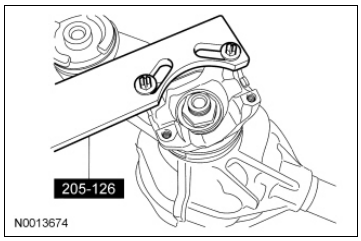
11. Position the Drive Pinion/Differential Carrier Puller on the differential bearing.



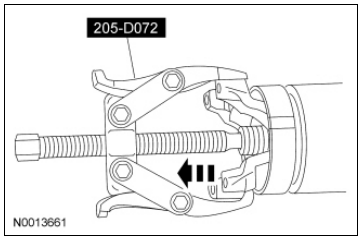
12. Using the Drive Pinion/Differential Carrier Puller, remove and discard the LH and RH differential bearings.



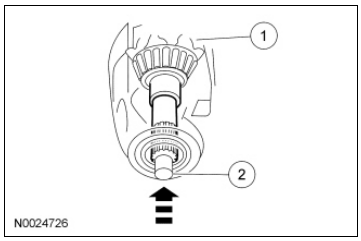
13. Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, remove and discard the pinion nut.



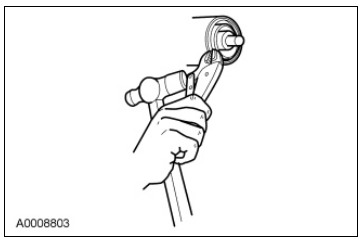
14. Using the 2 Jaw Puller, remove the pinion flange.



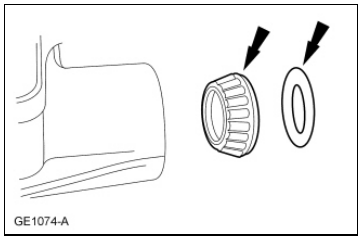
15. Using a soft-face hammer, remove the pinion from the differential housing.
    1. Hold the pinion inside the differential housing.
    2. Use a soft-face hammer to remove the pinion from the outer pinion bearing.



16. Use a screwdriver to force up the metal portion of the pinion seal. Using gripping pliers and a hammer, remove the drive pinion oil seal.

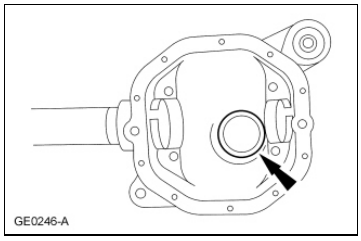


17. Remove the front axle drive pinion shaft oil slinger and the outer pinion bearing.
    - Discard the outer pinion bearing.



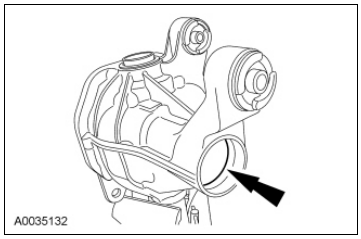
18. **NOTE:** To prevent it from becoming misaligned in the bore, remove the outer pinion bearing cup by tapping alternately on each side of the outer pinion bearing cup with a brass drift.

    Remove and discard the outer pinion bearing cup.



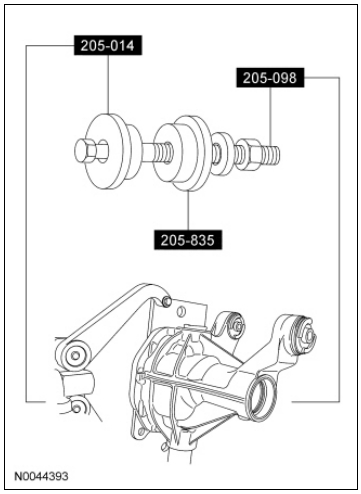
19. **NOTE:** To prevent it from becoming misaligned in the bore, remove the inner pinion bearing cup by tapping alternately on each side of the inner pinion bearing cup with a brass drift.

    Remove and discard the inner pinion bearing cup.



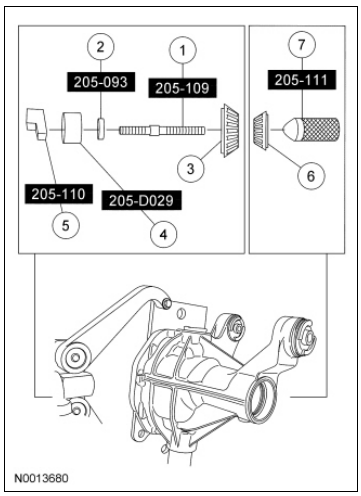
Installation

1. Install new drive pinion bearing cups.
   - Using the Rear Axle Draw Bar, Drive Pinion Bearing Cup Installers install the drive pinion bearing cups.

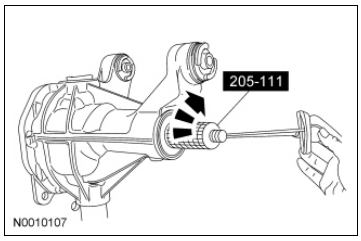


2. Assemble and position the following in the differential housing.

1. Position the Adapter.
2. Position the Adapter.
3. Position the inner pinion bearing.
4. Position the Gauge Disc.
5. Position the Adapter.
6. Position the outer pinion bearing.
7. Thread on the Adapter.

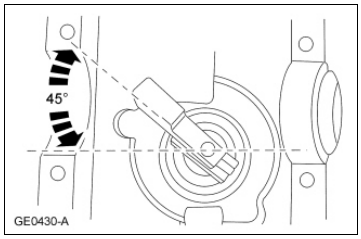


3. Using a Nm torque wrench, tighten the Adapter.
   - Tighten to 2.5 Nm (22 lb-in).

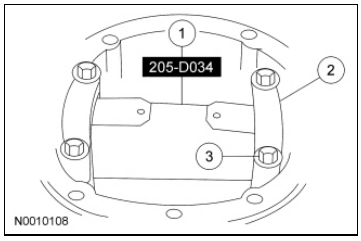


4. **NOTE:** Offset the Adapter to obtain an accurate reading.

   Rotate the Adapter several half turns to make sure the pinion bearings seat correctly. Position the Adapter as shown.

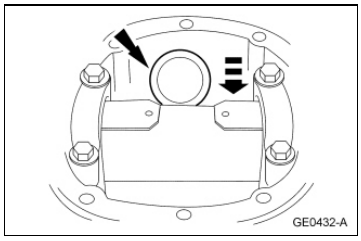


5. Install the Gauge Tube.
   1. Position the Gauge Tube.
   2. Install the 2 differential bearing caps.
   3. Install the 4 differential bearing cap bolts.
      - Tighten to 61 Nm (45 lb-ft).



6. **NOTE:** Selection of a drive pinion position shim that is too thick results in deep tooth contact at final assembly. Do not attempt to force the feeler gauge or drive pinion position shim between the Adapter and the Gauge Tube. A slight drag indicates a correct selection.

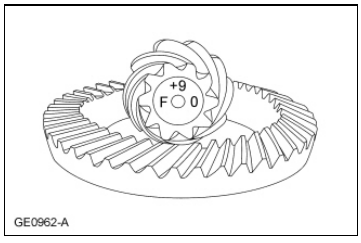
   Using a feeler gauge or a flat, clean drive pinion position shim, measure between the Adapter and the Gauge Tube. Record the measurement.



7. Select the correct thickness drive pinion position shim.
   - New drive pinion position shims are available in the following sizes:

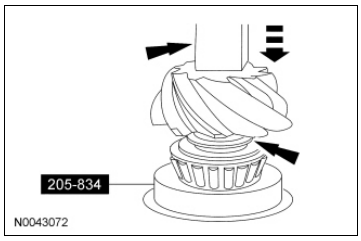
mm	Inch
1.35	0.053
1.40	0.055
1.45	0.057
1.50	0.059
1.55	0.061
1.60	0.063
1.65	0.065
1.70	0.067
1.75	0.069
1.80	0.071
1.85	0.073

   - Notice the plus (+), minus (-) or zero (0) etching on the new drive pinion, and adjust the thickness of the new drive pinion position shim. If etching is plus (+), subtract the number from the gauged drive pinion position shim thickness. If etching is minus (-), add the number to the gauged drive pinion position shim thickness.

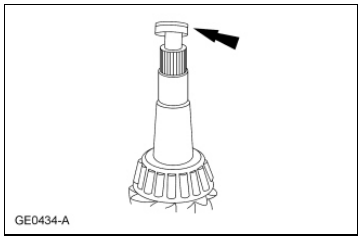


8. Install the selected drive pinion position shim and the new inner pinion bearing.

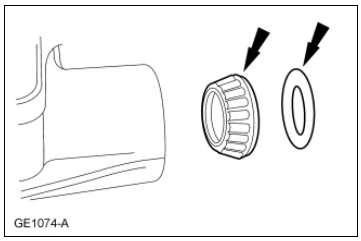
- Using the Drive Pinion Bearing Cone Installer and a suitable press, seat the inner pinion bearing firmly against the drive pinion position shim.



9. Install a new collapsible spacer.

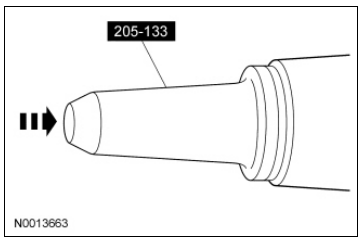


10. Install the new outer drive pinion bearing and the drive pinion oil slinger.



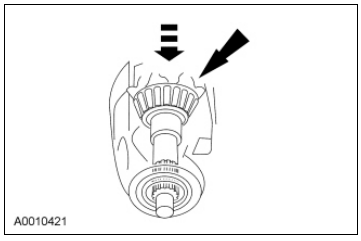
11. **NOTE:** Lubricate the drive pinion oil seal lips with rear axle lubricant.

    Using the Drive Pinion Oil Seal Installer, install the drive pinion oil seal.



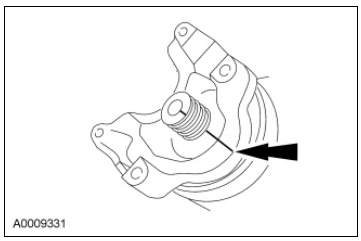
12. Lubricate the drive pinion gear splines with rear axle lubricant.

13. Install the drive pinion gear into the axle housing.

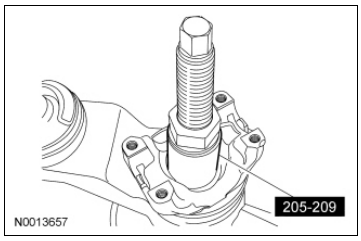


14. ***NOTICE:*** **Never use a metal hammer on the pinion flange or install the flange with power tools or damage to the component may occur.**

Position the pinion flange.



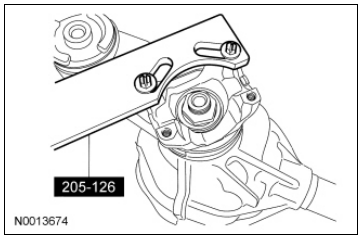
15. Using the Drive Pinion Flange Installer, install the pinion flange.



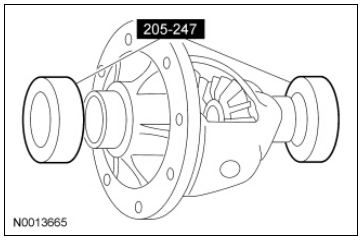
16. ***NOTICE:*** **Do not loosen the pinion nut to reduce pinion bearing preload. Install a new collapsible spacer and pinion nut if pinion bearing preload reduction is necessary or damage to the component may occur.**

    Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, tighten the new pinion nut to set the pinion bearing preload.

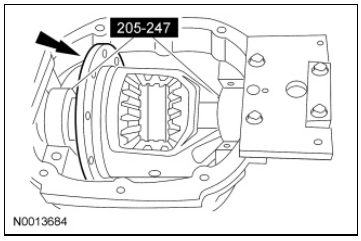
    - Tighten the pinion nut, rotating the pinion occasionally to make sure the pinion bearings are seating correctly. Take frequent pinion bearing preload readings by rotating the pinion with a Nm torque wrench. The final reading must be 1.7-3.4 Nm (15-30 lb-in).



17. Install the Differential Dummy Bearing Gauge.



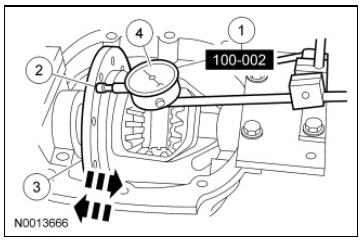
18. Position the differential assembly and Differential Dummy Bearing Gauge in the differential housing.



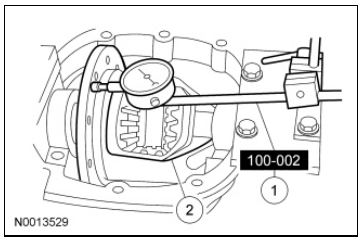
19. **NOTE:** Repeat this step until obtaining a consistent reading.

    Measure the total differential end play.

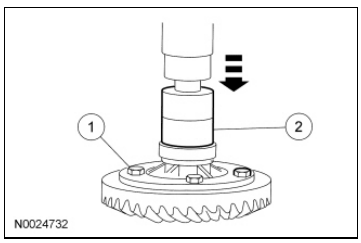
    1. Install the Dial Indicator Gauge with Holding Fixture.
    2. Force the differential assembly as far as possible away from the indicator. Position the Dial Indicator Gauge tip on the machined surface and adjust it to measure full travel. With force still applied, set the Dial Indicator Gauge to zero.
    3. Force the differential assembly as far as possible in the opposite direction.
    4. Record the total end play reading on the Differential Bearing Shim Selection Procedure Worksheet, Line A in this procedure.



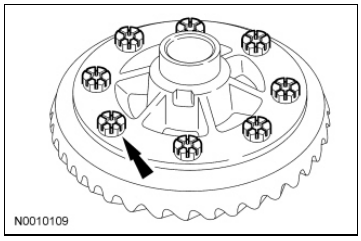
20. Remove the Dial Indicator Gauge with Holding Fixture, then remove the differential assembly.
    1. Remove the Dial Indicator Gauge with Holding Fixture.
    2. Remove the differential assembly.



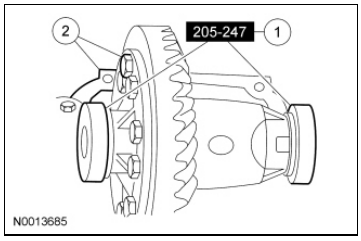
21. Using a suitable press, install the differential ring gear.
    1. Position the differential ring gear and the differential assembly. Start 3 new differential ring gear bolts to align the holes in the differential ring gear and the differential assembly.
    2. Using a suitable press, install the differential ring gear.



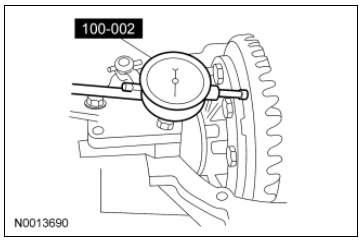
22. Install the remaining 7 new differential ring gear bolts.
    - Tighten to 122 Nm (90 lb-ft).



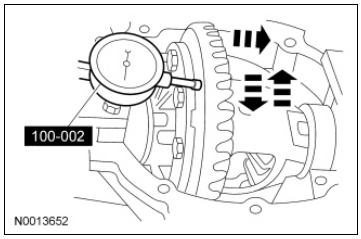
23. Install the Differential Dummy Bearing Gauge and position the differential assembly in the differential housing.
    1. Install the Differential Dummy Bearing Gauge.
    2. Position the differential assembly in the differential housing.



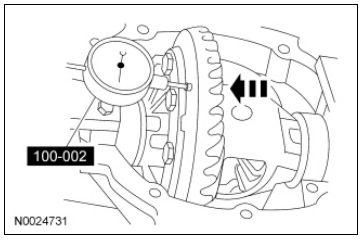
24. Position the Dial Indicator Gauge with Holding Fixture.



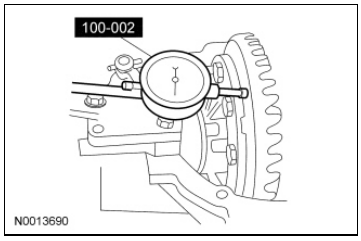
25. Force the differential ring gear into mesh with the pinion gear (zero backlash). With force still applied, set the Dial Indicator Gauge to zero.



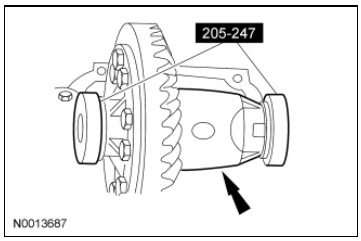
26. Force the differential ring gear away from the pinion gear as far as possible. Record the reading on the Differential Bearing Shim Selection Procedure Worksheet, Line D in this procedure.



27. Remove the Dial Indicator Gauge with Holding Fixture.



28. Remove the differential assembly from the differential housing. Remove the Differential Dummy Bearing Gauge from the differential assembly hubs.



29. Complete the worksheet and select the appropriate thickness differential bearing shims. New differential bearing shims are available in 0.0762 mm (0.003 in), 0.127 mm (0.005 in), 0.254 mm (0.010 in) and 0.762 mm (0.030 in) thickness.

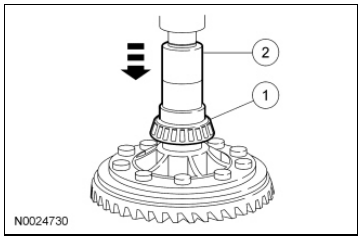
Differential Bearing Shim Selection Procedure Worksheet

Line	Item	Result (actual) mm (in)	Result (example) mm (in)
A	Total end play reading (without gears)		2.032 (0.080)
B	Add preload	+0.2032 (+0.008)	+0.2032 (+0.008)
C	Total (add A and B)		2.2352 (0.088)
D	End play measurement (with gears)		1.0414 (0.041)
E	Subtract the shim thickness on the differential ring gear side	-0.0762 (-0.003)	-0.0762 (-0.003)
F	Total (subtract E from D) (thickness of shims to place on the differential ring gear side)		0.9652 (0.038)
G	Total (subtract F from C) (thickness of shims to place on the drive pinion side)		1.27 (0.050)

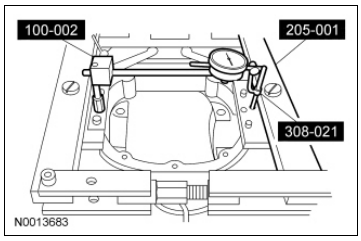
30. **NOTE:** Most axles will have the larger amount of shims on the differential ring gear side and the smaller amount on the case side.

    Install the selected differential bearing shims and the RH and LH differential bearings.

    1. Position the differential bearing shims and the differential bearing.
    2. Using a suitable press, install the differential bearing.
    - Repeat this step for the opposite side of the differential assembly.

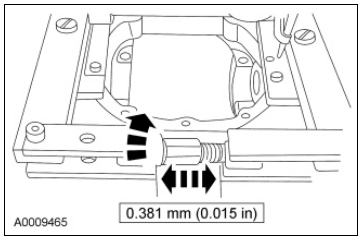


31. Install the Dial Indicator Gauge with Holding Fixture, Clutch Housing Gauge and Differential Carrier Spreader.
    - Position the Clutch Housing Gauge needle in the Differential Carrier Spreader adapter hole.

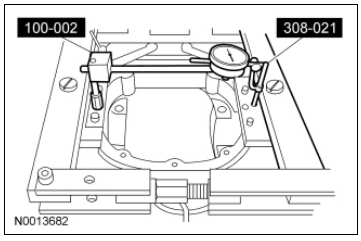


32. ***NOTICE:*** **Overspreading can damage the differential housing.**

    Spread the differential housing to specification.



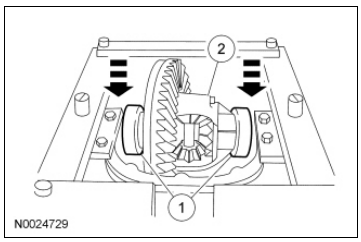
33. Remove the Dial Indicator Gauge with Holding Fixture and the Clutch Housing Gauge.



34. **NOTE:** Push the differential assembly downward to fully seat the differential bearing cups in the differential housing.

    Install the 2 differential bearing cups and the differential assembly in the differential housing.

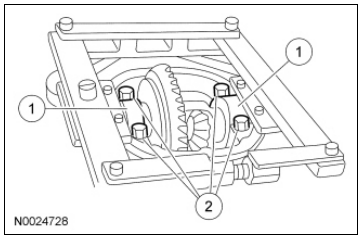
    1. Position the 2 differential bearing cups on the differential bearings.
    2. Lower the differential assembly in place.



35. **NOTE:** Do not tighten the differential bearing cap bolts to specification at this time.

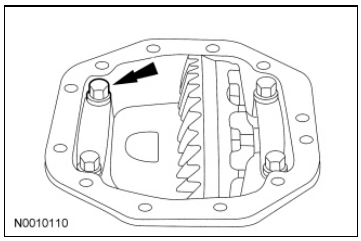
    Install the 2 differential bearing caps in their original positions.

    1. Position the 2 differential bearing caps.
    2. Install the 4 differential bearing cap bolts hand-tight.



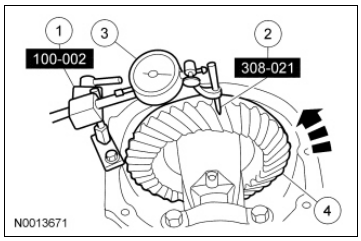
36. Remove the Differential Carrier Spreader.

37. Tighten the 4 differential bearing cap bolts.
    - Tighten to 61 Nm (45 lb-ft).

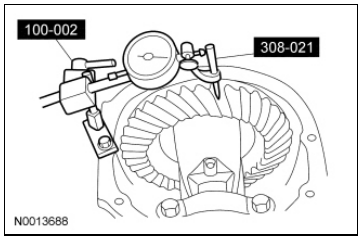


38. Verify that the differential assembly rotates freely.

39. Using the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge, measure the backlash at 3 equally spaced points on the differential ring gear.
    1. Mount the Dial Indicator Gauge with Holding Fixture.
    2. Position the Clutch Housing Gauge.
    3. Zero the Dial Indicator Gauge.
    4. Turn the differential ring gear without turning the pinion gear. Record the measurement.
    - The backlash tolerance is 0.13 mm (0.005 in) to 0.20 mm (0.008 in) and cannot vary more than 0.05 mm (0.002 in) between points checked.
    - If the backlash is not within specification, correct by increasing the thickness of one differential bearing shim and decreasing the thickness of the other differential bearing shim by the same amount.



40. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



41. Apply marking compound and rotate the differential assembly 5 complete revolutions.

42. Verify an acceptable pattern check. For additional information, refer to Section 205-00 .

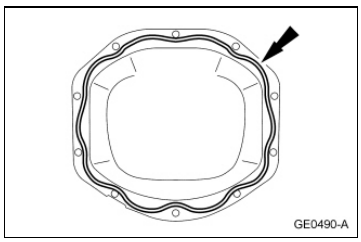
43. Install the RH axle shaft.

44. **NOTE:** The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.

    NOTE: Install the differential housing cover within 15 minutes of applying the silicone material.

    NOTE: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface as shown.



45. Install the differential housing cover and the 10 differential housing cover bolts.
    - Tighten to 29 Nm (21 lb-ft).

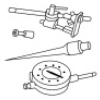
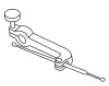
46. Install the axle assembly. For additional information, refer to Axle Assembly in this section.

47. Remove the fill plug and fill the axle with axle lubricant to 9.56 mm (0.38 in) below the bottom of the filler hole.

48. Install the fill plug.
    - Tighten to 27 Nm (20 lb-ft).

Differential Bearings

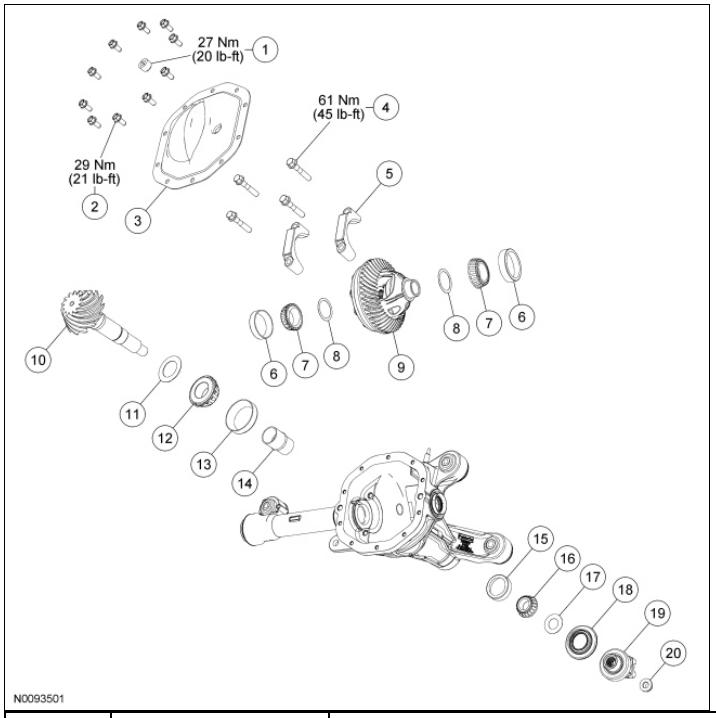
Special Tool(s)

 ST2026-A	2 Jaw Puller 205-D072 (D97L-4221-A) or equivalent
 ST1610-A	Adapter for 205-001 205-001-01
 ST1118-A	Adapter for 205-S127 205-093 (T75P-4020-A2)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
 ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1869-A	Drawbar, Rear Axle 205-098 (T75T-1176-A)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1548-A	Gauge, Differential Dummy Bearing 205-247 (T86T-4222-AH)
 ST1433-B	Gauge Disc (0.4782 inch) 205-D029 (D80T-4020-F44)
 ST1434-A	Gauge Tube (2.892 inch) 205-D034 (D80T-4020-F49) or equivalent
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)

 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1484-A	Installer, Drive Pinion Bearing Cone 205-834
 ST1361-A	Installer, Drive Pinion Bearing Cup 205-014 (T60K-4616-A)
 ST1851-A	Installer, Drive Pinion Bearing Cup 205-835
 ST1800-A	Installer, Drive Pinion Flange 205-209 (T83T-4851-A)
 ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)
 ST1347-A	Puller, Drive Pinion/Differential Carrier 205-D036 (D81L-4220-A)
 ST1310-A	Remover, Bearing 205-055 (T71P-4621-B)
 ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)

Material

Item	Specification
Motorcraft® High Contrast Hypoid Gear Marking Compound XG-14	-
Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

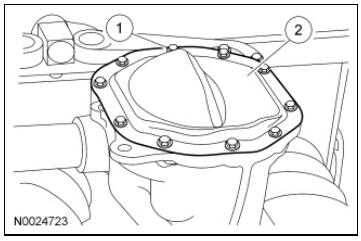


Item	Part Number	Description
1	2002748	Fill plug
2	40286-5	Differential housing cover bolt (10 required)
3	2002323	Differential housing cover
4	40284-1	Differential bearing cap bolt (4 required)
5	42769	Differential bearing cap (2 required)
6	550734	Differential carrier bearing cups
7	550433	Differential carrier bearing cones
8	30215	Differential carrier bearing shims
9	80383	Differential assembly
10	3A410	Differential pinion
11	44453	Differential pinion bearing shim
12	NP310800	Differential pinion inner bearing cone
13	NP312191	Differential pinion inner bearing cup
14	2003879	Differential pinion collapsible spacer
15	2003899	Differential pinion outer bearing cup
16	2003898	Differential pinion outer bearing cone
17	42778	Differential oil slinger
18	3N296	Drive pinion seal
19	4851	Drive pinion flange
20	2002800	Drive pinion flange nut

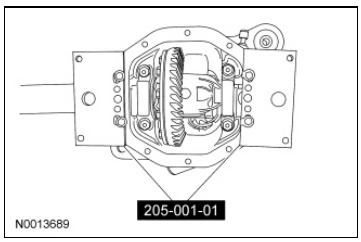
Removal

1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.

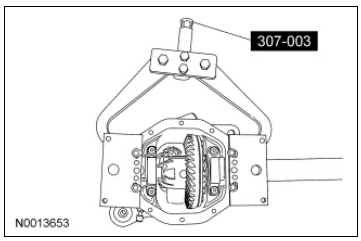
2. Drain the front axle assembly.
    1. Remove the 10 differential housing cover bolts.
    2. Remove the differential cover.



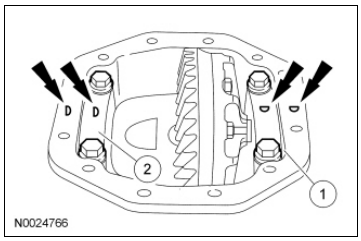
3. Install the Adapters on the differential housing.



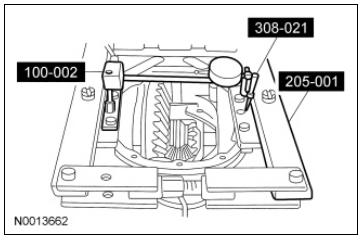
4. Install the Transmission Holding Fixture on the Adapters and mount the assembly to the bench.



5. Remove the 2 differential bearing caps.
    1. Remove the 4 differential bearing cap bolts.
    2. Remove and identify the 2 differential bearing caps.



6. Install the Dial Indicator Gauge with Holding Fixture, Clutch Housing Gauge and Differential Carrier Spreader.

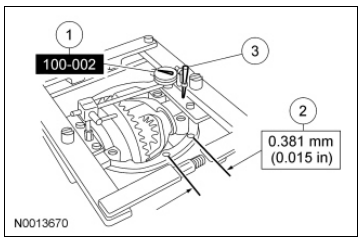


7. ***NOTICE:*** **Overspreading can damage the differential housing.**

    Spread the differential housing to the specification.

    1. Adjust the Dial Indicator Gauge to zero.
    2. Tighten the differential carrier spreader screw.

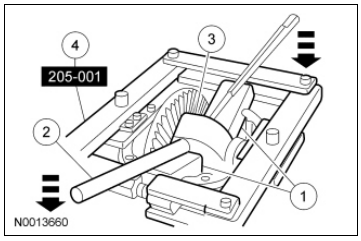
3. Remove the Dial Indicator Gauge.



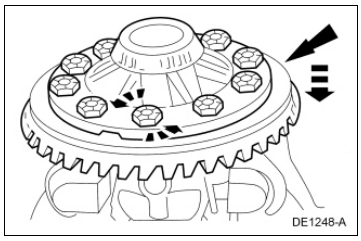
8. ***NOTICE:*** **Use wood blocks to avoid damaging the differential housing.**

   Remove the differential assembly from the housing.

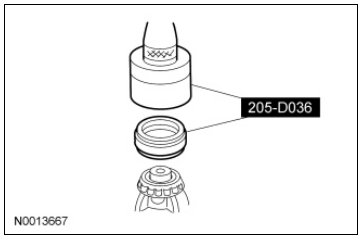
   1. Position the wood blocks.
   2. Push downward on the pry bars.
   3. Remove the differential assembly.
   4. Remove the Differential Carrier Spreader.



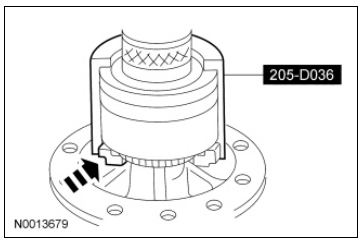
9. Remove and discard the 10 differential ring gear bolts and the differential ring gear.
   - Use a drift punch to separate the differential ring gear from the differential case.



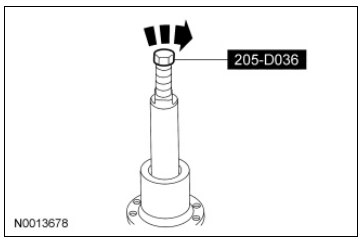
10. Assemble the Drive Pinion/Differential Carrier Puller.



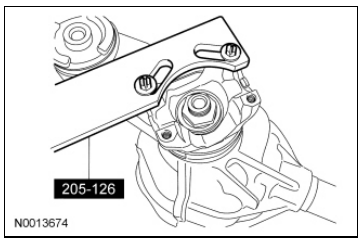
11. Position the Drive Pinion/Differential Carrier Puller on the differential bearing.



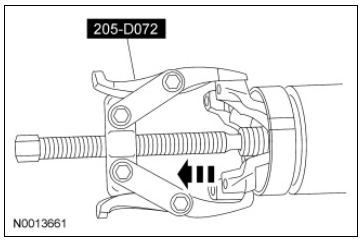
12. Using the Drive Pinion/Differential Carrier Puller, remove the RH and LH differential bearings.



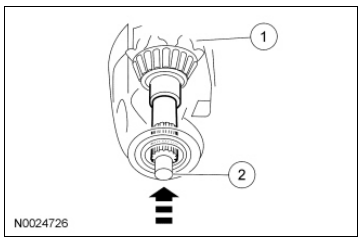
13. Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, remove and discard the pinion nut and washer.



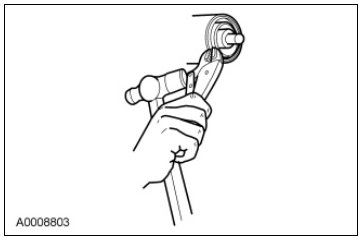
14. Using the 2 Jaw Puller, remove the pinion flange.



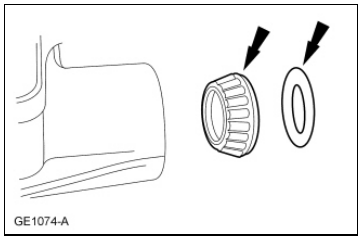
15. Using a soft-face hammer, remove the pinion from the differential housing.
    1. Hold the pinion inside the differential housing.
    2. Use a soft-face hammer to remove the pinion from the outer pinion bearing.



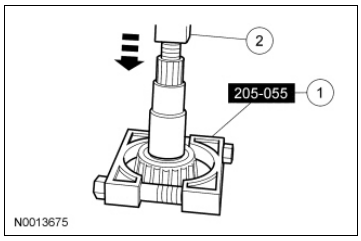
16. Use a screwdriver to force up the metal lip of the pinion seal. Using gripping pliers and a hammer, remove the pinion oil seal.



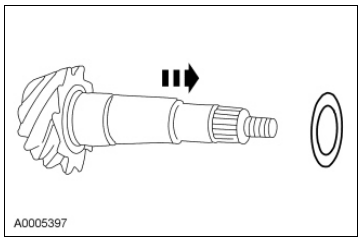
17. Remove the front axle drive pinion shaft oil slinger and the outer pinion bearing.



18. Remove the inner pinion bearing.
    1. Position the Bearing Remover under the bearing.
    2. Using a shop press, remove the inner pinion bearing.

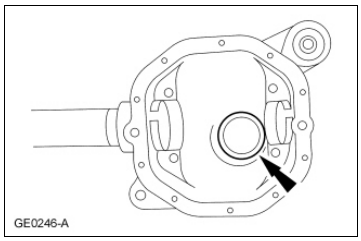


19. Remove the drive pinion position shim.
    - Measure and record the thickness of the pinion position shim for reference during installation.



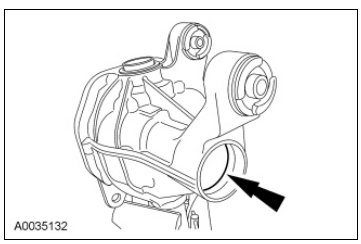
20. **NOTE:** To prevent it from becoming misaligned in the bore, remove the outer pinion bearing cup by tapping alternately on each side of the outer pinion bearing cup with a brass drift.

    Remove the outer pinion bearing cup.



21. **NOTE:** To prevent it from becoming misaligned in the bore, remove the inner pinion bearing cup by tapping alternately on each side of the inner pinion bearing cup with a brass drift.

    Remove the inner pinion bearing cup.

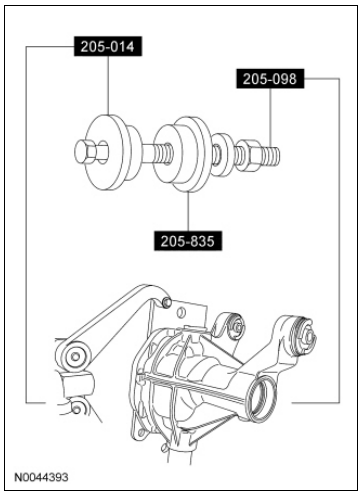


Installation

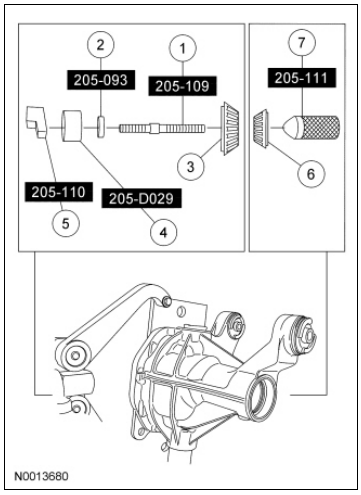
1. **NOTE:** Lubricate the new differential drive pinion bearing cups with rear axle lubricant.

   Install the new inner and outer drive pinion bearing cups.

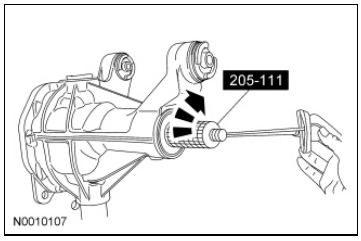
   - Using the Rear Axle Drawbar and Drive Pinion Bearing Cup Installers, install the new drive pinion bearing cups.



2. Assemble and position the following in the differential housing.
   1. Position the Adapter.
   2. Position the Adapter.
   3. Position the inner pinion bearing.
   4. Position the Gauge Disc.
   5. Position the Adapter.
   6. Position the outer pinion bearing.
   7. Thread on the Adapter.

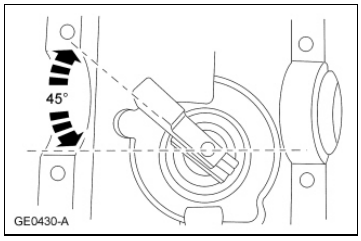


3. Using a Nm torque wrench, tighten the Adapter.
   - Tighten to 2.5 Nm (22 lb-in).

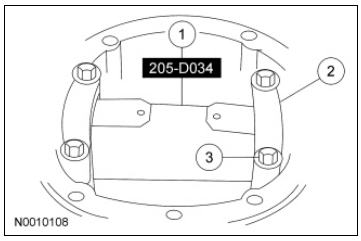


4. **NOTE:** Offset the Adapter to obtain an accurate reading.

   Rotate the Adapter several half turns to make sure the pinion bearings seat correctly. Position the Adapter as shown.



5. Install the Gauge Tube.
   1. Position the Gauge Tube.
   2. Install the 2 differential bearing caps.
   3. Install the 4 differential bearing cap bolts.
      - Tighten to 61 Nm (45 lb-ft).



6. **NOTE:** Selection of a drive pinion position shim that is too thick results in deep tooth contact at final assembly. Do not attempt to force the feeler gauge or drive pinion position shim between the Adapter and the Gauge Tube. A slight drag indicates a correct selection.

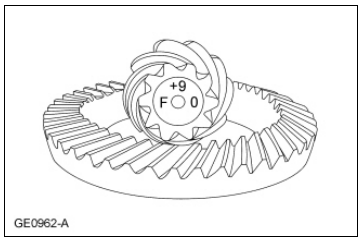
   Using a feeler gauge or a flat, clean drive pinion position shim, measure between the Adapter and the Gauge Tube. Record the measurement.

7. Select the correct thickness drive pinion position shim.
   - New drive pinion position shims are available in the following sizes:

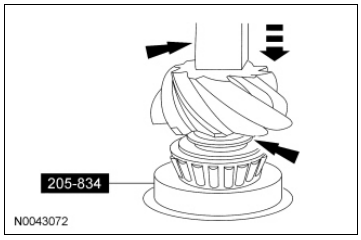
mm	Inch
1.35	0.053
1.40	0.055
1.45	0.057
1.50	0.059
1.55	0.061
1.60	0.063
1.65	0.065
1.70	0.067

1.75	0.069
1.80	0.071
1.85	0.073

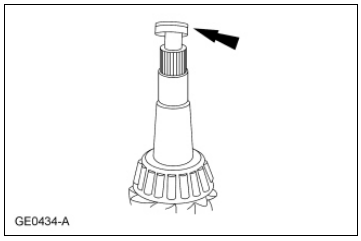
- Notice the plus (+), minus (-) or zero (0) etching on the drive pinion, and adjust the thickness of the new shim. If the etching is positive, subtract the number from the selected position shim. If the etching is negative, subtract the number from the selected position shim.
- The selected shim thickness should be very close to the recorded thickness of the original position shim.



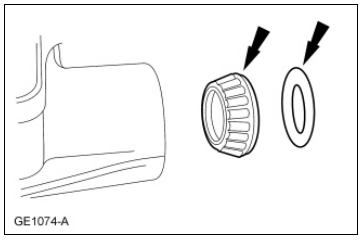
8. Install the new selected drive pinion position shim and the new inner pinion bearing on the drive pinion.
    - Using the Drive Pinion Bearing Cone Installer and a suitable press, seat the inner pinion bearing firmly against the drive pinion position shim.



9. Install a new collapsible spacer.



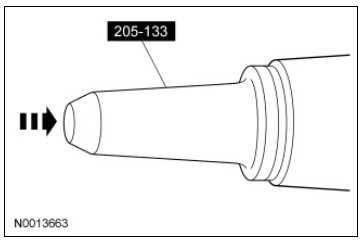
10. Install the new outer drive pinion bearing and the drive pinion oil slinger.



11. ***NOTICE:*** **The drive pinion oil seal must be fully seated all the way around or drive pinion oil seal damage will occur.**

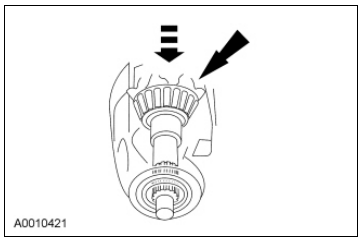
    NOTE: Lubricate the drive pinion oil seal lips with rear axle lubricant.

Using the Drive Pinion Oil Seal Installer, install the drive pinion oil seal.



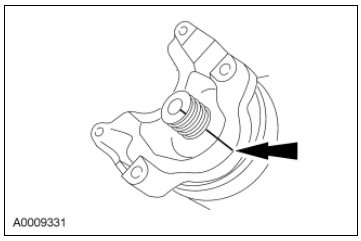
12. Lubricate the drive pinion gear splines with rear axle lubricant.

13. Install the drive pinion gear into the axle housing.

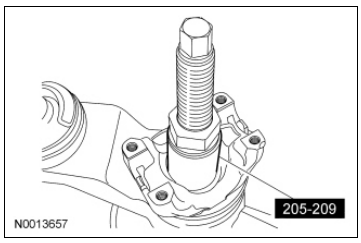


14. ***NOTICE:*** **Never use a metal hammer on the pinion flange or install the flange with power tools or damage to the component may occur.**

    Align the pinion flange.



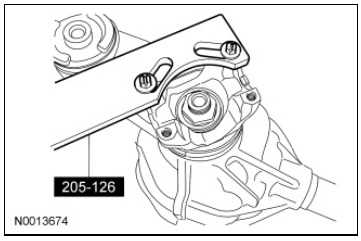
15. Using the Drive Pinion Flange Installer, install the pinion flange.



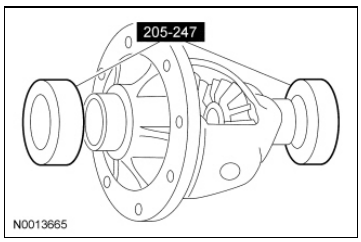
16. ***NOTICE:*** **Do not loosen the pinion nut to reduce pinion bearing preload or damage to the component may occur. Install a new collapsible spacer and pinion nut if pinion bearing preload reduction is necessary.**

    Using the Drive Pinion Flange Holding Fixture to hold the pinion flange, tighten the pinion nut to set the pinion bearing preload.

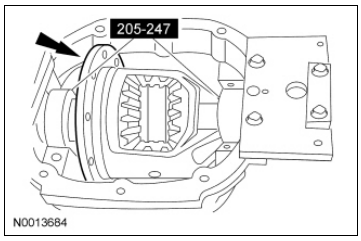
    - Tighten the pinion nut, rotating the pinion occasionally to make sure the pinion bearings are seating correctly. Take frequent pinion bearing preload readings by rotating the pinion with a Nm torque wrench. The final reading must be 1.7-3.4 Nm (15-30 lb-in).



17. Install the Differential Dummy Bearing Gauge.



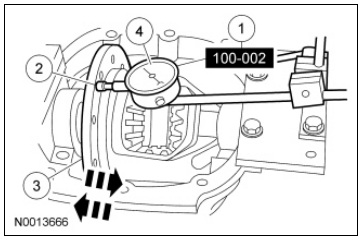
18. Position the differential assembly and the Differential Dummy Bearing Gauge in the differential housing.



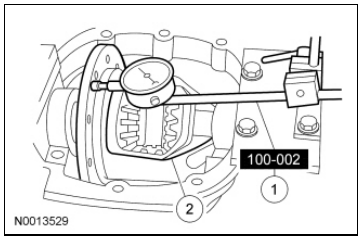
19. **NOTE:** Repeat this step until obtaining a consistent reading.

    Measure the total end play.

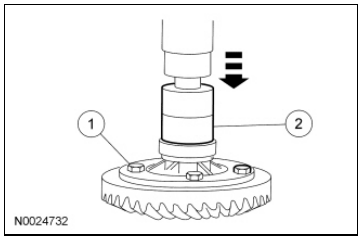
    1. Install the Dial Indicator Gauge with Holding Fixture.
    2. Force the differential assembly as far as possible away from the Dial Indicator Gauge. Position the Dial Indicator Gauge tip on the machined surface and adjust it to measure full travel. With force still applied, set the Dial Indicator Gauge to zero.
    3. Force the differential assembly as far as possible in the opposite direction.
    4. Record the total end play reading on the Differential Bearing Shim Selection Procedure Worksheet, Line A in this procedure.



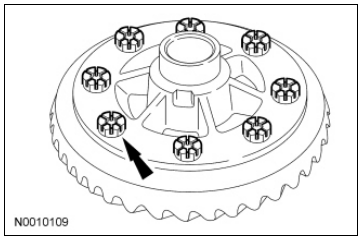
20. Remove the Dial Indicator Gauge with Holding Fixture, then remove the differential assembly.
    1. Remove the Dial Indicator Gauge with Holding Fixture.
    2. Remove the differential assembly.



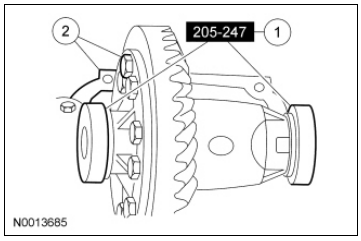
21. Using a suitable press, install the differential ring gear.
    1. Position the differential ring gear and the differential assembly. Start 3 new differential ring gear bolts to align the holes in the differential ring gear and the differential assembly.
    2. Using a suitable press, install the differential ring gear.



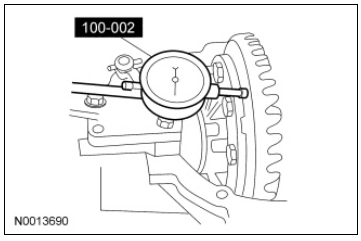
22. Install the 7 remaining new differential ring gear bolts.
    - Tighten to 122 Nm (90 lb-ft).



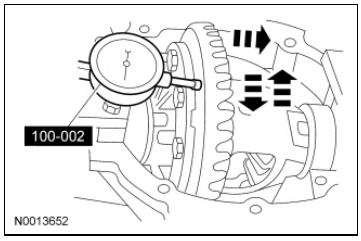
23. Install the Differential Dummy Bearing Gauge and position the differential assembly in the differential housing.
    1. Install the Differential Dummy Bearing Gauge.
    2. Position the differential assembly in the differential housing.



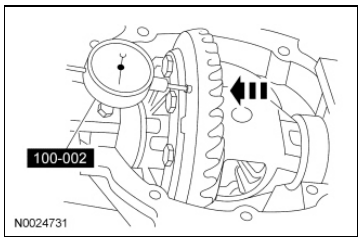
24. Position the Dial Indicator Gauge with Holding Fixture.



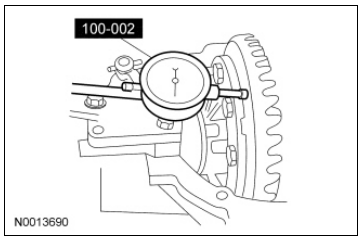
25. Force the differential ring gear into mesh with the pinion gear (zero backlash). With force still applied, set the Dial Indicator Gauge to zero.



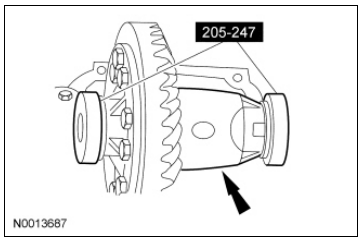
26. Force the differential ring gear away from the pinion gear as far as possible. Record the reading on the Differential Bearing Shim Selection Procedure Worksheet, Line D in this procedure.



27. Remove the Dial Indicator Gauge with Holding Fixture.



28. Remove the differential assembly from the differential housing. Remove the Differential Dummy Bearing Gauge from the differential assembly hubs.



29. Complete the worksheet and select the appropriate thickness differential bearing shims. New differential bearing shims are available in 0.0762 mm (0.003 in), 0.127 mm (0.005 in), 0.254 mm (0.010 in) and 0.762 mm (0.030 in) thickness.

Differential Bearing Shim Selection Procedure Worksheet

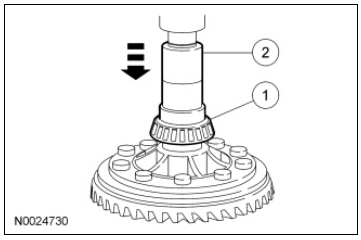
Line	Item	Result (actual) mm (in)	Result (example) mm (in)
A	Total end play reading (without gears)		2.032 (0.080)
B	Add preload	+0.2032 (+0.008)	+0.2032 (+0.008)
C	Total (add A and B)		2.2352 (0.088)
D	End play measurement (with gears)		1.0414 (0.041)
E	Subtract the shim thickness on the differential ring gear side	-0.0762 (-0.003)	-0.0762 (-0.003)

F	Total (subtract E from D) (thickness of shims to place on the differential ring gear side)		0.9652 (0.038)
G	Total (subtract F from C) (thickness of shims to place on the drive pinion side)		1.27 (0.050)

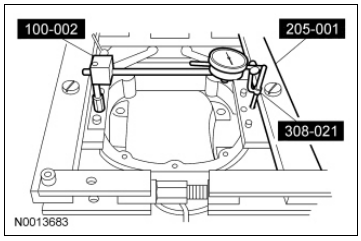
30. **NOTE:** Most axles will have the larger amount of shims on the differential ring gear side and the smaller amount on the case side.

    Install the selected differential bearing shims and the new LH and RH differential bearings.

    1. Position the differential bearing shims and the differential bearing.
    2. Using a suitable press, install the differential bearing.
    - Repeat this step for opposite side of the differential assembly.

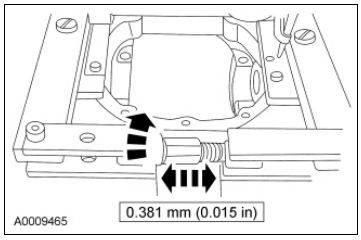


31. Install the Dial Indicator Gauge with Holding Fixture, Clutch Housing Gauge and Differential Carrier Spreader.
    - Position the Clutch Housing Gauge needle in the Differential Carrier Spreader adapter hole.

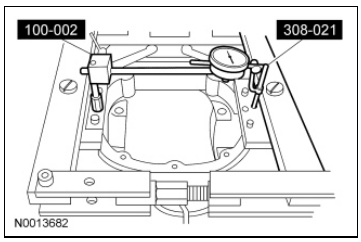


32. ***NOTICE:*** **Overspreading can damage the differential housing.**

    Spread the differential housing to specification.



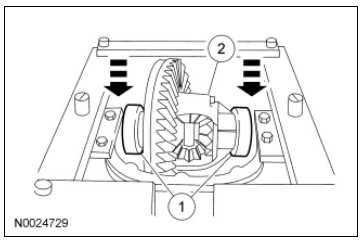
33. Remove the Dial Indicator Gauge with Holding Fixture and the Clutch Housing Gauge.



34. **NOTE:** Push the differential assembly downward to fully seat the differential bearing cups in the differential housing.

    Install the 2 differential bearing cups and the differential assembly in the differential housing.

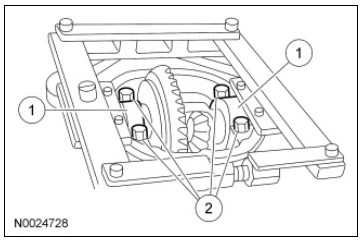
    1. Position the 2 differential bearing cups on the 2 differential bearings.
    2. Lower the differential assembly in place.



35. **NOTE:** Do not tighten the differential bearing cap bolts to specification at this time.

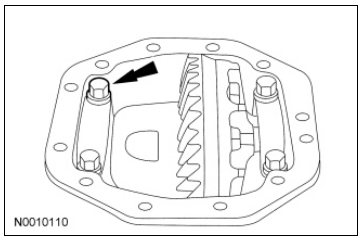
    Install the 2 differential bearing caps in their original positions.

    1. Position the 2 differential bearing caps.
    2. Install the 4 differential bearing cap bolts hand-tight.



36. Remove the Differential Carrier Spreader.

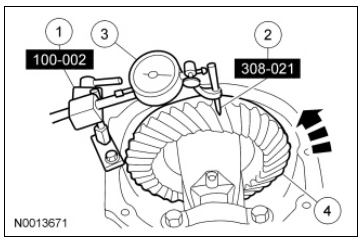
37. Tighten the 4 differential bearing cap bolts.
    - Tighten to 61 Nm (45 lb-ft).



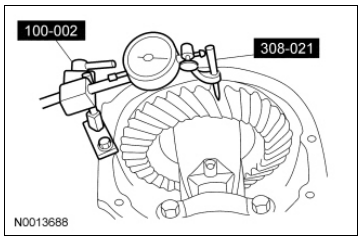
38. Verify that the differential assembly rotates freely.

39. Using the Dial Indicator Gauge with Holding Fixture and the Clutch Housing Gauge, measure the backlash at 3 equally spaced points on the differential ring gear.
    1. Mount the Dial Indicator Gauge.
    2. Position the Clutch Housing Gauge.
    3. Zero the Dial Indicator Gauge.
    4. Turn the differential ring gear without turning the pinion gear. Record the measurement.
    - The backlash tolerance is 0.13 mm (0.005 in) to 0.20 mm (0.008 in) and cannot vary more than 0.05 mm (0.002 in) between points checked.
    - If the backlash is not within specification, correct by increasing the thickness of one differential bearing shim and decreasing the thickness of the other differential bearing shim

by the same amount.



40. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



41. Apply marking compound and rotate the differential assembly 5 complete revolutions.

42. Verify an acceptable pattern check. For additional information, refer to Section 205-00 .

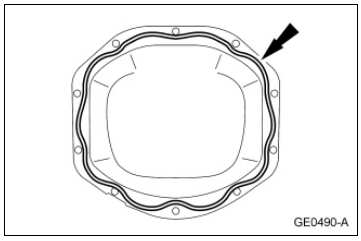
43. Install the RH axle shaft.

44. **NOTE:** The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.

    NOTE: Install the differential housing cover within 15 minutes of applying the silicone material.

    NOTE: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface as shown.



45. Install the differential housing cover and the 10 differential housing cover bolts.
    - Tighten to 29 Nm (21 lb-ft).

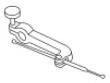
46. Install the axle assembly. For additional information, refer to Axle Assembly in this section.

47. Remove the fill plug and fill the axle with rear axle lubricant to 9.56 mm (0.38 in) below the bottom of the filler hole.

48. Install the fill plug.
    - Tighten to 27 Nm (20 lb-ft).

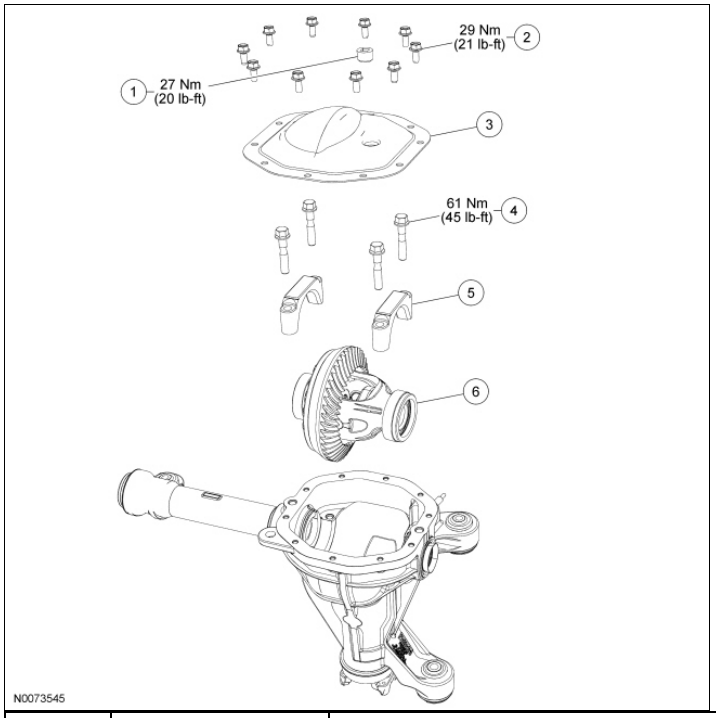
Differential Carrier

Special Tool(s)

 ST1610-A	Adapter for 205-001 205-001-01
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1259-A	Spreader, Differential Carrier 205-001 (TOOL-4000-E)

Material

Item	Specification
Motorcraft® SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



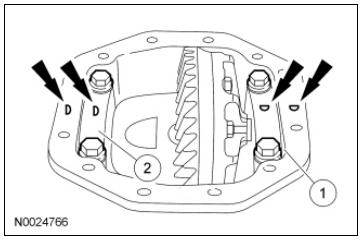
Item	Part Number	Description
1	2002748	Fill plug
2	40286-5	Differential housing cover bolt (10 required)
3	2002323	Differential housing cover
4	40284-1	Differential bearing cap bolt (4 required)
5	42769	Differential bearing cap (2 required)
6	80383	Differential carrier assembly

Removal

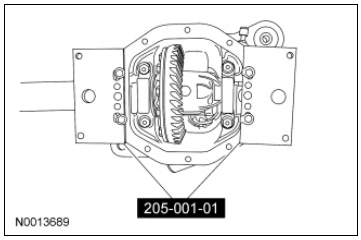
1. Remove the axle assembly. For additional information, refer to Axle Assembly in this section.

2. Remove the 10 differential housing cover bolts and the differential housing cover.

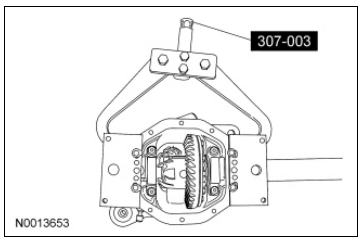
3. Remove the 2 differential bearing caps.
    1. Remove the 4 differential bearing cap bolts.
    2. Remove and identify the 2 differential bearing caps.



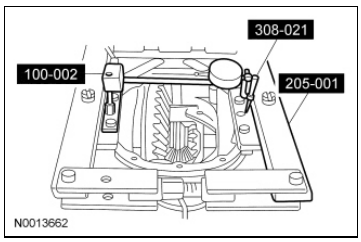
4. Install the Adapters.



5. Install the axle assembly and Transmission Holding Fixture into the bench fixture.



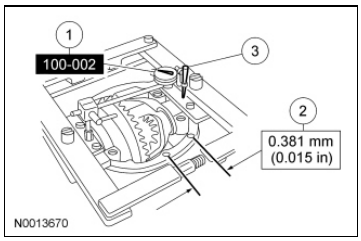
6. Install the Dial Indicator Gauge with Holding Fixture, Clutch Housing Gauge and Differential Carrier Spreader.



7. ***NOTICE:*** **Overspreading can damage the differential housing.**

   Spread the differential housing to the specification.

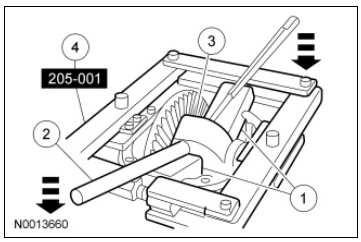
   1. Adjust the Dial Indicator Gauge to zero.
   2. Tighten the Differential Carrier Spreader screw.
   3. Remove the Dial Indicator Gauge.



8. ***NOTICE:*** **Use wood blocks to avoid damaging the differential housing.**

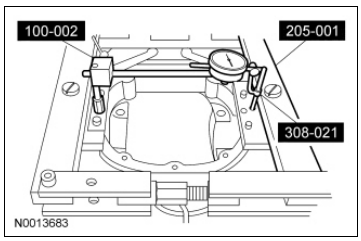
   Remove the differential assembly from the housing.

   1. Position the wood blocks.
   2. Push downward on the pry bars.
   3. Remove the differential assembly.
   4. Remove the Differential Carrier Spreader.



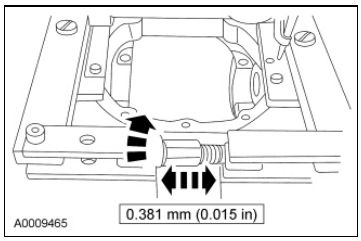
Installation

1. Install the Differential Carrier Spreader, Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.
    - Position the Clutch Housing Gauge needle in the Differential Carrier Spreader adapter hole.

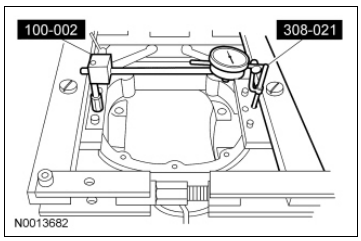


2. ***NOTICE:*** **Overspreading can damage the differential housing.**

    Spread the differential housing to the specification.



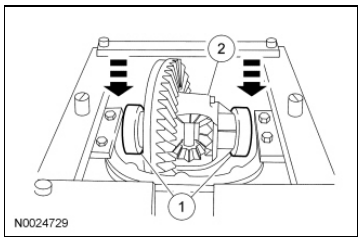
3. Remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



4. **NOTE:** Push the differential assembly downward to fully seat the differential bearing cups in the differential housing.

    Install the differential bearing cups and the differential assembly in the differential housing.

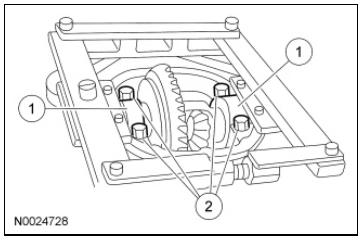
    1. Position the 2 differential bearing cups on the 2 differential bearings.
    2. Lower the differential assembly in place.



5. ***NOTICE:*** **Do not tighten the 4 differential bearing cap bolts to specification at this time.**

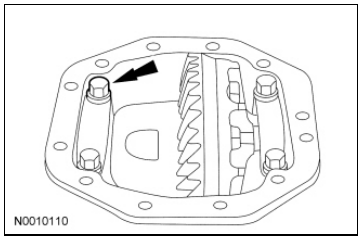
    Install the 2 differential bearing caps in their original positions.

    1. Position the 2 differential bearing caps.
    2. Install the 4 differential bearing cap bolts hand-tight.



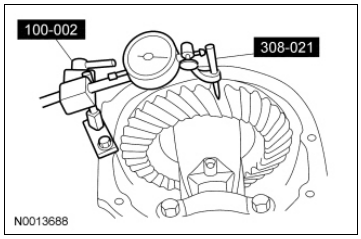
6. Remove the Differential Carrier Spreader.

7. Tighten the 4 differential bearing cap bolts.
   - Tighten to 61 Nm (45 lb-ft).



8. Verify that the differential assembly rotates freely.

9. Check the ring gear backlash and remove the Dial Indicator Gauge with Holding Fixture and Clutch Housing Gauge.



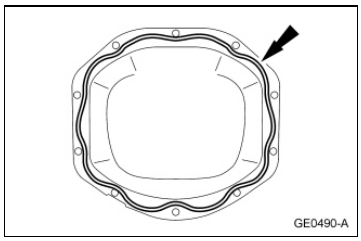
10. Install the RH axle shaft.

11. **NOTE:** The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the new silicone sealant. Cover the inside of the axle before cleaning the machined surface to prevent contamination.

    NOTE: Install the differential housing cover within 15 minutes of applying the silicone material.

    NOTE: Allow the sealant to cure for one hour before filling the axle with lubricant.

    Apply a continuous bead of sealant, of the specified thickness, to the differential housing cover mounting surface as shown.



12. Install the differential housing cover and the 10 differential housing cover bolts.

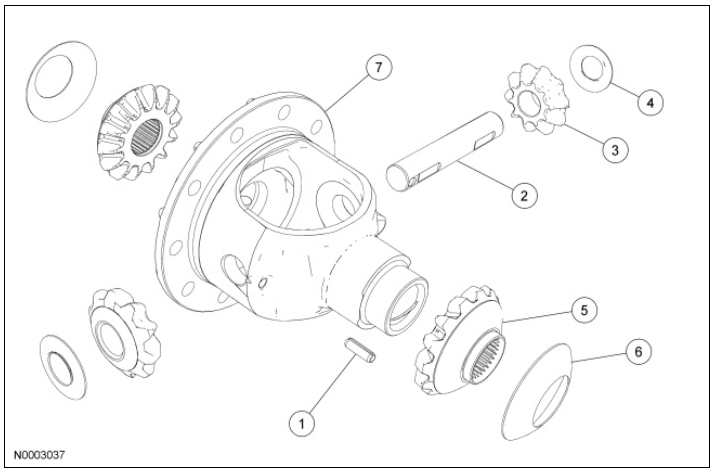
- Tighten to 29 Nm (21 lb-ft).

13. Install the axle assembly. For additional information, refer to Axle Assembly in this section.

14. Remove the fill plug and fill the axle with rear axle lubricant to 9.56 mm (0.38 in) below the bottom of the filler hole.

15. Install the fill plug.
    - Tighten to 27 Nm (20 lb-ft).

Differential Case



Item	Part Number	Description
1	4241	Differential pinion shaft roll pin
2	4211	Differential pinion shaft
3	4215	Differential pinion gear
4	4230	Differential pinion gear thrust washer
5	4236	Differential side gear
6	4228	Differential side gear thrust washer
7	4205	Differential case

Disassembly and Assembly

1. Remove the differential case from the differential housing. For additional information, refer to Differential Carrier in this section.

2. **NOTE:** When the differential pinion shaft is removed from the differential case, drive the roll pin from the shaft.

   Use a drift punch to drive the roll pin into the differential pinion shaft until the roll pin bottoms against the differential case.

3. Remove the differential pinion shaft.

4. Remove the differential pinion gears and thrust washers.

5. Remove the differential side gears and thrust washers.

6. Inspect all parts.

7. **NOTE:** Align the differential pinion shaft hole with the hole in the differential case. Using a hammer, install the differential shaft roll pin in the differential case until the pin is flush with the case.

   To assemble, reverse the disassembly procedure.

General Specifications

Item	Specification
Front Axle	
LH halfshaft assembled length	685.3 mm (26.98 in)
RH halfshaft assembled length	615.3 mm (24.22 in)

Torque Specifications

Description	Nm	lb-ft
Brake caliper anchor plate bolt	165	122
Halfshaft nut	250	184
Stabilizer bar link nut and grommet	35	26
Tie-rod nut	103	76
Upper ball joint nut	55	41

Front Drive Halfshafts

The front axle halfshafts consist of the following:

- Inner CV joints
- Outer CV joints
- Interconnecting shafts
- A circlip stopper that holds the cross-groove inboard race assembly (inboard CV joint) together
- A circlip that retains the splined inboard CV joint to the differential side gear on the LH halfshaft
- A circlip that retains the splined RH inboard CV joint to the intermediate shaft
- CV joint boot clamps
- Convoluted CV joint boots
- Tripod joint housings
- Ball and cage housings

The front axle halfshafts are driven by the differential side gears inside the front axle assembly or the RH axle shaft. Rotational torque is transferred from the stub shafts through the inner CV joint, intermediate shaft and outer CV joint to the outer stub shaft. The outboard stub shafts are splined to drive the wheel hubs. They are retained in the wheel hubs by special wheel hub nuts, which also control the wheel bearing preload. The LH halfshaft is splined on the inboard stub shaft and is retained in the differential side gear in the transaxle by a circlip. The RH halfshaft has internal splines which are driven by the axle shaft. The axle shaft has a circlip on the outboard end and is retained inside the inboard stub shaft. New circlips must be installed whenever they are removed. The CV joint mates the interconnecting shaft with the stub shaft. The joint allows for smooth rotation of the interconnecting shaft and the stub shafts. They also adjust for length variances and angle requirements as the vehicle goes through jounce and rebound. New halfshaft components are available as kits containing grease, boots and clamps.

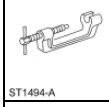
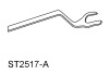
Handle all halfshaft components carefully during removal and installation and during various component disassembly and assembly procedures. Never pick up or hold the halfshaft only by the inboard or outboard CV joint. Do not overangle the CV joints. Damage will occur to an assembled inboard CV joint if it is overplunged outward from the joint housing. Never use a hammer to remove or install the halfshafts from the front hub. Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft. Do not allow the boots to contact sharp edges or hot exhaust components. Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints. Excessive pulling force on the interconnecting shaft between joints of the halfshaft will result in internal joint damage. Axial loads used in assisting removal must be applied through the inboard joint housing only. Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage. Do not remove the outer CV joint by pulling on the interconnecting shaft. Inspect all machined surfaces and splines for damage.

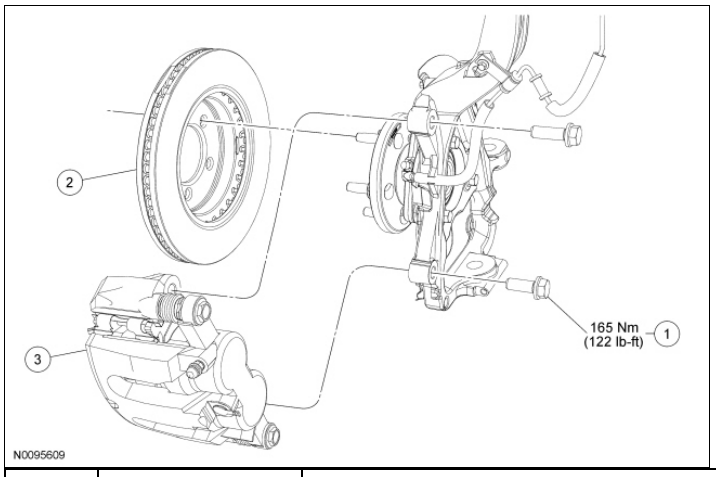
Front Drive Halfshafts

Refer to Section 205-00 .

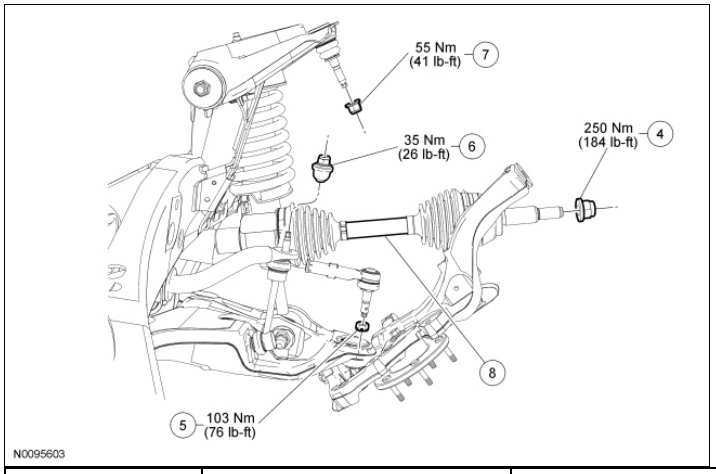
Halfshaft

Special Tool(s)

 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)
 ST2272-A	Remover, Front Wheel Hub 205-D070 (D93P-1175-B) or equivalent
 ST2517-A	Remover, Halfshaft 205-291 (T89P-3514-A)
 ST2273-A	Remover, Steering Arm 211-003 (T64P-3590-F)



Item	Part Number	Description
1	2027	Brake caliper and anchor plate bolt (2 required)
2	1125	Brake disc
3	-	Brake caliper and anchor plate assembly



Item	Part Number	Description
4	W705967	Halfshaft nut
5	N800895-S	Tie-rod nut
6	N807144-S	Stabilizer bar link nut
7	W520214-S	Upper ball joint nut
8	3A427	Halfshaft assembly

Removal and Installation

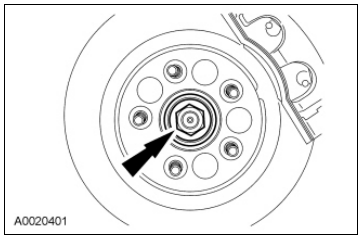
Both halfshafts

1. ***NOTICE:*** **Do not loosen the front axle wheel end nut until after the wheel and tire assembly are removed from the vehicle. Wheel bearing damage will occur if the wheel bearing is unloaded with the weight of the vehicle applied.**

   With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the front wheel and tire. For additional information, refer to Section 204-04 .

3. Remove and discard the halfshaft nut.
   - To install, tighten to 250 Nm (184 lb-ft).



4. ***NOTICE:*** **Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

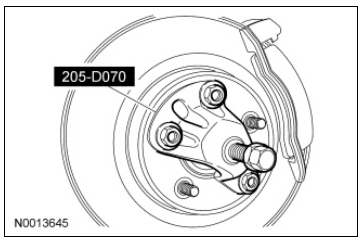
   Remove the bolts and position the caliper, pads and anchor plate assembly aside.

   - Discard the bolts.
   - Support the caliper and anchor plate assembly using mechanic's wire.
   - To install, tighten to 165 Nm (122 lb-ft).

5. ***NOTICE:*** **Do not use a hammer to separate the outboard Constant Velocity (CV) joint from the**

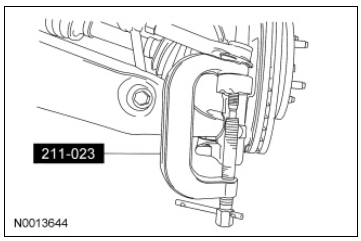
hub. Damage to the threads and internal CV joint components can result.

Using the Front Wheel Hub Remover, press the outboard CV joint until it is loose in the hub.



6. Remove and discard the tie-rod nut.
   - To install, tighten the new nut to 103 Nm (76 lb-ft).

7. Using the C-Frame and Screw, separate the tie rod from the knuckle.

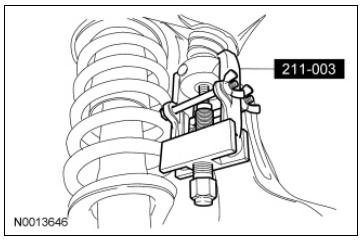


8. Remove and discard the stabilizer bar link nut.
   - To install, tighten the new nut and grommet to 35 Nm (26 lb-ft).

9. Remove and discard the upper ball joint nut.
   - To install, tighten the new nut to 55 Nm (41 lb-ft).

10. **NOTE:** Do not allow the knuckle to hang freely. It is possible to overextend and internally separate each inner CV joint from its housing.

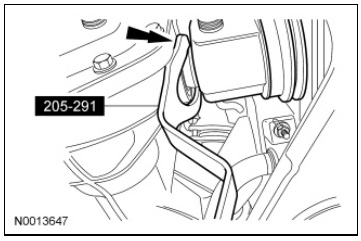
    Using the Steering Arm Remover, disconnect the upper ball joint from the knuckle.



LH halfshaft

11. ***NOTICE:*** **Do not damage the axle shaft oil seal or the machined sealing surface on the inboard Constant Velocity (CV) joint housing.**

    Using the Halfshaft Remover, disengage the LH CV joint housing from the side gear.

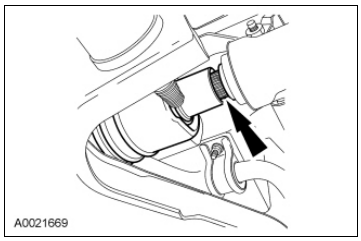


12. Remove the LH halfshaft.

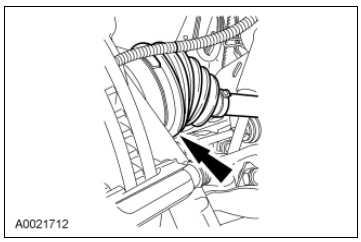
RH halfshaft

13. **NOTE:** Install a new retainer circlip on the outboard spline end of the axle shaft before reseating the axle shaft in the differential side gear.

    Pull the RH halfshaft and the axle shaft away from the axle tube, and separate the inboard CV joint housing from the axle shaft.



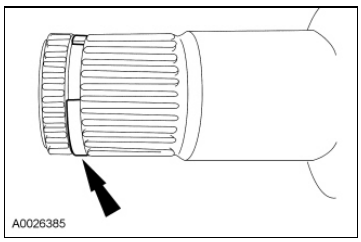
14. Remove the RH halfshaft.



Both halfshafts

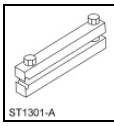
15. **NOTE:** Start one end of the circlip in the groove and work the circlip over the halfshaft and into the groove to prevent the circlip from overexpanding.

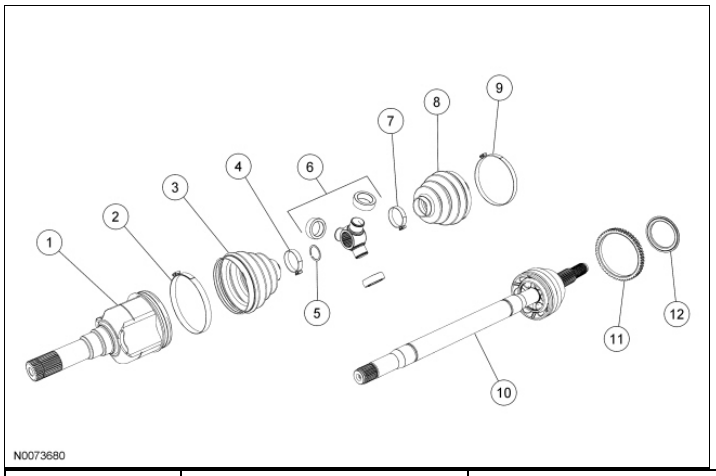
    To install, reverse the removal procedure.



Halfshaft

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Joint Boot Clamp 205-343 (T95P-3514-A)

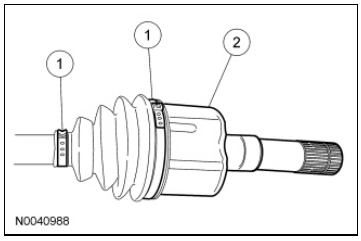


Item	Part Number	Description
1	3B418	Inboard CV joint housing
2	3B478	Inboard large boot clamp
3	3A331	Inboard CV joint boot
4	3B478	Inboard small boot clamp
5	4B422	Tri-lobe retainer
6	3W007A	Tri-lobe joint
7	3B478	Outboard small boot clamp
8	3A331	Outboard CV joint boot
9	3B478	Outboard large boot clamp
10	3B413	Intermediate shaft
11	20202	Wheel speed sensor ring
12	1175	Front wheel dust seal

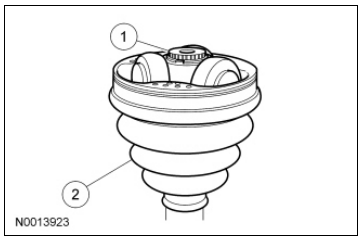
Disassembly

1. Remove the RH or LH halfshaft assembly. For additional information, refer to Halfshaft in this section.

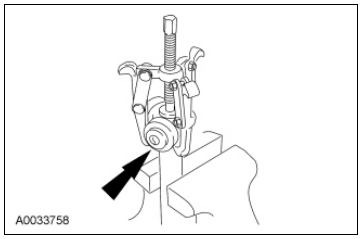
2. For the inboard CV joint, carry out the following:
    1. Remove and discard the 2 boot clamps.
    2. Remove the inboard CV joint housing.



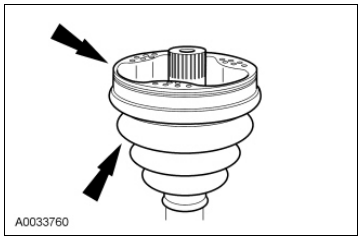
3. For the inboard CV joint, carry out the following:
    1. Remove and discard the retainer circlip.
    2. Slide the boot away from the CV joint.



4. Using a suitable 3-jaw puller, remove the CV joint.



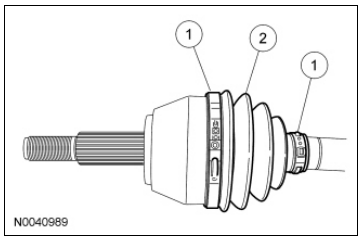
5. Remove and discard the inner CV boot.



6. **NOTE:** The outboard CV joint is not removable from the halfshaft. The boot must be removed or installed from the inboard CV joint side of the shaft.

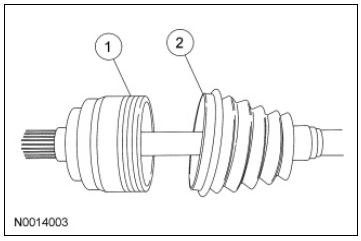
    For the outboard CV joint, carry out the following:

    1. Remove and discard the 2 boot clamps.
    2. Remove and discard the boot.

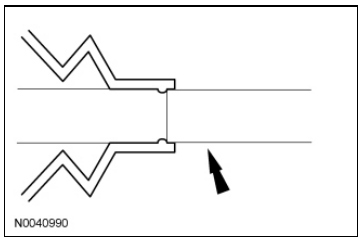


Assembly

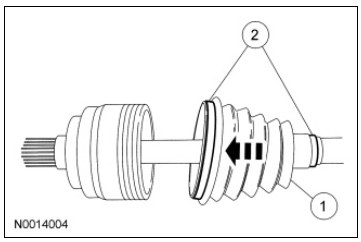
1. Lubricate the outboard CV joint.
    1. Pack the outboard CV joint with grease from the kit.
        - One-third of the grease must be installed in the joint with the remainder placed in the boot.
    2. Spread the remaining grease evenly inside the boot.



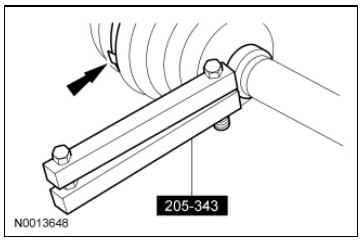
2. Position the boot so the rib on the boot is located in the groove of the shaft.



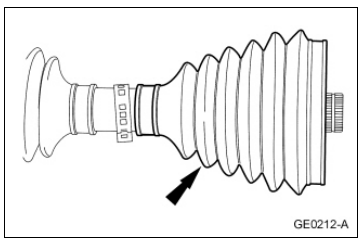
3. Position the outboard halfshaft boot and the outboard boot clamps.
    1. Position the boot.
    2. Position the 2 boot clamps.



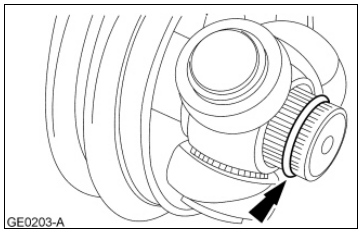
4. Using the Constant Velocity Joint Boot Clamp Installer, install the outboard CV boot clamps.



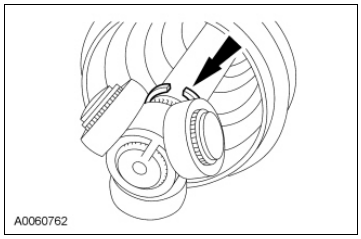
5. Position the inboard clamp and boot.



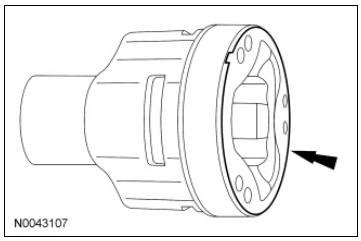
6. Install the CV joint and snap ring on the halfshaft.



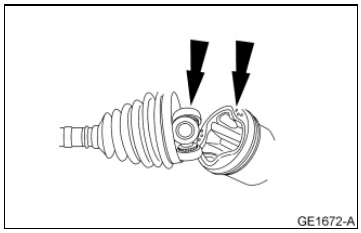
7. Install the stop ring.



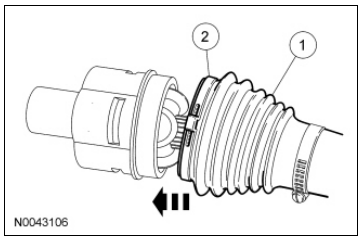
8. Fill the inboard CV joint housing with grease from the kit.
    - One-half of the grease must be installed in the joint and the remainder placed in the boot.



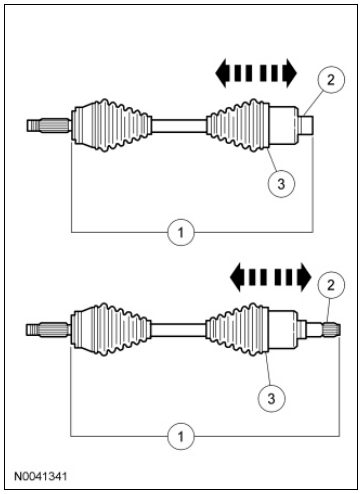
9. Position the CV housing on the CV joint.



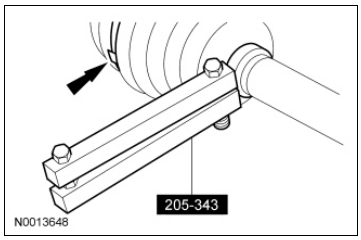
10. Position the inboard halfshaft boot and clamp.
    1. Position the boot in the housing groove.
    2. Position the boot clamp.



11. Set the halfshaft assembled length to specifications. For additional information, refer to Specifications in this section.
    1. Measure the entire assembly length.
    2. Push in or pull out on the inner joint as necessary to adjust the halfshaft assembled length.
    3. Hold the inner joint to prevent the assembled length from changing and insert a small flat-blade screwdriver between the boot and the joint to equalize the pressure.



12. Using the Constant Velocity Joint Boot Clamp Installer, install the boot clamps.



13. Install the RH or LH halfshaft assembly. For additional information, refer to Halfshaft in this section.

Material

Item	Specification	Fill Capacity
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1	Inboard joint 250 g (8.82 oz)
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1	Outboard joint 225 g (7.93 oz)

General Specifications

Item	Specification
Left rear halfshaft assembled length	843.7 mm (33.2 in)
Right rear halfshaft assembled length	872.7 mm (34.3 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake cable retaining screw	20	-	177
Lower arm outboard bolt	275	203	-
Halfshaft nut	275	203	-
Rear toe link outboard bolt	350	259	-
Upper arm outboard bolt	275	203	-
Wheel knuckle bolts	275	203	-

Rear Drive Halfshafts

The rear drive halfshafts consist of the following:

- Inner CV joints
- Outer CV joints
- Interconnecting shafts
- Convoluted CV joint boots
- CV joint boot clamps
- Special CV high-temperature grease
- Tripod joint housings
- Ball and cage housings
- A circlip stopper that holds the cross-groove inboard race assembly (inboard CV joint) together
- A circlip that retains the splined inboard CV joint to the differential side gear
- The RH and LH halfshafts are different lengths, with the LH halfshaft being the longer of the 2.

The rear drive halfshafts link the rear axle to the rear wheel hubs. The CV joints allow the halfshafts to rotate smoothly through the required changes in angles between the stationary axle and the varying angles of the rear wheels including jounce and rebound. The CV joints are either tri-lobed style or the caged ball type depending on inboard or outboard. New halfshaft components are available as kits containing grease, boots and clamps.

Handle all halfshaft components carefully during removal and installation and during various component disassembly and assembly procedures. Never pick up or hold the halfshaft only by the inboard or outboard CV joint. Do not overangle the CV joints. Damage will occur to an assembled inboard CV joint if it is overplunged outward from the joint housing. Never use a hammer to remove or install the halfshafts from the hub. Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft. Do not allow the boots to contact sharp edges or hot exhaust components. Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints. Excessive pulling force on the interconnecting shaft between joints of the halfshaft will result in internal joint damage. Axial loads used in assisting removal must be applied through the inboard joint housing only. Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage. Do not remove the outer CV joint by pulling on the interconnecting shaft. Inspect all machined surfaces and splines for damage.

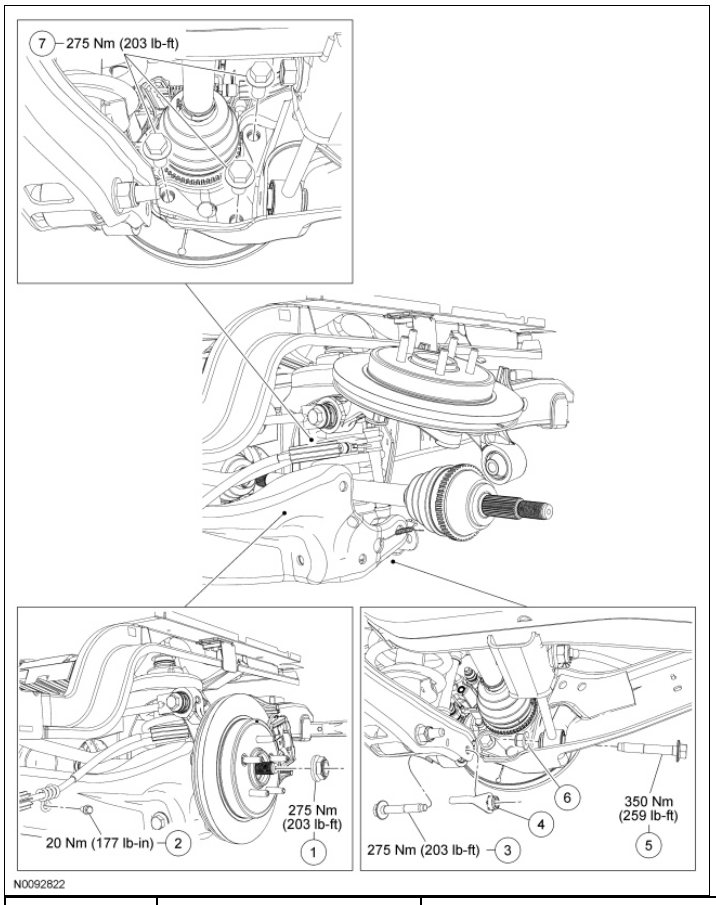
Rear Drive Halfshafts

Refer to Section 205-00 .

Halfshaft

Special Tool(s)

 ST1326-A	Handle 205-153 (T80T-4000-W)
 ST2272-A	Remover, Front Wheel Hub 205-D070 (D93P-1175-B) or equivalent
 ST2666-A	Remover, Halfshaft 205-529



Item	Part Number	Description
1	N808405	Halfshaft nut
2	W704911	Parking brake cable bracket bolt
3	W711444	Lower arm outboard bolt
4	W710808	Lower arm outboard flag nut
5	W711444	Toe link outboard bolt

6	W520216	Toe link outboard nut
7	W710678	Wheel knuckle bolts (3 required)

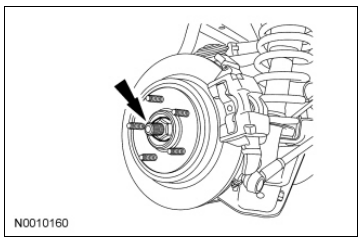
Removal and Installation

1. ***NOTICE:*** **Do not loosen the rear axle wheel end nut until after the wheel and tire assembly are removed from the vehicle. Wheel bearing damage will occur if the wheel bearing is unloaded with the weight of the vehicle applied.**

   With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

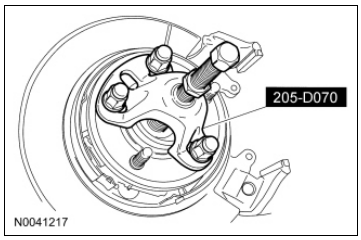
2. Remove the rear wheel and tire. For additional information, refer to Section 204-04 .

3. Remove the halfshaft nut.
   - To install, tighten to 275 Nm (203 lb-ft).

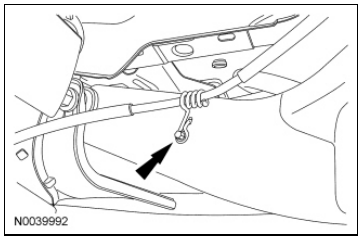


4. ***NOTICE:*** **Do not use a hammer to separate the rear axle halfshaft assembly from the hub. Damage to the threads and internal Constant Velocity (CV) joint components may result.**

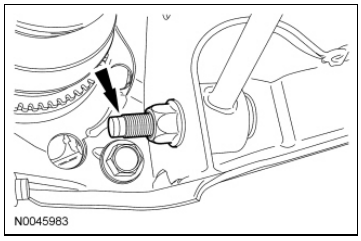
   Using the Front Wheel Hub Remover, press the outboard CV joint until it is loose in the hub.



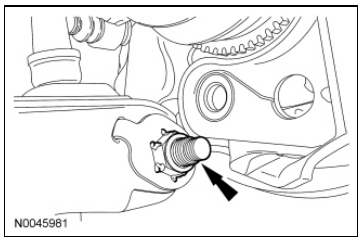
5. Remove the brake cable retainer screw.
   - To install, tighten to 20 Nm (177 lb-in).



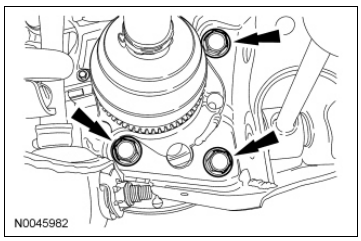
6. Remove and discard the outboard toe link nut and back out the bolt for clearance.
   - To install, tighten to 350 Nm (259 lb-ft) at curb ride height.



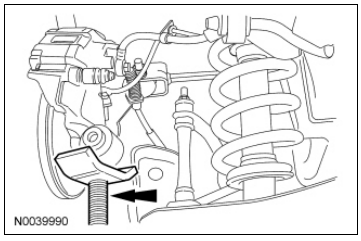
7. Remove and discard the lower arm outboard bolt.
    - To install, tighten to 275 Nm (203 lb-ft) at curb ride height.



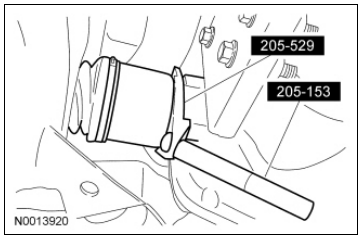
8. Remove and discard the 3 wheel knuckle bolts.
    - To install, tighten to 275 Nm (203 lb-ft).



9. Pivot the wheel knuckle assembly upward on the upper arm outboard bolt.
    - Loosen the upper arm bolt to prevent bushing damage.
        - ♦ To install, tighten to 275 Nm (203 lb-ft) at curb ride height.



10. Using the Halfshaft Remover and Handle, disengage the inboard CV joint housing from the differential side gear.



11. Remove the halfshaft assembly.

12. ***NOTICE:*** **Do not tighten the wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage**

will occur if the wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

Position the halfshaft in the hub and use the previously removed hub nut to seat the halfshaft.

- Tighten to 350 Nm (258 lb-ft).
- Remove and discard the hub nut.

13. ***NOTICE:*** **The wheel hub nut contains a one-time locking chemical that is activated by the heat created when it is tightened. Install and tighten the new wheel hub nut to specification within 5 minutes of starting it on the threads. Always install a new wheel hub nut after loosening or when not tightened within the specified time or damage to the components can occur.**

    NOTE: Apply the brake to keep the halfshaft from rotating.

    Install a new hub nut.

    - Tighten to 350 Nm (258 lb-ft).

14. **NOTE:** Always install a new differential stub shaft seal whenever the halfshaft is removed. For additional information, refer to Section 205-02 .

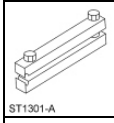
    NOTE: Make sure the halfshaft is completely seated in the differential side gear by pushing the halfshaft into the rear axle assembly until an audible click is heard or a leak may occur from the axle assembly.

    NOTE: Apply the brake to keep the halfshaft from rotating.

    To install, reverse the removal procedure.

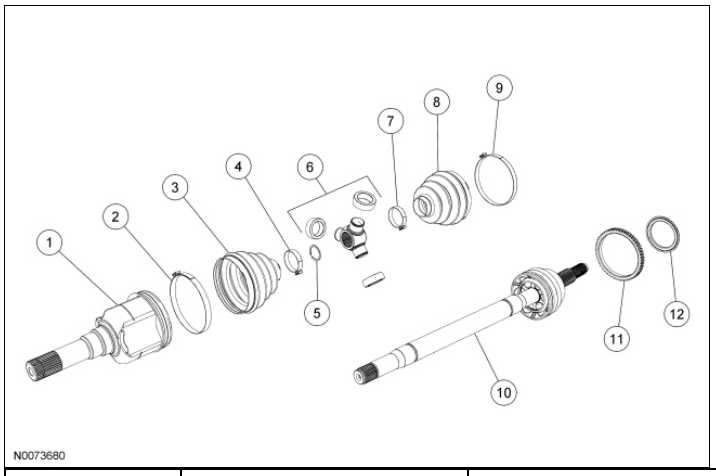
Halfshaft Joint

Special Tool(s)

 ST1301-A	Installer, Constant Velocity Joint Boot Clamp 205-343 (T95P-3514-A)
 ST1358-A	Installer, Drive Pinion Oil Seal 205-133 (T79P-4676-A)

Material

Item	Specification
Constant Velocity Joint Grease (High Temperature) XG-5	WSS-M1C258-A1

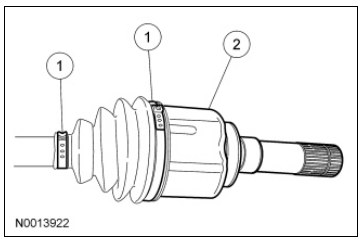


Item	Part Number	Description
1	3B418	Inboard CV joint housing
2	3B478	Inboard large boot clamp
3	3A331	Inboard CV joint boot
4	3B478	Inboard small boot clamp
5	4B422	Tri-lobe retainer
6	3W007A	Tri-lobe joint
7	3B413	Intermediate shaft
8	3B478	Outboard small boot clamp
9	3A331	Outboard CV joint boot
10	3B478	Outboard large boot clamp
11	20202	Wheel speed sensor ring
12	1175	Front wheel dust seal

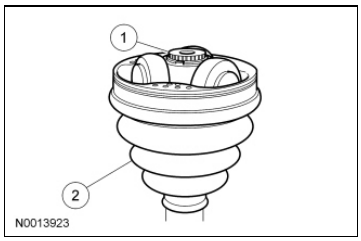
Disassembly

1. Remove the halfshaft assembly. For additional information, refer to Halfshaft in this section.

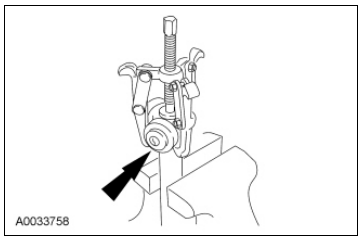
2. For the inboard CV joint, carry out the following:
    1. Remove and discard the boot clamps.
    2. Remove the inboard CV joint housing.



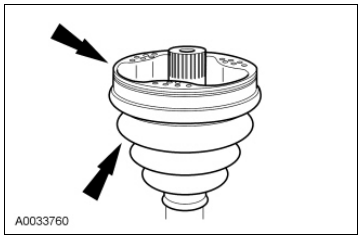
3. For the inboard CV joint, carry out the following:
    1. Remove and discard the retainer circlip.
    2. Slide the boot away from the CV joint.



4. Using a suitable 3-jaw puller, remove the CV joint.



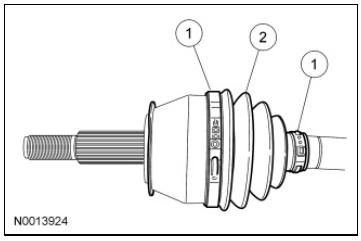
5. Remove and discard the tri-lobe insert and the boot.



6. **NOTE:** The outboard CV joint is not removable from the halfshaft. The boot must be removed or installed from the inboard CV joint side of the shaft.

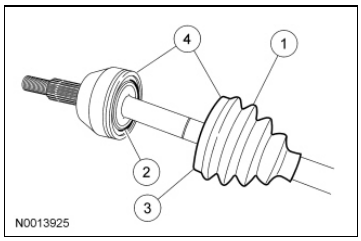
   For the outboard CV joint, carry out the following:

    1. Remove and discard the boot clamps.
    2. Remove and discard the boot.

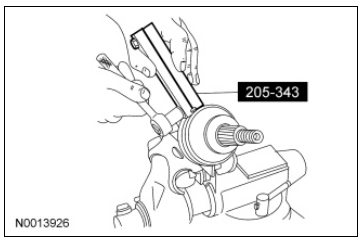


Assembly

1. For the outboard CV joint, carry out the following:
    1. Slide the boot on the interconnecting shaft.
    2. Pack the outboard CV joint with 225 g (7.93 oz) of grease.
    3. Spread any remaining grease evenly inside the boot.
    4. Install the boot by seating it in the groove in the CV joint housing.

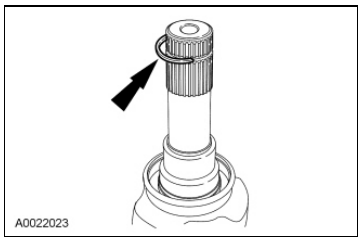


2. Using the Constant Velocity Joint Boot Clamp Installer, install the boot clamps.

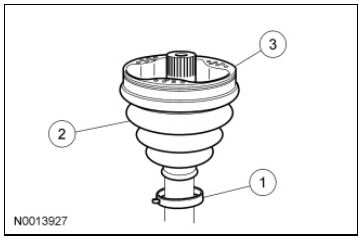


3. **NOTE:** Install a new circlip every time the halfshaft is removed from the axle.

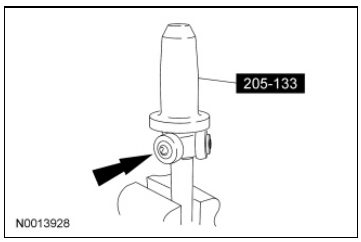
   Install a new retainer circlip.



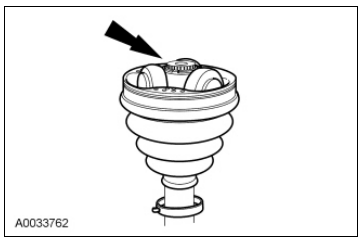
4. For the inboard CV joint, carry out the following:
    1. Position the clamp on the interconnecting shaft.
    2. Position the boot on the interconnecting shaft.
    3. Install the tri-lobe insert.



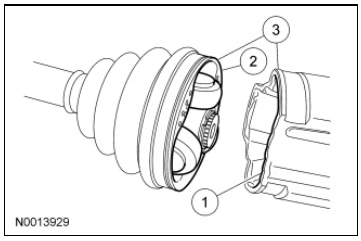
5. Using the Drive Pinion Oil Seal Installer, install the CV joint.



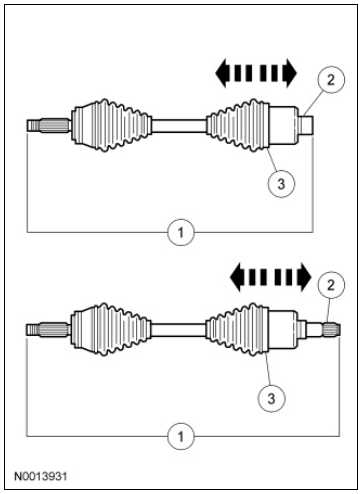
6. Install the retainer circlip.



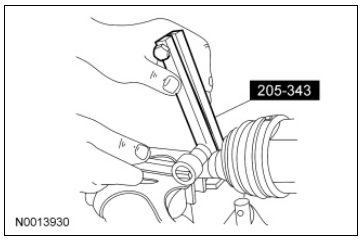
7. For the inboard CV joint, carry out the following:
    1. Pack the inboard CV joint housing with 250 g (8.82 oz) of grease.
    2. Spread any remaining grease evenly inside the boot and CV joint.
    3. Install the inboard CV joint housing, seating the boot in the groove in the housing.



8. Set the halfshaft assembled length to specifications. For additional information, refer to Specifications in this section.
    1. Measure the entire assembly length.
    2. Push in or pull out on the inner joint as necessary to adjust the halfshaft assembled length.
    3. Hold the inner joint to prevent the assembled length from changing, and insert a soft, flat tool between the boot and the joint to equalize the pressure.



9. Using the Constant Velocity Joint Boot Clamp Installer, install both boot clamps.



10. Install the halfshaft assembly. For additional information, refer to Halfshaft in this section.

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	1020 ml (2.15 pt)
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

General Specifications

Item	Specification
Brake Disc	
Front brake disc minimum thickness	28.5 mm (1.122 in)
Rear brake disc minimum thickness	11.0 mm (0.433 in)
Brake Pads	
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Front brake caliper bleeder screws	11	-	97
Master cylinder brake tube fittings	18	-	159
Rear brake caliper bleeder screws	22	16	-

Brake System

The brake system consists of the following components:

- Front and rear disc brakes
- Cable/drum-in-hat actuated parking brake
- Brake master cylinder and fluid reservoir
- Vacuum-assisted power brake booster
- Four-wheel ABS
- Red brake warning indicator

The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. When the brake pedal is pressed, brake fluid is pushed through the double-walled steel tubes and flexible hoses to the front and rear disc brake calipers. The brake fluid enters the disc brake calipers, forcing the caliper pistons and brake pads outward against the brake disc friction surface, slowing or stopping rotation. When the brake pedal is released, brake fluid pressure is relieved, returning the front and rear disc brake caliper pistons and brake pads to the unapplied position.

For information on the following:

- Front disc brakes, refer to Section 206-03 .
- Rear disc brakes, refer to Section 206-04 .
- Parking brake actuation, refer to Section 206-05 .
- Hydraulic brake actuation, refer to Section 206-06 .
- Vacuum-assisted power brake booster, refer to Section 206-07 .
- ABS, refer to Section 206-09 .

Principles of Operation

Brake System

Applying the brake pedal uses lever action to push a rod into the brake booster, which through the use of vacuum, boosts the force of the rod and then transmits this force to the primary piston in the master cylinder. This produces hydraulic pressure in the master cylinder. This pressure builds in the master cylinder and brake tubes as the brake pedal is applied further. The pressure between the primary and secondary piston forces the secondary piston to compress, building pressure in its circuit. The hydraulic pressure is transmitted by brake fluid through the brake tubes to the ABS Hydraulic Control Unit (HCU), which then distributes that pressure to the individual brake calipers. The brake calipers use hydraulic pressure to apply the pads. The application of the brake pads will cause the rotation of the wheels to slow or stop, depending on how much brake pressure is applied. The parking brakes carry out the same function except that they are mechanically actuated by a cable that connects only to the rear brakes.

Brake Master Cylinder Compensator Ports

The purpose of the compensator ports in the brake master cylinder is to supply additional brake fluid from the master cylinder reservoir when needed by the brake system due to brake lining wear and allow brake fluid to return to the master cylinder reservoir when the brakes are released. The returning brake fluid creates a slight turbulence in the master cylinder reservoir. This is a normal condition and indicates that the compensator ports are not clogged. Clogged compensator ports may cause the brakes to hang up or not fully release.

Red Brake Warning Indicator

The red brake warning indicator alerts the driver to certain conditions that exist in the brake system. The Instrument Cluster (IC) performs a bulb check when the ignition key is turned to the RUN position. The conditions that cause the indicator to illuminate are low brake fluid level, the parking brake is applied or there is a fault in the ABS (if the yellow ABS warning indicator is also illuminated). To diagnose red brake warning indicator concerns, refer to Section 413-01 .

Inspection And Verification

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Blistering or swelling of rubber brake components can indicate contamination of the brake fluid by a petroleum-based substance. The entire hydraulic brake system must be flushed with clean, specified brake fluid and contaminated rubber components must be replaced to prevent recontamination.**

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal. The brake warning indicator in the Instrument Cluster (IC) and the brake fluid level in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel is locked and the vehicle must be moved, open a bleeder screw at the locked wheel to let out enough fluid to relieve the pressure. Close the bleeder screw. If multiple wheels are locked, check the brake pedal free play to verify brake pedal is not partially applied. These operations may release the brakes, but will not correct the concern. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

1. Verify the customer concern.
   - For parking brake concerns, refer to Section 206-05 .
   - For ABS concerns, refer to Section 206-09 .
   - For adjustable pedal concerns, refer to Section 206-06 .
   - For all other concerns, continue with the next step.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Brake fluid level and condition • Brake master cylinder • Brake master cylinder reservoir • Brake booster • Brake booster check valve • Brake booster vacuum hose • Brake hoses and tubes • Brake caliper, guide pins and anchor plate • Brake disc • Brake pads • Brake pedal, bracket and booster linkage • Aftermarket modifications	• Parking brake switch • Brake fluid level switch • Wiring, terminals or connectors

3. Visually inspect the suspension system and tires for obvious signs of wear or damage.
    - For suspension system concerns, refer to Section 204-00 .
    - For tire concerns, refer to Section 204-04 .

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

5. If the cause is not visually evident, GO to Symptom Chart - Brake System or GO to Symptom Chart - NVH in this section.

Symptom Chart

Symptom Chart - Brake System

Symptom Chart - Brake System

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Vibration when the brakes are applied
- Brake disc(s)
- Suspension components
- GO to Pinpoint Test A .
- Brake vibration/shudder - occurs when the brake pedal is released
- Brake drag
- GO to Symptom Chart - Brake System .
- Rear brake noise - occurs when the brake pedal is unapplied
- Parking brake component
- REFER to Section 206-05 to diagnose the parking brake system.
- Rattling noise
- Caliper guide pins or guide pin bolts
- CHECK the caliper guide pins and guide pin bolts. REFER to Brake System Inspection in this section.
- Missing or damaged anti-rattle clips or springs

- CHECK the brake pads for missing clips or broken springs. INSTALL new components as necessary. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

- Loose brake disc shield

- TIGHTEN the brake disc shield bolts to specification. REFER to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

- Squealing noise - occurs on first (morning) brake application

- Brake pads

- Acceptable condition. Caused by humidity and low brake pad temperature.

- Squealing noise - a continuous squeal

- Brake pads

- INSPECT the brake pads. REFER to Brake System Inspection in this section.

- Squealing noise - an intermittent squeal

- Brake pads

- Acceptable condition. Caused by cold, heat, water, mud or snow.

- Groaning noise - occurs at low speeds with brake lightly applied (creeping)

- Brake pads

- Acceptable condition.

- Grinding/moaning noise - continuous

- Brake pads
- Brake disc

- INSPECT the brake pads, brake discs and attaching hardware for damage. VERIFY brake components are within specifications. REFER to Brake System Inspection in this section.

Pinpoint Tests

Pinpoint Test A: Vibration When the Brakes are Applied

Normal Operation

During moderate to heavy braking, noise from the Hydraulic Control Unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation or steering wheel nibble when the brakes are applied (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component.

PINPOINT TEST A: VIBRATION WHEN THE BRAKES ARE APPLIED

Test Step	Result / Action to Take
A1 ROAD TEST THE VEHICLE - LIGHT BRAKING	
• Road test the vehicle. Warm the brakes by slowing the vehicle from 80 to 32 km/h (50 to 20 mph) using light brake force. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using light pedal force. • **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**	**Yes** GO to A4 . **No** GO to A2 .
A2 ROAD TEST THE VEHICLE - MODERATE TO HEAVY BRAKING	
• Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force. • **Is there a vibration/shudder?**	**Yes** GO to A3 . **No** The concern is not present at this time.
A3 CHECK ABS OPERATION	
• **NOTE:** During moderate to heavy braking, noise from the HCU and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct operation of the ABS. Pedal pulsation or steering wheel nibble with the frequency proportional to vehicle speed indicates a concern with a brake or suspension component. • Road test the vehicle and apply the brakes on a dry, firm surface, then apply the brakes on a wet, snowy or loose surface (such as gravel). • **Is the vibration/shudder only present on a wet, snowy or loose surface?**	**Yes** This is a normal operating condition of the ABS. **No** GO to A5 .
A4 ISOLATE BRAKE VIBRATION	

• **NOTE:** This test is not applicable to vehicles with drum-in-hat type parking brakes. For vehicles with drum-in-hat parking brakes, proceed to the next test step. For all other vehicles, apply the parking brake to identify if the problem is in the front or rear brake. • Apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89-97 km/h (55-60 mph), lightly apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test. • **Is there a vibration/shudder?**	**Yes** GO to A7 . **No** GO to A5 .
A5 CHECK THE FRONT SUSPENSION	
• Check the front suspension. Refer to Section 204-00 . • **Are all the suspension components in satisfactory condition?**	**Yes** GO to A6 . **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
A6 CHECK THE FRONT BRAKE DISCS	
• Inspect the front brake discs. Refer to Brake System Inspection in this section. • Road test the vehicle. • **Is the vibration/shudder present?**	**Yes** GO to A7 . **No** The concern has been repaired.
A7 CHECK THE REAR SUSPENSION	
• Check the rear suspension. Refer to Section 204-00 . • **Are all the suspension components in satisfactory condition?**	**Yes** INSPECT the rear brake discs. REFER to Brake System Inspection in this section. **No** REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Brake Booster

1. Disconnect the brake booster vacuum sensor/check valve from the brake booster and connect a suitable vacuum/pressure tester to the booster side of the vacuum sensor/check valve.

2. Apply the parking brake, start the engine and place the transmission in NEUTRAL.
   - Allow the engine to reach normal operating temperature.

3. **NOTE:** Subtract approximately 3.38 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 ft) of elevation above sea level.

   Verify that vacuum is available at the vacuum sensor/check valve with engine running at normal idle speed.

   - The vacuum gauge should read between 51-74 kPa (15-22 in-Hg).
   - If specified vacuum is available, stop the engine, connect the vacuum sensor/check valve and continue with Step 5.
   - If specified vacuum is not available, continue with Step 4.

4. Disconnect the vacuum sensor/check valve from the vacuum hose and verify that the specified vacuum is available at the hose with the engine at idle speed and the transmission in NEUTRAL.
   - If specified vacuum is available, stop the engine, install a new vacuum sensor/check valve and continue with Step 5.
   - If specified vacuum is not available, stop the engine, connect the vacuum hose to the vacuum sensor/check valve and refer to Section 303-00 to diagnose the no/low vacuum condition.

5. Apply the brake pedal several times to exhaust all vacuum from the system.

6. Apply the brake pedal and hold it in the applied position. Start the engine and verify that the brake pedal moves downward after the engine starts.
   - If the brake pedal moves, the brake booster is operating correctly.
   - If the brake pedal does not move, install a new brake booster. Refer to Section 206-07 .

7. Operate the engine a minimum of 20 seconds at idle. Stop the engine and let the vehicle stand for 10 minutes, then apply the brake pedal. The brake pedal feel should be the same as that noted with the engine operating.
   - If the brake pedal feels hard (no power assist), install a new brake booster vacuum sensor/check valve and retest.
   - If condition still exists, install a new brake booster. Refer to Section 206-07 .
   - If the brake pedal feels the same as noted with the engine operating, the vacuum sensor/check valve is functioning properly.

Brake Master Cylinder - Bypass Condition

1. Inspect the master cylinder. Refer to Brake System Inspection in this section.

2. Disconnect the brake tubes from the master cylinder.

3. Plug the outlet ports of the master cylinder.

4. **NOTE:** Make sure that the outlet port plugs do not show signs of leakage.

   Lightly apply the brakes and hold for 10 seconds. Release the brakes and then reapply with heavy force. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new brake master cylinder must be installed.

   - If brake pedal height is maintained, reinstall brake tubes and tighten to specifications. Refer to Specifications in this section. After installation, bleed the brake system. Refer to Brake System Bleeding in this section.

Brake Master Cylinder - Compensator Port

1. Inspect the master cylinder. Refer to Brake System Inspection in this section.

2. With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 .

3. Apply and release the brakes.

4. With the brakes released, attempt to rotate each wheel and check for any brake drag.
   - If an excessive amount of brake drag exists at multiple wheels, continue to Step 5.
   - If an excessive amount of brake drag exists at only one wheel, it indicates a possible seized brake caliper, brake wheel cylinder or parking brake component. Repair or install new components as necessary.

5. Check the brake stoplamp switch and the brake pedal free play to verify that the brake pedal is not partially applied.

6. Loosen the brake master cylinder nuts and position the brake master cylinder away from the brake booster.

7. With the brakes released, attempt to rotate each wheel and check for any brake drag.
   - If the brake drag is no longer present, install a new brake booster. Refer to Section 206-07 .
   - If the brake drag is still present, install a new master cylinder. Refer to Section 206-06 .

Brake System Inspection

Material

Item	Specification
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Brake Pads

NOTE: It is not required to install new brake pads when the brake discs are machined.

1. Inspect the brake pad friction material for contamination.
   - If the friction material shows evidence of contamination, install new brake pads. For additional information, refer to Section 206-03 for front brake pads or Section 206-04 for rear brake pads.

2. Inspect and measure the thickness of the brake pad friction material. For additional information, refer to Specifications in this section.
   - Minor surface cracks do not require pad replacement, however, if there are missing chunks or cracks in the lining through to the backing plate, install new brake pads. For additional information, refer to Section 206-03 for front brake pads or Section 206-04 for rear brake pads.
   - If the thickness of the friction material is less than the specified thickness, install new brake pads. For additional information, refer to Section 206-03 for front brake pads or Section 206-04 for rear brake pads.
   - If the friction material shows taper wear that is not within specifications, install new brake pads and verify the caliper guide pins are functioning correctly. For additional information, refer to Brake Caliper Guide Pins inspection.

Brake Discs

NOTICE: **Using an impact tool without a torque socket will lead to unevenly tightened wheel nuts. This causes brake disc on-vehicle lateral runout and brake roughness.**

1. Inspect the brake discs and measure the brake disc thickness. Record the measurement. Refer to Specifications in this section.
   - If the brake disc is cracked or otherwise damaged, install a new brake disc. For additional information, refer to Section 206-03 for front brakes or Section 206-04 for rear brakes.
   - If the measurement is below the minimum thickness specification, install a new brake disc. For additional information, refer to Section 206-03 for front brakes or Section 206-04 for rear brakes.

- If the diagnosis has revealed vibration in the steering wheel, seat or pedal while braking that varies with vehicle speed, machine the brake disc. Heavily scored brake discs, similar to that caused by pads worn down to the backing plate, should also be machined. In order to machine, discs must be above the minimum thickness specification. For additional information, refer to Specifications and Brake Disc Machining in this section.

Brake Calipers

1. Inspect the brake calipers for leaks, damage to seals and piston corrosion or binding.
    - If the brake caliper is leaking or otherwise damaged, install a new brake caliper. For additional information, refer to Section 206-03 for front brake calipers or Section 206-04 for rear brake calipers.

Brake Caliper Guide Pins

1. The guide pins should slide with a reasonable amount of hand force. If the brake pads show taper wear or the guide pins are difficult to move, carry out the following steps.
    - Disassemble the brake caliper guide pins and inspect the guide pins and guide pin bores for wear, damage and corrosion. If the bore is worn or damaged, replace the damaged component.
    - Use a wire brush, rolled-up sandpaper or emery cloth to remove all corrosion and foreign material from the caliper guide pin bores. Clean any remaining foreign material from the bores with brake parts cleaner and compressed air.
    - Assemble the caliper seals, boots and guide pins. Use an ample amount of the specified grease to lubricate the bores and guide pins.
    - Inspect the brake pads. For additional information, refer to Brake Pads inspection in this section.

Brake Flexible Hoses and Tubes

NOTICE: **Never use copper tubing. It is subject to fatigue, cracking and corrosion, which may result in brake tube failure.**

NOTE: Double-wall steel tubing is used throughout the brake hydraulic system. All brake tube fittings must be correctly double flared to provide strong, leakproof connections. When bending tubing to fit the underbody or rear axle contours, be careful not to kink or crack the tube.

1. Inspect brake tubes for corrosion, cracks, leaks or any other signs of damage.
    - If a section of the brake tube is damaged, the entire section must be installed with a new tube of the same type, size, shape and length.
    - When installing the hydraulic brake tubing, hoses or connectors, tighten all connections to specifications. After installation, bleed the brake system. For additional information, refer to Brake System Bleeding in this section.

2. Inspect the brake flexible hoses for cracks, leaks and swelling during brake application or any other signs of damage.
    - Install a new brake flexible hose if the hose shows signs of softening, cracking or other damage. For additional information, refer to Section 206-03 for the front brake flexible hose or Section 206-04 for the rear brake flexible hose.

Brake Master Cylinder

NOTE: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir will fall during brake application and rise during release. The returning brake fluid creates a slight turbulence in the master cylinder reservoir. This is a normal condition and indicates that the compensator ports are not clogged. Clogged compensator ports may cause the brakes to hang up or not fully release. The net fluid level (such as after brake application and release) will remain unchanged. Fluid level will decrease with pad wear.

NOTE: A trace of brake fluid will exist on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

1. Inspect the brake master cylinder for fluid leaks.
    - Install a new master cylinder or brake fluid reservoir if signs of excessive leaking are present. For additional information, refer to Section 206-06 .
    - To check for correct brake master cylinder operation, refer to Component Tests in this section.

Brake Booster

1. Inspect the brake booster for excessive corrosion or damage. Inspect the vacuum hoses for leaks and kinks.
    - Install a new brake booster if signs of excessive corrosion or damage is found. For additional information, refer to Section 206-07 .
    - Repair or replace vacuum hoses as necessary.
    - To check for correct brake booster operation, refer to Component Tests in this section.

Brake Disc Machining

NOTE: Do not use a bench lathe to machine the brake discs. Use an on-vehicle brake lathe only. Read the entire operating manual and/or view the video shipped with the lathe before installing, operating or repairing the lathe.

NOTE: An on-vehicle brake lathe with an automatic runout adjustment feature is preferred. However, if the lathe is not self adjusting, the lathe oscillation must be adjusted using a dial indicator. The total indicated runout target is 0.000 mm (0.000 in). The maximum indicated runout should be no more than 0.050 mm (0.002 in). If the runout adjustment (automatic or manual) is carried out correctly prior to machining, then the final brake disc runout will be within specification and a runout measurement is not necessary after machining.

NOTE: Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe will make sure that these dimensions are within specification.

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. ***NOTICE:*** **Do not allow the caliper to hang from the brake hose or damage to the hose may occur.**

   Remove the bolts and position the brake caliper or brake caliper and anchor plate assembly aside, as required.

   - Support the brake caliper using mechanic's wire.

3. Install the hub adapter using:
   - four wheel nuts on a 4-stud wheel hub.
   - five wheel nuts on a 5-stud wheel hub.
   - six wheel nuts on a 6-stud wheel hub.
   - four wheel nuts on a 7- or 8-stud wheel hub.
   - five wheel nuts on a 10-stud wheel hub.

4. Install the cutting lathe.

5. If the lathe is not self adjusting, adjust the lathe oscillation using a dial indicator. The total indicated runout target is 0.000 mm (0.000 in). The maximum indicated runout should be no more than 0.050 mm (0.002 in).

6. Center the cutting head, adjust the cutting bits and install the chip deflector/silencer.

7. **NOTE:** The depth of the cut should be between 0.10 and 0.40 mm (0.004 and 0.015 in). Lighter cuts will cause the bit to heat up and wear faster. Heavier cuts will cause poor brake disc surface finish.

   Machine the brake disc.

8. Remove the lathe and the silencer.

9. Remove the wheel nuts and hub adapter.

10. Remove the metal shavings.

11. Measure the brake disc thickness.
    - If the measurement is below the minimum specification, install a new brake disc. For additional information, refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

12. **NOTE:** It is not required to install new brake pads if friction material is within specifications. For additional information, refer to Specifications in this section.

    Position the brake caliper or brake caliper and anchor plate assembly.

    - Install the bolts.
    - For fastener torque specifications, refer to Section 206-03 for front disc brakes or Section 206-04 for rear disc brakes.

13. Install the wheel and tire. For additional information, refer to Section 204-04 .

Component Bleeding

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

Master Cylinder

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

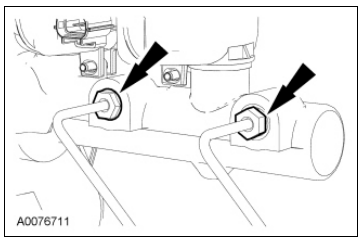
⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

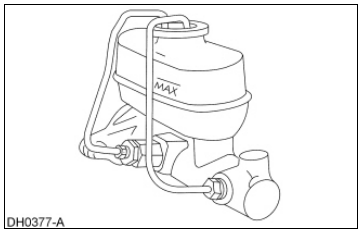
NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

NOTE: When a new brake master cylinder has been installed, or the system is emptied or partially emptied, it should be primed to prevent air from entering the system.

1. Disconnect the brake tubes from the master cylinder.



2. Install short brake tubes with the ends submerged in the brake master cylinder reservoir.



3. Fill the brake master cylinder reservoir with clean, specified brake fluid.

4. Have an assistant pump the brake pedal until clear fluid flows from both brake tubes, without air bubbles.

5. Remove the short brake tubes and install the brake outlet tubes.

6. Bleed the brake system. For additional information, refer to Brake System Bleeding in this section.

Brake Caliper

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

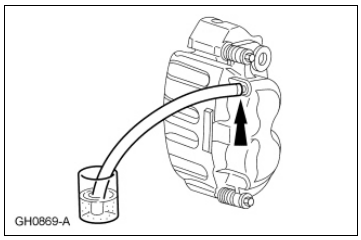
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⚠ WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

***NOTICE:* Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. **NOTE:** It is not necessary to do a complete brake system bleed if only the brake caliper was disconnected or installed new.

   Remove the bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

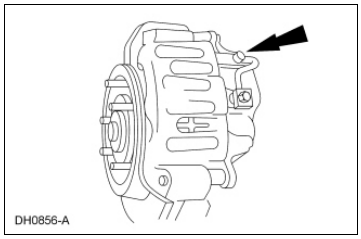


2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal.

3. Loosen the bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.

- Repeat until clear, bubble-free fluid comes out.
- Refill the brake master cylinder reservoir as necessary.

4. Remove the rubber hose and tighten the bleeder screw to specifications. For additional information, refer to Specifications in this section.
    - Install the bleeder screw cap.



Brake System Bleeding

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

Pressure

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

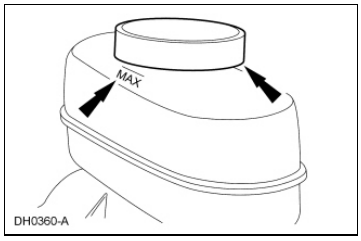
⚠ WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

NOTE: The Hydraulic Control Unit (HCU) bleeding procedure must be carried out if the HCU or any components upstream of the HCU are installed new.

NOTE: Pressure bleeding the brake system is preferred to manual bleeding.

1. Clean all dirt from the brake master cylinder filler cap and remove the filler cap.
   - Fill the brake master cylinder with clean specified brake fluid.



2. **NOTE:** Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the equipment manufacturer when installing the adapter.

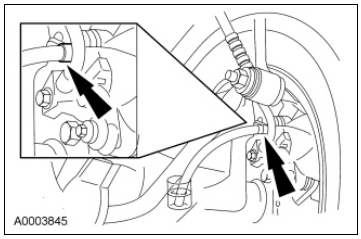
   Install the bleeder adapter to the brake master cylinder reservoir and attach the bleeder tank hose to the fitting on the adapter.

3. **NOTE:** Make sure the bleeder tank contains enough clean, specified brake fluid to complete the bleeding operation.

   Open the valve on the bleeder tank.

   - Apply 207-345 kPa (30-50 psi) to the brake system.

4. Remove the RH rear bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.



5. Loosen the RH rear bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH rear bleeder screw and remove the rubber hose.
   - Tighten to specifications. For additional information, refer to Specifications in this section.
   - Install the bleeder screw cap.

6. Continue bleeding the system, going in order from the LH rear bleeder screw to the RH front bleeder screw ending with the LH front bleeder screw.

7. Release the bleeder tank pressure and close the bleeder tank valve. Remove the tank hose from the adapter and remove the adapter from the brake fluid reservoir.

Manual

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet

(MSDS) if available. Failure to follow these instructions may result in serious personal injury.

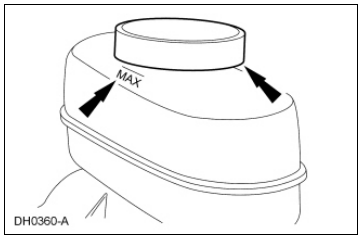
⚠ WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

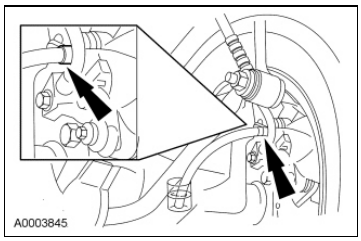
NOTE: The HCU bleeding procedure must be carried out if the HCU or any components upstream of the HCU are installed new.

NOTE: Pressure bleeding the brake system is preferred to manual bleeding.

1. Clean all dirt from the brake master cylinder filler cap and remove the filler cap.
   - Fill the brake master cylinder with clean specified brake fluid.



2. Remove the bleeder screw cap and place a box-end wrench on the RH rear bleeder screw. Attach a rubber drain hose to the RH rear bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.



3. Have an assistant pump the brake pedal at least 3 times and then hold firm pressure on the brake pedal.

4. Loosen the RH rear bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH rear bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.

5. Remove the rubber hose and tighten the bleeder screw to specifications. For additional information, refer to Specifications in this section.
   - Install the bleeder screw cap.

6. Repeat Steps 2 through 5 for the LH rear, RH front and LH front bleeder screws in this order.

Hydraulic Control Unit (HCU)

NOTE: The HCU bleeding procedure must be carried out if the HCU or any components upstream of the

HCU are installed new.

NOTE: Pressure bleeding the brake system is preferred to manual bleeding.

1. Follow the Pressure Bleeding or Manual Bleeding procedure steps to bleed the system.
2. Connect the scan tool and follow the ABS Service Bleed instructions.
3. Repeat the Pressure Bleeding or Manual Bleeding procedure steps to bleed the system.

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	1,020 ml (2.15 pt)
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A	-
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-	-

General Specifications

Item	Specification
Brake Disc	
Brake disc minimum thickness	28.5 mm (1.122 in)
Brake Pads	
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate bolts	165	122	-
Brake caliper bleeder screw	11	-	97
Brake caliper guide pin bolts	72	53	-
Brake disc shield bolts	8	-	71
Brake flexible hose flow bolt	35	26	-
Brake tube-to-brake hose fitting	18	-	159

Front Disc Brake

The front brake disc system consists of the following components:

- Brake pads
- Brake caliper anchor plate
- Brake caliper
- Brake disc
- Brake disc shield
- Brake flexible hose

When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing of wheel rotation and the vehicle.

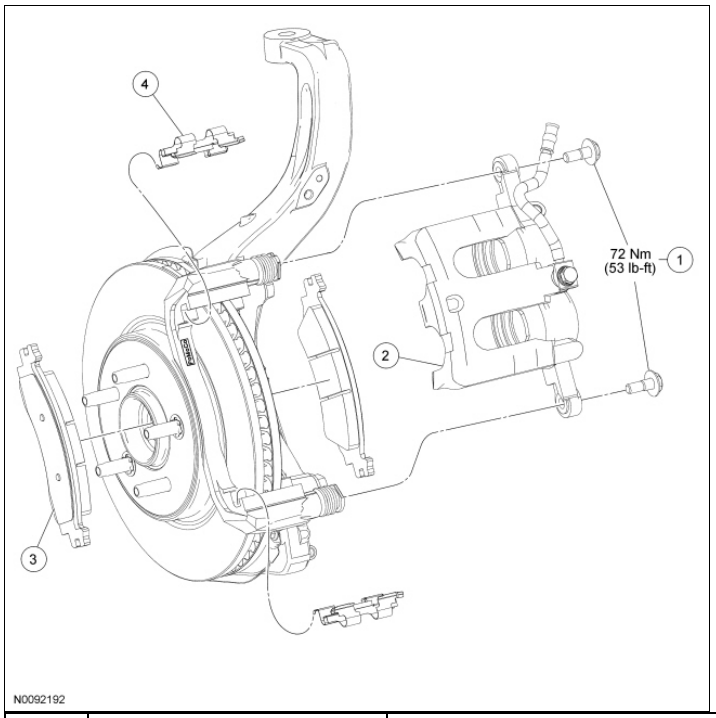
Front Disc Brake

Refer to Section 206-00 .

Brake Pads

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1



Item	Part Number	Description
1	2W303	Brake caliper guide pin bolts (2 required)
2	2B120 RH/ 2B121 LH	Brake caliper housing
3	2001	Brake pad (2 required)
4	-	Brake pad clip (part of 2001)

Removal

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Check the brake fluid level in the brake master cylinder reservoir.
   - If required, remove brake fluid until the brake master cylinder reservoir is one-half full.

2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. ***NOTICE:*** **Do not pry in the brake caliper sight hole to retract the pistons as this can damage the pistons and boots.**

   NOTICE: **Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.**

   Remove the 2 brake caliper guide pin bolts and position the brake caliper aside.

   - Support the caliper using mechanic's wire.

4. Remove the brake pads and clips.
   - Discard the clips.

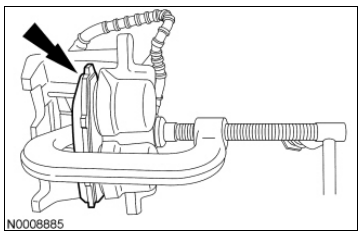
Installation

1. **NOTE:** One brake disc pad kit contains the pads and pad clips required for both sides.

   Install the new brake pad clips and the brake pads.

2. ***NOTICE:*** **Protect the piston and boots when pushing the caliper piston into the caliper piston bores or damage to components may occur.**

   Using a C-clamp and a worn brake pad, compress the disc brake caliper pistons into the caliper.



3. Position the brake caliper and install the 2 guide pin bolts.
   - Tighten to 72 Nm (53 lb-ft).

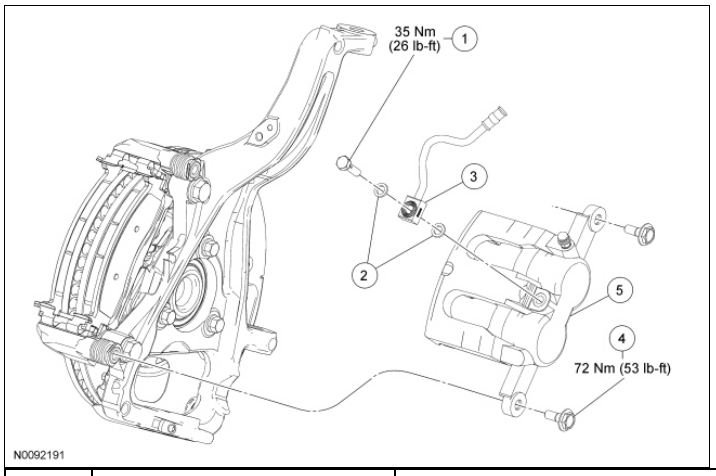
4. Fill the brake master cylinder reservoir with clean specified brake fluid.

5. Install the wheel and tire. For additional information, refer to Section 204-04 .
   - Apply brakes several times to verify correct brake operation.

Brake Caliper

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1



Item	Part Number	Description
1	385116	Brake flexible hose flow bolt
2	2149	Copper washers (2 required)
3	2078	Brake flexible hose
4	2W303	Brake caliper guide pin bolt (2 required)
5	2B120 RH/ 2B121 LH	Brake caliper housing

Removal

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. Remove the brake flexible hose flow bolt and position the brake hose aside.
    - Discard the 2 copper washers.
    - Cap the fluid ports.

3. ***NOTICE:*** **Do not pry in the brake caliper sight hole to retract the pistons as this can damage the pistons and boots.**

   Remove the 2 brake caliper guide pin bolts and the brake caliper.

    - If leaks or damaged boots are found, install a new brake caliper.

Installation

1. Position the brake caliper and install the 2 guide pin bolts.
    - Tighten to 72 Nm (53 lb-ft).

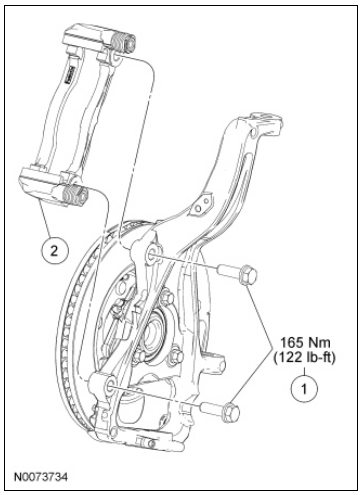
2. Using 2 new copper washers, position the brake hose and install the brake hose flow bolt.
    - Tighten to 35 Nm (26 lb-ft).

3. Bleed the brake caliper. For additional information, refer to Section 206-00 Component Bleeding.

4. Install the wheel and tire. For additional information, refer to Section 204-04 .

Brake Caliper Anchor Plate

Removal and Installation



Item	Part Number	Description
1	2027	Brake caliper anchor plate bolts (2 required)
2	2B134 RH/ 2B292 LH	Brake caliper anchor plate

1. Remove the brake pads. For additional information, refer to Brake Pads in this section.

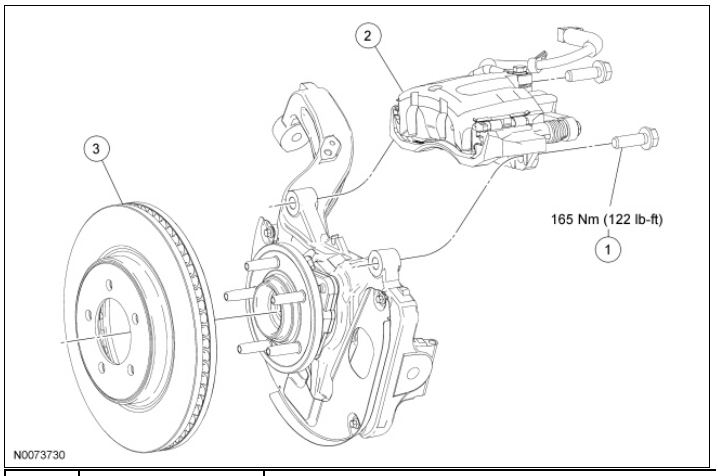
2. Remove and discard the 2 brake caliper anchor plate bolts and remove the brake caliper anchor plate.
   - To install, tighten to 165 Nm (122 lb-ft).

3. To install, reverse the removal procedure.

Brake Disc

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-



Item	Part Number	Description
1	2027	Brake caliper anchor plate bolt (2 required)
2	-	Brake caliper, brake pads and anchor plate assembly
3	1125	Brake disc

Removal

1. ***NOTICE:*** **Do not allow the brake caliper, brake pads and anchor plate assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the 2 brake caliper anchor plate bolts and position the brake caliper, brake pads and anchor plate assembly aside.

   - Support the caliper, brake pads and anchor plate assembly using mechanic's wire.

2. **NOTE:** If the brake disc cannot be removed easily, apply specified rust penetrant on the brake disc-to-hub mating surfaces.

Remove the brake disc.

Installation

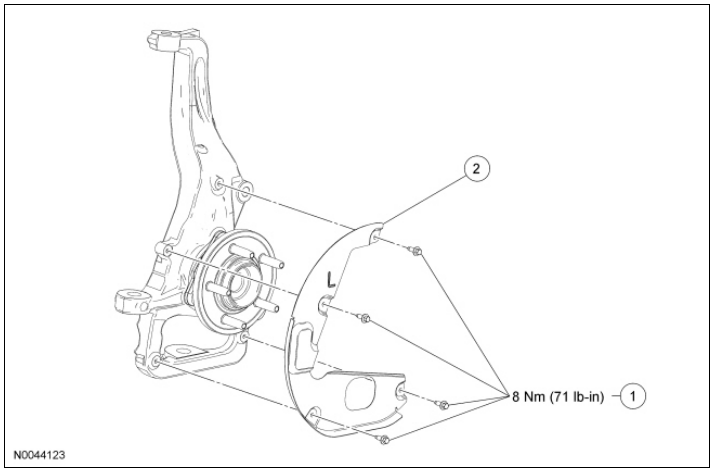
1. Clean any rust or foreign material from brake disc and wheel hub.
    - Use specified parts cleaner to clean the front brake disc and hub surfaces.

2. Apply a thin coat of specified anti-seize lubricant to the hub flange.

3. Install the brake disc.

4. Position the brake caliper, brake pads and brake caliper anchor plate assembly and install the 2 brake caliper anchor plate bolts.
    - Tighten to 165 Nm (122 lb-ft).

Brake Disc Shield



Item	Part Number	Description
1	W500212	Brake disc shield bolts (4 required)
2	2K004 RH/ 2K005 LH	Brake disc shield

Removal and Installation

1. Remove the brake disc. For additional information, refer to Brake Disc in this section.

2. Remove and discard the 4 brake disc shield bolts.
   - To install, tighten new bolts to 8 Nm (71 lb-in).

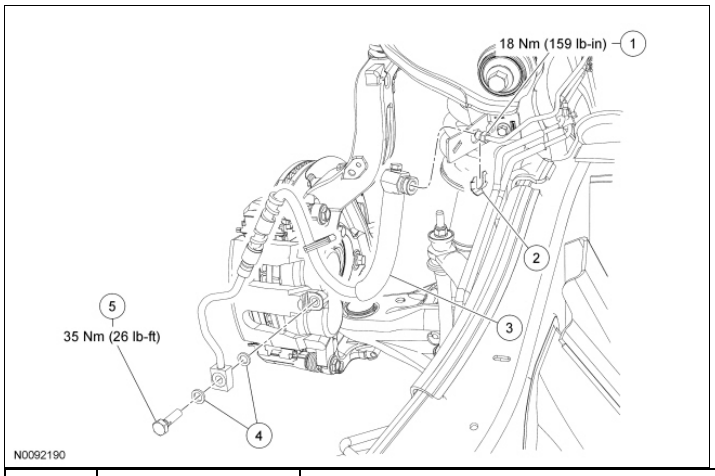
3. Remove the brake disc shield.

4. To install, reverse the removal procedure.

Brake Flexible Hose

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1



Item	Part Number	Description
1	-	Brake tube fitting (part of 2264 LF/ 2263 RF)
2	-	Brake flexible hose retaining clip (part of 2078)
3	2078	Brake flexible hose
4	2149	Copper washers (2 required)
5	385116	Brake caliper flow bolt

Removal and Installation

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Remove the brake flexible hose flow bolt and discard the 2 copper washers.
    - To install, tighten to 35 Nm (26 lb-ft).

- Use 2 new copper washers.

2. Disconnect the brake tube fitting from the brake flexible hose.
   - To install, tighten to 18 Nm (159 lb-in).

3. Remove the brake flexible hose retaining clip and the brake flexible hose.

4. To install, reverse the removal procedure.
   - Bleed the brake caliper. For additional information, refer to Section 206-00 Component Bleeding.

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	1,020 ml (2.15 pt)
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-

General Specifications

Item	Specification
Brake Disc	
Brake disc minimum thickness	11.0 mm (0.433 in)
Brake Pads	
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Brake caliper bleeder screw	22	16	-
Brake caliper guide pin bolts	32	24	-
Brake disc shield bolts	8	-	71
Brake flexible hose bracket bolt	20	-	177
Brake flexible hose flow bolt	35	26	-
Brake tube-to-brake hose flexible fitting	18	-	159

Rear Disc Brake

The rear disc brake system consists of the following components:

- Brake caliper anchor plate
- Brake caliper
- Brake disc
- Brake flexible hose
- Brake pads

When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing or stopping of wheel rotation and the vehicle.

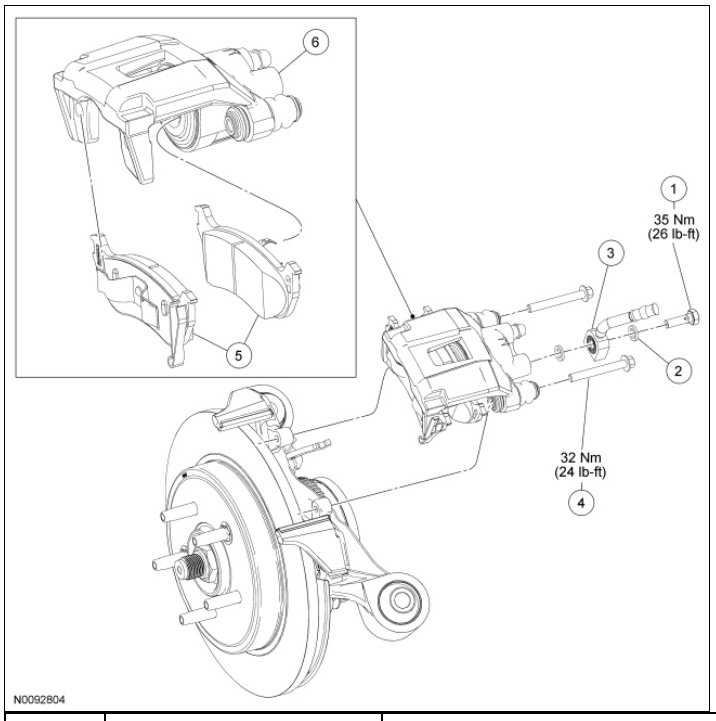
Rear Disc Brake

Refer to Section 206-00 .

Brake Caliper

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1



Item	Part Number	Description
1	385116	Brake flexible hose flow bolt
2	2149	Copper washer (2 required)
3	2282	Brake flexible hose
4	2333	Brake caliper guide pin bolt (2 required)
5	2200	Brake pads
6	2552 RH/ 2553 LH	Brake caliper

Removal

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products

call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. Remove the brake flow bolt and position the brake hose aside.
   - Discard the 2 copper washers.

3. Remove the 2 brake caliper guide pin bolts and remove the brake caliper.

4. Remove the brake pads from the brake caliper.

Installation

1. Install the brake pads to the brake caliper.

2. Position the brake caliper and install the 2 guide pin brake caliper bolts.
   - Tighten to 32 Nm (24 lb-ft).

3. Using 2 new copper washers, position the brake hose and install the brake hose flow bolt.
   - Tighten to 35 Nm (26 lb-ft).

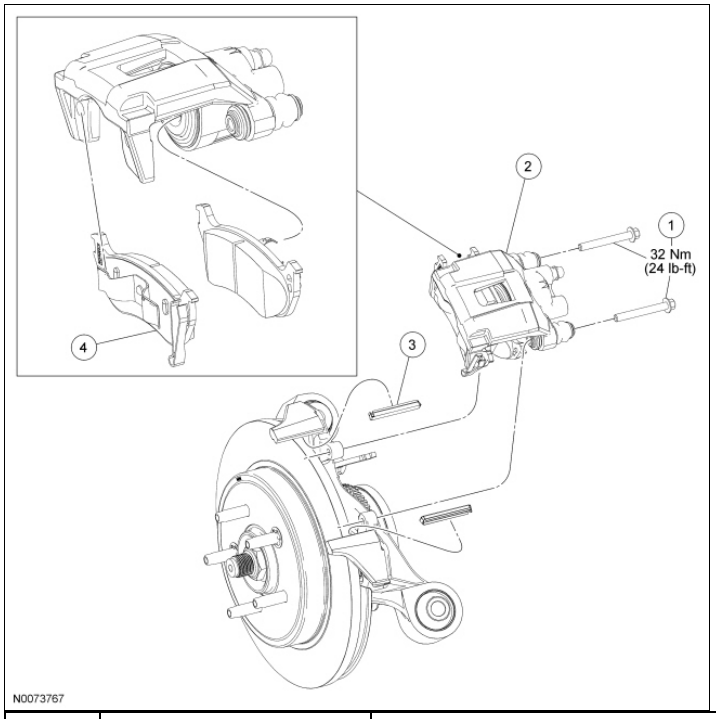
4. Bleed the brake caliper. For additional information, refer to Section 206-00 , Component Bleeding.

5. Install the wheel and tire. For additional information, refer to Section 204-04 .
   - Apply brakes several times to verify correct brake operation.

Brake Pads

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



Item	Part Number	Description
1	2333	Brake caliper guide pin bolts
2	2552 RH/ 2553 LH	Brake caliper
3	-	Brake pad clip (part of 2200) (2 required)
4	2200	Brake pad

Removal

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products

call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

⚠ **WARNING: Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.**

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Check the brake fluid level in the brake master cylinder reservoir.
   - If required, remove the fluid until the brake master cylinder reservoir is half full.

2. Remove the wheel and tire. For additional information, refer to Section 204-04 .

3. ***NOTICE:*** **Do not pry in the caliper sight hole to retract the pistons, as this can damage the pistons and boots.**

   NOTICE: **Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.**

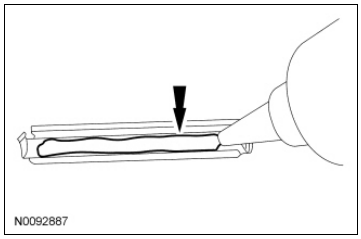
   Remove the 2 brake caliper guide pin bolts and position the caliper aside.

   - Support the caliper using mechanic's wire.

4. Remove the 2 brake pads.
   - Discard the brake pad clips.

Installation

1. Apply a thin bead of the specified sealant to the center section of the inside of the brake pad clips.



2. Install the brake pad clips and brake pads.

3. ***NOTICE:*** **Protect the piston and boots when pushing the caliper piston into the caliper piston bores or damage to components may occur.**

   If installing new brake pads, using a suitable tool and a worn brake pad, compress the disc brake caliper pistons into the caliper.

4. Position the brake caliper and install the 2 brake caliper guide pin bolts.
   - Tighten to 32 Nm (24 lb-ft).

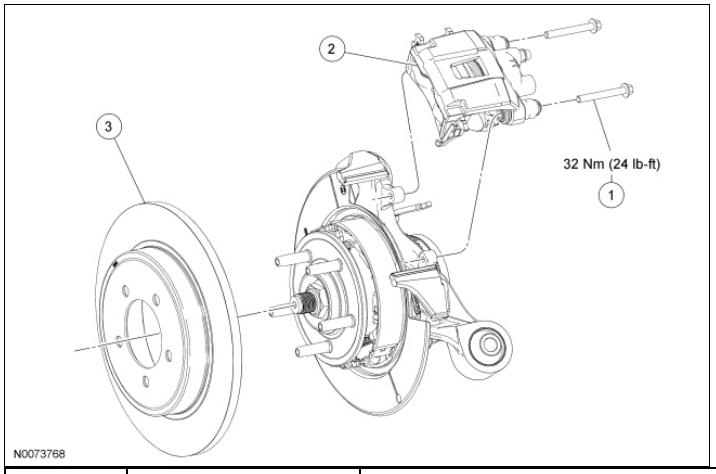
5. Fill the brake master cylinder reservoir with clean, specified brake fluid.

6. Install the wheel and tire. For additional information, refer to Section 204-04 .
   - Apply brakes several times to verify correct brake operation.

Brake Disc

Material

Item	Specification
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Penetrating and Lock Lubricant (US); Penetrating Fluid (Canada) XL-1 (US); CXC-51-A (Canada)	-



Item	Part Number	Description
1	2333	Brake caliper guide pin bolt (2 required)
2	-	Brake caliper and brake pad assembly
3	2C026	Brake disc

Removal

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .
2. ***NOTICE:*** **Do not pry in the caliper sight hole to retract the pistons, as this can damage the pistons and boots.**

   NOTICE: **Do not allow the brake caliper and brake pad assembly to hang from the brake hose or damage to the hose can occur.**

   Remove the 2 brake caliper guide pin bolts, position the caliper and pads aside as an assembly.

   - Support the caliper and brake pad assembly using mechanic's wire.
3. **NOTE:** If the brake disc binds on the parking brake shoe and lining, remove the adjustment hole knockout panel or access plug and contract the parking brake shoe and lining.

NOTE: If the brake disc cannot be removed easily, apply specified penetrating and lock lubricant on the brake disc-to-hub mating surfaces.

Remove the brake disc.

Installation

NOTE: If the adjustment hole knockout panel or access plug was removed, it is necessary to install an access plug to prevent the entry of contaminants.

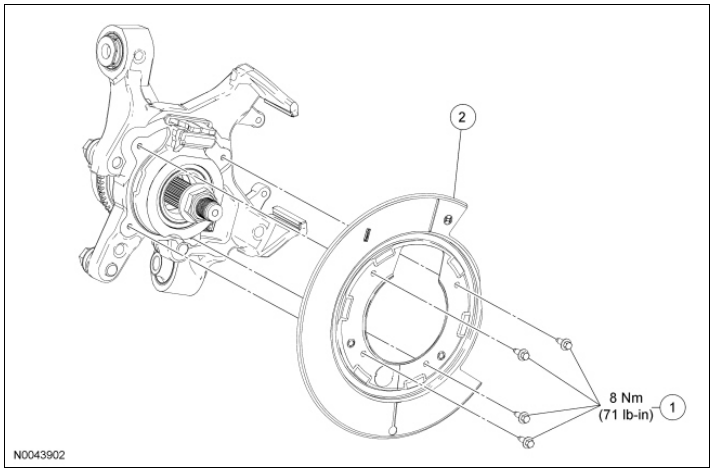
1. Clean any rust or foreign material from brake disc and wheel hub.
   - Use specified parts cleaner to clean the front brake disc and hub surfaces.

2. Install the brake disc.

3. Position the brake caliper and brake pad assembly. Install the 2 brake caliper guide pin bolts.
   - Tighten to 32 Nm (24 lb-ft).

4. Install the wheel and tire. For additional information, refer to Section 204-04 .
   - Apply brakes several times to verify correct brake operation.

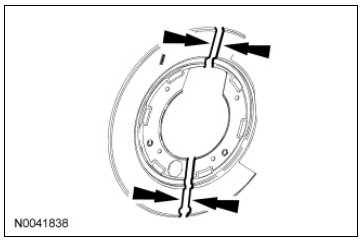
Brake Disc Shield



Item	Part Number	Description
1	W500212	Brake disc shield bolts
2	2C028 RH/ 2C029 LH	Brake disc shield

Removal

1. Remove the parking brake shoes. For additional information, refer to Section 206-05 .
2. Remove the brake disc shield bolts.
3. Cut the shield at the perforations and remove the brake disc shield halves.



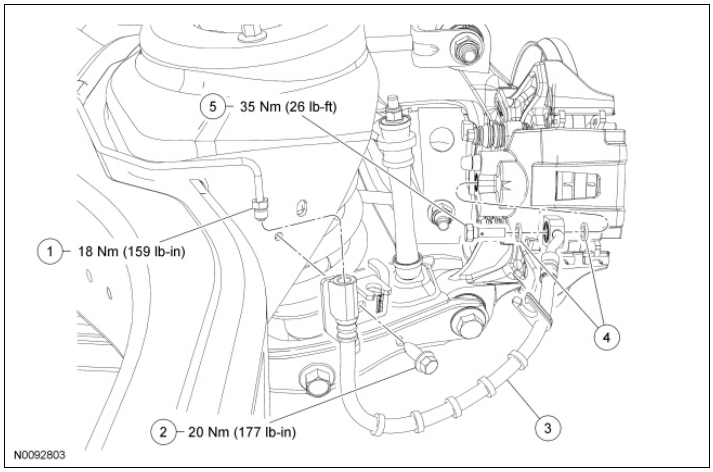
Installation

1. **NOTE:** If installing a new brake disc shield, cut the new shield in half at the perforations.

   Position the brake disc shield halves and install 2 bolts in each half.

   - Tighten to 8 Nm (71 lb-in).
2. Install the parking brake shoes. For additional information, refer to Section 206-05 .

Brake Flexible Hose



Item	Part Number	Description
1	-	Brake tube fitting (part of 2C008)
2	-	Brake flexible hose bracket bolt (part of 2282)
3	2282	Brake flexible hose
4	2149	Copper washers
5	385116	Brake caliper flow bolt

Removal and Installation

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Remove the wheel and tire. For additional information, refer to Section 204-04 .

2. Remove the brake caliper flow bolt and discard the 2 copper washers.
   - To install, tighten to 35 Nm (26 lb-ft).

3. Disconnect the brake tube fitting from the brake flexible hose.
   - To install, tighten to 18 Nm (159 lb-in).

4. Remove the brake flexible hose bracket bolt and the brake hose.
   - To install, tighten to 20 Nm (177 lb-in).

5. To install, reverse the removal procedure.
    - Bleed the brake caliper. For additional information, refer to Section 206-00 , Component Bleeding.

Material

Item	Specification	Fill Capacity
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

General Specifications

Item	Specification
Parking brake shoe clearance	0.54 mm (0.021 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
LH parking brake cable bracket bolt	23	17	-
LH parking brake cable wire form bolt	23	17	-
Parking brake cable bracket-to-crossmember bolts	15	-	133
Parking brake control bolts	20	-	177
Parking brake release handle bolts	3	-	27
RH parking brake cable wire form bolt	15	-	133

Parking Brake

The parking brake and actuation system consists of the following components:

- Parking brake cables
- Parking brake control
- Parking brake shoes
- Red brake warning indicator

The parking brake system is a foot-operated/cable-actuated system that applies a drum-in-hat assembly within each rear brake disc. A red brake warning indicator is located in the instrument cluster and will illuminate when the system is actuated to alert the driver that the parking brakes are applied.

Parking Brake

Principles of Operation

The parking brake system is an independent cable-actuated system controlled by a foot-operated parking brake control that is self adjusting. The parking brake control applies tension to the front parking brake cable and conduit. The front parking brake cable is coupled to the LH rear parking brake cable and conduit which is coupled to the RH rear parking brake cable. The parking brake cable and conduits actuate the parking brake levers, engaging the parking brake shoes with the parking brake drum-in-hat assembly. The system is returned to the released position by pulling the parking brake control release handle. Springs in the parking brake system apply the necessary force to return the system to the unapplied position. The parking brake warning indicator is located in the instrument cluster. It illuminates to signal the driver that the parking brake is applied or to signal a low brake fluid condition. The warning indicator system is diagnosed in Section 413-01 .

Inspection and Verification

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

Visual Inspection Chart

Mechanical
• Parking brake cable(s) • Parking brake cable equalizer • Parking brake control • Parking brake control release handle • Parking brake shoes and hardware

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Parking Brake Will Not Apply

Normal Operation

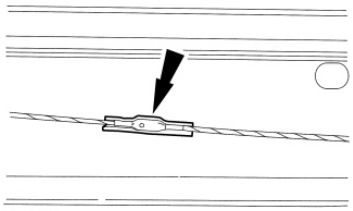
When the parking brake control is pressed, tension is applied to the intermediate parking brake cable. The intermediate cable is attached to both rear cables by an equalizer. The tension pulls equally on both rear parking brake cables, which are attached to the rear parking brake actuators and apply the parking brake shoes.

This pinpoint test is intended to diagnose the following:

- Parking brake cable(s)
- Parking brake control
- Rear brake hardware
- Rear brake shoes and linings

PINPOINT TEST A: THE PARKING BRAKE DOES NOT APPLY

Test Step	Result / Action to Take
A1 CHECK THE PARKING BRAKE CONTROL	
• Press the parking brake control pedal. • **Does the parking brake control pedal move?**	**Yes** GO to A2 . **No** GO to A5 .
A2 CHECK FOR BROKEN CABLES	
• **NOTE:** Have an assistant press and release the parking brake pedal to help isolate disconnected cables or cables that do not move. • Inspect the following items for damage and correct connections. ♦ Front cable and conduit ♦ Intermediate cable ♦ LH rear cable and conduit ♦ RH rear cable and conduit ♦ Rear cable brackets • **Are the cables in good condition?**	**Yes** GO to A3 . **No** CONNECT the cable(s) or INSTALL new parking brake component(s) as necessary. TEST the system for normal operation.
A3 CHECK THE PARKING BRAKE SHOES, ACTUATOR LEVERS AND HARDWARE	
• Remove the rear brake disc, refer to Section 206-04 . Inspect the parking brake shoes, actuator levers and hardware.	**Yes** GO to A4 . **No** INSTALL new components as necessary. REFER

• **Are the parking brake shoes, actuator levers and hardware in good condition?**	to Parking Brake Shoes in this section. TEST the system for normal operation.
A4 CHECK THE PARKING BRAKE SHOE ADJUSTMENT	
• Check the parking brake shoe adjustment. Refer to Parking Brake Shoe Adjustment in this section. • **Are the parking brake shoes adjusted to specification?**	**Yes** INSTALL a new parking brake control. REFER to Parking Brake Control in this section. TEST the system for normal operation. **No** ADJUST the rear parking brake shoes. REFER to Parking Brake Shoe Adjustment in this section.
A5 ISOLATE THE PARKING BRAKE CONTROL AND FRONT PARKING BRAKE CABLE	
• Disconnect the front cable from the intermediate cable at the cable union.  N0002007 • Press the parking brake control pedal. • **Does the parking brake control pedal move?**	**Yes** GO to A6 . **No** GO to A8 .
A6 ISOLATE THE INTERMEDIATE PARKING BRAKE CABLE	
• Disconnect the LH and RH rear cables from the intermediate cable equalizer. • While holding the intermediate cable conduit, attempt to slide the intermediate cable inside the conduit. • **Does the intermediate cable slide freely inside the conduit?**	**Yes** GO to A7 . **No** INSTALL new intermediate brake cable. REFER to Parking Brake Cable - Intermediate in this section. TEST the system for normal operation.
A7 ISOLATE THE REAR PARKING BRAKE CABLES	
• Disconnect the rear parking brake cables from the brake shoe actuators. • While holding the rear cable conduit, attempt to slide the rear cable inside the conduit. • **Does the rear cable slide freely inside the conduit?**	**Yes** The system is operating normally at this time. The concern may have been caused by a seized or binding component. CLEAN and LUBRICATE the parking brake backing plate. CONNECT all cables and INSTALL all components. TEST the system for normal operation. **No** INSTALL new rear brake cable(s). REFER to

	Parking Brake Cable - Rear, LH and/or Parking Brake Cable - Rear, RH in this section. TEST the system for normal operation.
A8 ISOLATE THE FRONT PARKING BRAKE CABLE	
• Disconnect the front parking brake cable and conduit from the parking brake control. • While holding the cable conduit, attempt to slide the cable inside the conduit. • **Does the cable slide freely inside the conduit?**	**Yes** INSTALL a new parking brake control. REFER to Parking Brake Control in this section. TEST the system for normal operation. **No** INSTALL a new front parking brake cable. REFER to Parking Brake Cable - Front in this section. TEST the system for normal operation.

Pinpoint Test B: The Parking Brake Will Not Release

Normal Operation

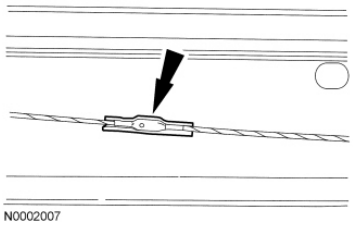
A ratcheting mechanism in the parking brake control keeps the parking brake applied until the release handle is pulled. When the release handle is pulled, the ratcheting mechanism in the parking brake control is released and the return springs in the parking brake shoes, and on the parking brake cables, return the system to the released position.

This pinpoint test is intended to diagnose the following:

- Parking brake cable(s)
- Parking brake control
- Parking brake control release handle
- Parking brake shoes and hardware

PINPOINT TEST B: THE PARKING BRAKE WILL NOT RELEASE

Test Step	Result / Action to Take
B1 CHECK THE PARKING BRAKE CONTROL RELEASE HANDLE	
• Verify that the release handle is connected to the parking brake control. • **Is the release handle connected?**	**Yes** GO to B2 . **No** CONNECT the handle. TEST the system for normal operation.
B2 ISOLATE THE PARKING BRAKE CONTROL	
• Disconnect the front cable from the intermediate cable at the cable union.	**Yes** GO to B4 . **No** GO to B3 .

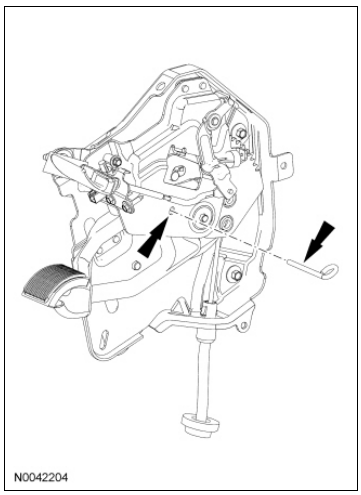
 N0002007 • **Does the parking brake release?**	
B3 CHECK THE FRONT PARKING BRAKE CABLE	
• Disconnect the front parking brake cable conduit from the parking brake control and from the frame bracket, then pull the front cable conduit through the opening in the vehicle floor. • While holding the front cable, attempt to slide the front conduit on the cable. • **Does the conduit slide freely on the cable?**	**Yes** INSTALL a new parking brake control. REFER to Parking Brake Control in this section. TEST the system for normal operation. **No** INSTALL a new front cable. REFER to Parking Brake Cable - Front in this section. TEST the system for normal operation.
B4 ISOLATE THE INTERMEDIATE PARKING BRAKE CABLE	
• Disconnect the LH and RH rear cables from the intermediate cable equalizer. • While holding the intermediate cable conduit, attempt to slide the intermediate cable inside the conduit. • **Does the intermediate cable slide freely inside the conduit?**	**Yes** GO to B5 . **No** INSTALL new intermediate brake cable. REFER to Parking Brake Cable - Intermediate in this section. TEST the system for normal operation.
B5 ISOLATE THE REAR PARKING BRAKE CABLES	
• Disconnect the rear parking brake cables from the brake shoe actuators. • While holding the rear cable conduit, attempt to slide the rear cable inside the conduit. • **Does the rear cable slide freely inside the conduit?**	**Yes** GO to B6 . **No** INSTALL new rear brake cable(s). REFER to Parking Brake Cable - Rear, LH and/or Parking Brake Cable - Rear, RH in this section. TEST the system for normal operation.
B6 CHECK THE REAR BRAKE SHOES AND HARDWARE	
• Remove the rear brake disc. Refer to Section 206-04 . • Inspect the parking brake shoes, hardware and backing plate. • **Are the shoes, hardware and backing plate in good condition?**	**Yes** The system is operating normally at this time. The concern may have been caused by a seized or binding component. CLEAN and LUBRICATE the brake backing plate using the specified cleaner and grease. CONNECT all cables and INSTALL all components. TEST the system for normal operation. **No** INSTALL new components as necessary. REFER to Parking Brake Shoes in this section. TEST the

	system for normal operation.

Parking Brake Cable Tension Release

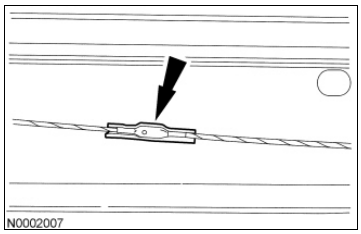
1. Remove the LH cowl side trim panel. For additional information, refer to Section 501-05 .

2. With the help of an assistant, release the parking brake cable tension by pulling down on the intermediate cable at the cable-to-cable connector clip until the parking brake control sector rotates to its stop and a 4 mm (0.15 in) x 150 mm (5.9 in) retainer pin can be inserted.



3. **NOTE:** Make sure the cable-to-cable connector clip is connected to the front and rear cable before removing the brake control retaining pin, and the cable tension is reloaded slowly.

   Disconnect the cable-to-cable connector clip.



4. To reload the tension on the parking brake cable, follow the release procedure in reverse.

Parking Brake Shoe Adjustment

Special Tool(s)

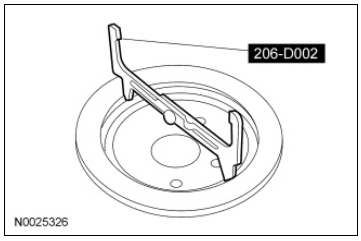
 ST1468-A	Brake Adjusting Gauge 206-D002 (D81L-1103-A) or equivalent

1. **NOTE:** Make sure the parking brake is fully released.

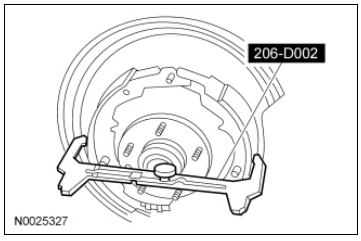
   Using the release handle, release the parking brake control.

2. Remove the rear brake disc. For additional information, refer to Section 206-04 .

3. Using the Brake Adjusting Gauge, measure the inside diameter of the drum portion of the rear brake disc and set the locking screw.
   - Record the measurement.



4. Place the Brake Adjusting Gauge over the widest diameter of the parking brake shoes.

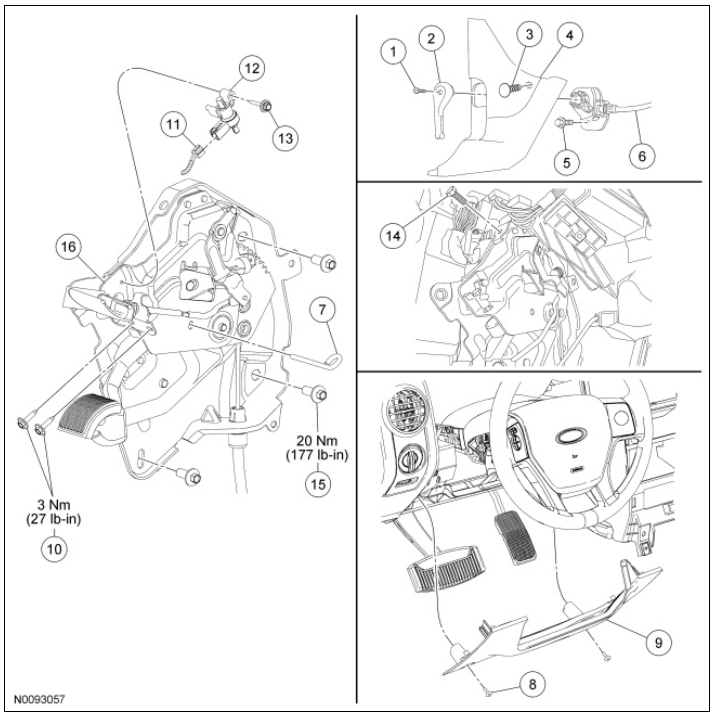


5. Adjust the parking brake shoe clearance to 0.54 mm (0.021 in) less than the inside diameter of the drum portion of the rear brake disc.
   - Rotate the parking brake shoe adjuster to achieve the correct parking brake shoe-to-brake disc clearance.

6. Install the rear brake disc. For additional information, refer to Section 206-04 .

7. Test the parking brake for normal operation.

Parking Brake Control



Item	Part Number	Description
1	-	Hood latch release handle screw (part of assembly 16916A)
2	16916A	Hood latch release handle
3	-	Pin-type retainer (part of 78023344)
4	7802344	A-pillar lower trim panel
5	N805375	Hood latch release cable assembly screw
6	16916	Hood latch release cable assembly
7	-	Locking pin
8	W707628	Instrument panel steering column cover screw (2 required)
9	7804459	Instrument panel steering column cover
10	W707628	Parking brake release handle bolts (2 required)
11	-	Parking brake switch electrical connector (part of 14A488)
12	15A851	Parking brake switch
13	-	Parking brake switch bolt (part of 15A851)
14	W707491	Wiring harness bracket bolt
15	W505264	Parking brake control bolt (3 required)
16	2780	Parking brake control

Removal and Installation

1. Remove the screw and the hood latch release handle.

2. Remove the pin-type retainer and the LH A-pillar lower trim panel.

3. Remove the hood latch release cable assembly screw and position the release cable assembly aside.

4. Release the tension on the parking brake cable. For additional information, refer to Parking Brake Cable Tension Release in this section.

5. Remove the 2 screws and the instrument panel steering column cover.

6. Remove the 2 parking brake release handle bolts from the bracket.
   - To install, tighten to 3 Nm (27 lb-in).

7. Disconnect the parking brake switch electrical connector.

8. Remove the wiring harness bracket screw and position the harness and bracket aside.

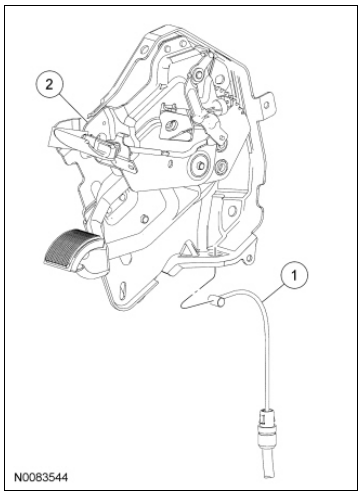
9. Remove the 3 bolts from the parking brake control.
   - To install, tighten to 20 Nm (177 lb-in).

10. Position the carpet aside and position the cable conduit grommet up through the floor.

11. Remove the parking brake control and cable assembly.

12. To install, reverse the removal procedure.
    - Test the parking brake system for correct operation.

Parking Brake Cable - Front



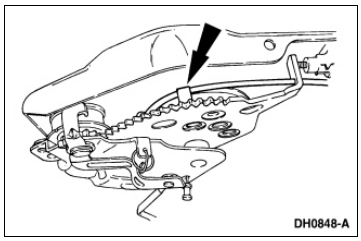
Item	Part Number	Description
1	2853	Front parking brake cable
2	2780	Parking brake control

Removal and Installation

1. Remove the parking brake control. For additional information, refer to Parking Brake Control in this section.

2. **NOTE:** The parking brake control take-up spool tab may need to be bent aside to allow the cable to be removed.

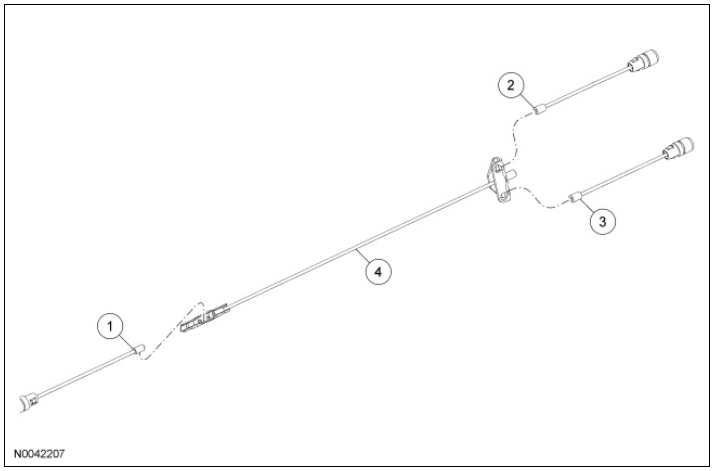
   Disconnect the front parking brake cable and conduit from the parking brake control.



3. To install, reverse the removal procedure.
   - Test the parking brake system for correct operation.

Parking Brake Cable - Intermediate

NOTE: The equalizer is integral to the intermediate cable.

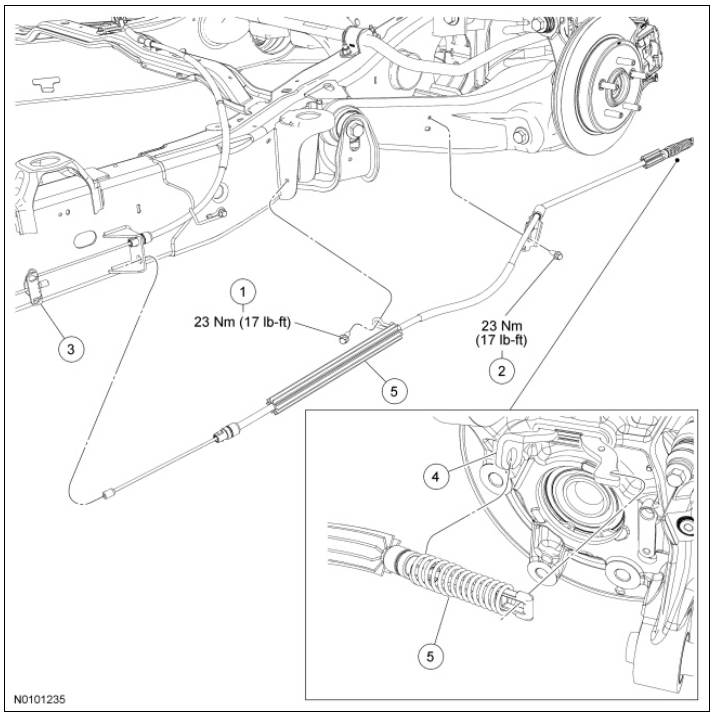


Item	Part Number	Description
1	2853	Front parking brake cable
2	2A635	RH rear parking brake cable
3	2A635	LH rear parking brake cable
4	2A793	Intermediate parking brake cable

Removal and Installation

1. Release the tension on the parking brake cable. For additional information, refer to Parking Brake Cable Tension Release in this section.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Disconnect the intermediate parking brake cable from the front cable at the cable connector clip.
4. Disconnect the LH and RH rear parking brake cables from the intermediate parking brake cable at the equalizer.
5. Remove the intermediate parking brake cable.
6. To install, reverse the removal procedure.

Parking Brake Cable - Rear, LH



Item	Part Number	Description
1	W704911	Wire form bracket bolt
2	W704911	Bracket bolt
3	-	Equalizer (part of 2A793)
4	2A638 LH/ 2A637 RH	Parking brake lever
5	2A635	LH rear parking brake cable

Removal and Installation

1. Release the parking brake cable tension. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the wire form bolt.
   - To install, tighten to 23 Nm (17 lb-ft).

4. Remove the bracket bolt.
   - To install, tighten to 23 Nm (17 lb-ft).

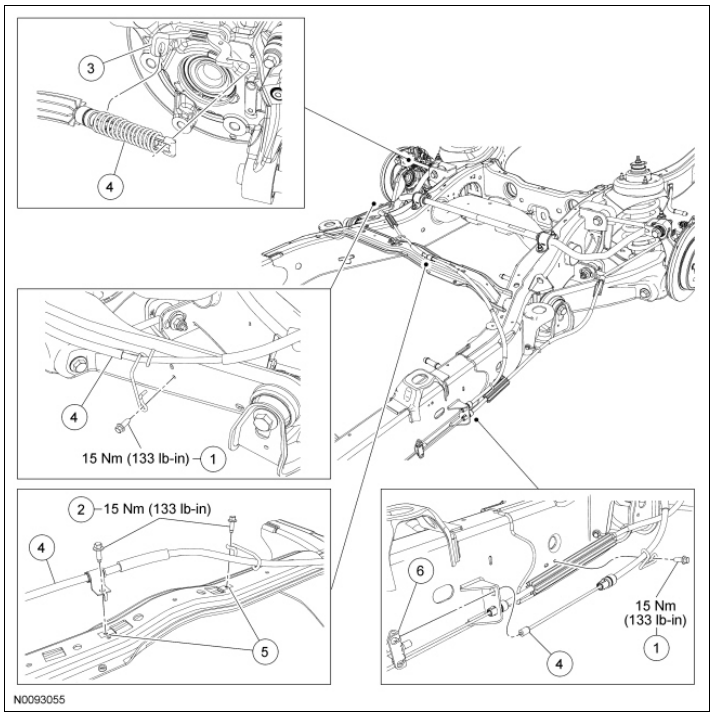
5. Disconnect the intermediate cable from the LH rear cable at the cable equalizer.

6. Disconnect the front of the LH rear cable conduit at the frame bracket.

7. Disconnect the LH parking brake cable from the parking brake lever and remove the cable.

8. To install, reverse the removal procedure.
    - Test the parking brake system for correct operation.

Parking Brake Cable - Rear, RH



Item	Part Number	Description
1	W704911	Wire form bracket bolts (2 required)
2	W500213	Parking brake cable bracket-to-crossmember bolts (2 required)
3	W520802	Parking brake cable bracket-to-crossmember clip (2 required)
4	-	Equalizer (part of 2A793)
5	2A637 RH/ 2A638 LH	Parking brake lever
6	2A635	RH rear parking brake cable

Removal and Installation

1. Release the parking brake cable tension. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. With the vehicle in NEUTRAL position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the 2 wire form bolts.
   - To install, tighten to 15 Nm (133 lb-in).

4. Remove the 2 parking brake cable bracket-to-crossmember bolts.
   - To install, tighten to 15 Nm (133 lb-in).

5. Disconnect the intermediate parking brake cable from the RH rear parking brake cable at the parking

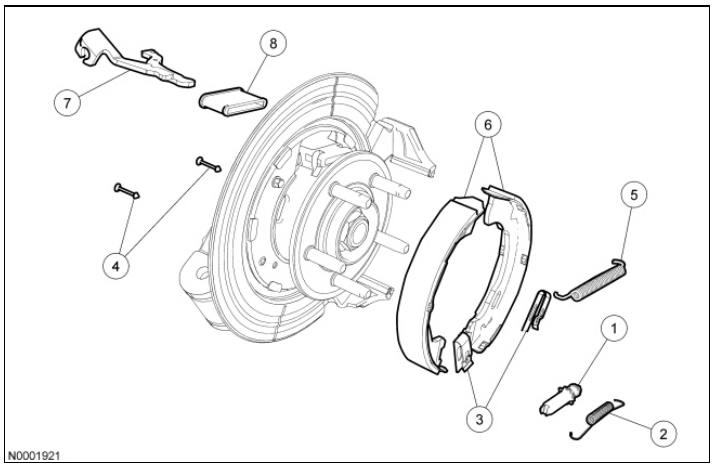
brake cable equalizer.

6. Disconnect the front of the RH parking brake cable conduit at the frame bracket.

7. Disconnect the RH parking brake cable from the parking brake lever and remove the parking brake cable.

8. To install, reverse the removal procedure.
    - Test the parking brake system for correct operation.

Parking Brake Shoes



Item	Part Number	Description
1	2041	Brake shoe adjusting screw
2	-	Brake shoe adjusting screw spring (part of 2648)
3	-	Brake shoe hold-down springs (part of 2648)
4	-	Brake shoe hold-down pins (part of 2648)
5	-	Brake shoe retracting spring (part of 2648)
6	2648	Parking brake shoes
7	2A637 RH/ 2A638 LH	Parking brake lever
8	2404	Parking brake lever boot

Removal

NOTE: A parking brake shoe kit contains the linings required for both the LH and RH side.

1. **NOTE:** Make sure the parking brake control is fully released.

   Release the tension on the parking brake cable. For additional information, refer to Parking Brake Cable Tension Release in this section.

2. Remove the rear brake disc. For additional information, refer to Section 206-04 .

3. Remove the parking brake shoe adjusting screw.

4. Remove the parking brake shoe adjusting screw spring.

5. Remove the 2 parking brake shoe hold-down springs and pins.

6. Remove the parking brake shoe retracting spring and the parking brake shoes.

Installation

1. Position the parking brake shoes and attach the retracting spring.
2. Install the 2 parking brake shoe hold-down pins and springs.
3. Install the parking brake shoe adjusting screw spring.
4. **NOTE:** Completely retract the parking brake adjusting screw before installation.

   Install the brake shoe adjusting screw.
5. Adjust the parking brake shoe. For additional information, refer to Parking Brake Shoe Adjustment in this section.
6. Reload the tension on the parking brake cable. For additional information, refer to Parking Brake Cable Tension Release in this section.

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	1,020 ml (2.15 pt)

Torque Specifications

Description	Nm	lb-ft	lb-in
Accelerator pedal bracket nuts	7	-	62
Adjustable pedal motor screws	3	-	27
Brake booster nuts	22	16	-
Brake master cylinder nuts	25	18	-
Brake pedal bracket bolts	22	16	-
Brake tube fittings	18	-	159
Steering column shaft bolt	30	22	-

Hydraulic Brake Actuation

The hydraulic brake actuation system consists of the following components:

- Brake master cylinder and fluid reservoir
- Brake tubes and hoses
- Brake pedal and bracket
- Hydraulic Control Unit (HCU)

The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. When the brake pedal is pressed, brake fluid is forced through the brake tubes and flexible hoses to the HCU . The brake fluid is then distributed to the front and rear brake calipers. The fluid enters the caliper, forcing the caliper pistons and brake pads outward against the brake disc friction surface. When the brake pedal is released, brake fluid pressure is relieved, returning the front and rear brake caliper pistons and brake pads to the unapplied position.

For information on the HCU , refer to Section 206-09 .

Adjustable Pedals

Adjustable brake and accelerator pedals are available as an optional feature on this vehicle. The brake pedal position can be changed in phase with the accelerator pedal to increase driver comfort. Two different adjustable pedal systems are available; one that is connected to the memory feature option and one that is not connected to the memory feature option.

Without Memory Feature

Adjustable brake pedals without memory feature consist of the following components:

- Adjustable brake pedal and bracket
- Adjustable accelerator pedal and bracket, refer to Section 310-02
- Adjustable pedal switch
- Adjustable pedal motor
- Adjustable pedal cables

The pedals are adjusted through the use of a rocker switch mounted on the instrument panel. When the switch is pressed, voltage is sent to the motor which spins a cable that is attached to the adjustable brake pedal, as the cable spins the pedals move either forward (away from the driver) or rearward (toward the driver) depending on how the switch is pressed.

With Memory Feature

Adjustable brake pedals with memory feature consist of the same components as a system without memory feature with the following additional components:

- Driver Seat Module (DSM), refer to Section 501-10 .
- Memory SET switch, refer to Section 501-10 .

- Remote Keyless Entry (RKE) transmitter, refer to Section 501-14 .

The pedals on a system with memory feature can be adjusted through the use of a rocker switch (mounted on the instrument panel), the memory SET switch (instrument panel center finish panel) or the RKE transmitter. When a switch is pressed or the transmitter is activated, a signal is sent to the DSM . The DSM then sends voltage to the adjustable pedal motor which operates in the same manner as the system without memory feature.

Principles of Operation

Hydraulic Brakes

To diagnose hydraulic brake concerns, refer to Section 206-00 .

Adjustable Pedals Without Memory Feature

The adjustable pedals without memory feature are controlled directly by the adjustable pedal switch. The adjustable pedal motor is attached to the LH side of the brake pedal bracket and controls the accelerator pedal and brake pedal directly through the use of 2 separate cables contained in sleeves. When the adjustable pedal switch is pressed, voltage is sent to the motor. The adjustable pedal motor will operate in both directions, forward and rearward, depending on which direction the switch is pressed. The end of the motor attached to the pedals will rotate the pinion of a worm gear set and cause the pedal to move. The pedals can be adjusted with the ignition switch in the OFF, ACC or RUN positions.

Adjustable Pedals With Memory Feature

The adjustable pedals with memory feature are controlled by the Driver Seat Module (DSM) and can be adjusted in 3 different ways:

- Using the adjustable pedal switch
- Using the memory SET switch
- Using the Remote Keyless Entry (RKE) transmitter

When the adjustable pedal switch is pressed, a voltage signal is sent to the DSM . When the DSM receives this signal, it will operate the adjustable pedal motor in the same manner as the system without memory.

When the memory SET switch or RKE transmitter is activated, a voltage signal is sent to the DSM . When the DSM receives this signal, it will send voltage to the adjustable pedal motor. The adjustable pedal motor will operate the same as when the adjustable pedal switch is used, as described above. The DSM monitors pedal position through the use of a Hall-effect switch that is built into the pedal motor. The pedal positions remain in memory as long as the DSM retains power. When a memory position is recalled through either the memory SET switch or the RKE transmitter, the DSM monitors the Hall-effect switch and stops sending voltage to the pedal motor once the stored memory position is reached. If the DSM receives a pedal position input during a memory position recall function, the module will stop the memory recall and respond to the new pedal position input. The pedals can be adjusted from the memory SET switch or the RKE transmitter with the ignition switch in the OFF, ACC or RUN position, but the transmission must be in the PARK or NEUTRAL position.

The DSM also controls the driver seat and the exterior mirrors. The DSM continually monitors the adjustable pedal motor and circuits, if an error is detected, the DSM is capable of setting DTCs.

For information on setting and recalling a memory pedal position, refer to Memory Position Programming in Section 501-10 .

Inspection And Verification

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

1. Verify the customer concern by operating the adjustable pedals.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Adjustable pedal cable • Adjustable pedal motor • Adjustable pedals • Foreign material	• Adjustable pedal switch • Driver Seat Module (DSM) • Memory position switch • Remote Keyless Entry (RKE) transmitter • Smart Junction Box (SJB) fuse 1 (20A) • Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:

- verify the ignition is ON.
- verify the scan tool operation with a known good vehicle.
- refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the Driver Seat Module (DSM).

9. If the DTCs retrieved are related to the concern, go to Driver Seat Module (DSM) DTC Chart. For all other DTCs, refer to the Master DTC Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Adjustable Pedals Without Memory Feature or GO to Symptom Chart - Adjustable Pedals With Memory Feature .

Diagnostic Trouble Code (DTC) Charts

Driver Seat Module (DSM) DTC Chart

DTC	Description	Action
B1987	Pedal Forward/Rearward Motor Stalled	GO to Pinpoint Test D .
B1988	Pedal Position Forward Switch Circuit Short to Battery	GO to Pinpoint Test B .
B1989	Pedal Position Rearward Switch Circuit Short to Battery	GO to Pinpoint Test B .
B1991	Pedal Forward/Rearward Potentiometer Feedback Circuit Short to Battery	GO to Pinpoint Test D .
B2275	Pedal Forward/Rearward Potentiometer Feedback Circuit Short to Ground	GO to Pinpoint Test D .
-	All Other DSM DTCs	REFER to Section 419-10 .

Symptom Charts

Symptom Chart - Adjustable Pedals Without Memory Feature

Symptom Chart - Adjustable Pedals Without Memory Feature

Symptom Chart - Adjustable Pedals With Memory Feature

Symptom Chart - Adjustable Pedals With Memory Feature

Pinpoint Tests

Special Tool(s)

 ST2574-A	Flex Probe Kit 105-R025D or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST3094-A	Test Light SGT27000 or equivalent 250-350 mA incandescent bulb test lamp
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Pinpoint Test A: Adjustable Brake Pedal is Inoperative/Does Not Operate Correctly (Without Memory Feature)

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

The adjustable pedal switch receives fused battery voltage from Smart Junction Box (SJB) fuse 1 (20A) along circuit SBP01 (RD).

When the adjustable pedal switch is pressed in the forward position (away from the driver), the switch connects circuit SBP01 (RD) to circuit CPP09 (VT/OG) and the voltage is sent to the adjustable pedal motor along circuit CPP09 (VT/OG). The voltage returns to the switch along circuit CPP10 (BN/BU) and is grounded through the switch along circuit GD138 (BK/WH).

When the adjustable pedal switch is pressed in the rearward position (toward the driver), the switch connects circuit SBP01 (RD) to circuit CPP10 (BN/BU) and the voltage is sent to the adjustable pedal motor along circuit CPP10 (BN/BU). The voltage returns to the switch along circuit CPP09 (VT/OG) and is grounded through the switch along circuit GD138 (BK/WH).

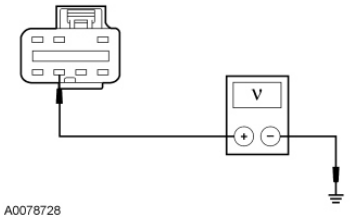
This pinpoint test is intended to diagnose the following:

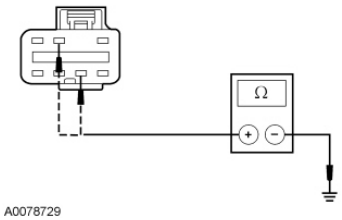
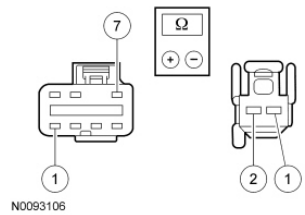
- Fuse
- Wiring, terminals or connectors
- Foreign material
- Adjustable pedal cable
- Adjustable pedal switch
- Adjustable pedal motor
- Adjustable brake pedal assembly

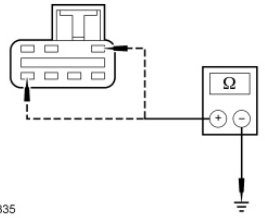
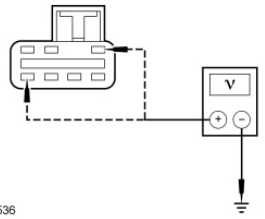
- Adjustable accelerator pedal assembly

PINPOINT TEST A: ADJUSTABLE BRAKE PEDAL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY (WITHOUT MEMORY FEATURE)

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
A1 CHECK THE ADJUSTABLE PEDAL MOTOR AND CABLE INSTALLATION	
• Check the adjustable pedal motor and both cables for correct installation. • **Are the motor and cables correctly installed?**	**Yes** GO to A2 . **No** CORRECT the adjustable pedal motor and or cable installation. TEST the system for normal operation.
A2 INSPECT FOR FOREIGN MATERIAL	
• Inspect the adjustable brake pedal and accelerator assemblies for foreign material causing a binding condition. • **Are the pedal assemblies free from foreign material?**	**Yes** GO to A3 . **No** REMOVE the foreign material. TEST the system for normal operation.
A3 TEST THE ADJUSTABLE PEDAL SWITCH	
• Ignition OFF. • Disconnect: Adjustable Pedal Switch C2089. • Carry out the adjustable pedal switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the adjustable pedal switch pass the component test?**	**Yes** GO to A4 . **No** INSTALL a new adjustable pedal switch. TEST the system for normal operation.
A4 CHECK FOR VOLTAGE TO THE ADJUSTABLE PEDAL SWITCH	
• Measure the voltage between adjustable pedal switch C2089-2, circuit SBP01 (RD), harness side and ground.  	**Yes** GO to A5 . **No** VERIFY SJB fuse 1 (20A) is OK. If OK, REPAIR circuit SBP01 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the cause for the circuit short. TEST the system for normal operation.

• **Is the voltage greater than 10 volts?**	
A5 CHECK THE ADJUSTABLE PEDAL SWITCH GROUND CIRCUIT FOR AN OPEN	
• Measure the resistance between ground and: ♦ adjustable pedal switch C2089-3, circuit GD138 (BK/WH), harness side. ♦ adjustable pedal switch C2089-6, circuit GD138 (BK/WH), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR circuit GD138 (BK/WH). TEST the system for normal operation.
A6 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR AN OPEN	
• Disconnect: Adjustable Pedal Motor C2003. • Measure the resistance between adjustable pedal switch C2089, harness side and adjustable pedal motor C2003, harness side as indicated in the following chart: **Adjustable Pedal Switch** / **Circuit** / **Adjustable Pedal Motor** C2089-7 / CPP10 (BN/BU) / C2003-2 C2089-1 / CPP09 (VT/OG) / C2003-2  • **Are the resistances less than 5 ohms?**	**Yes** GO to A7 . **No** REPAIR the affected circuit(s). TEST the system for normal operation.
A7 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR A SHORT TO GROUND	

• Measure the resistance between ground and: ♦ adjustable pedal switch C2089-7, circuit CPP10 (BN/BU), harness side. ♦ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side.  N0056335 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to A8 . **No** REPAIR the affected circuit(s). TEST the system for normal operation.
A8 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ adjustable pedal switch C2089-7, circuit CPP10 (BN/BU), harness side. ♦ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side.  N0070536 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). TEST the system for normal operation. **No** GO to A9 .
A9 CHECK THE ADJUSTABLE BRAKE PEDAL CABLE OPERATION	
• Ignition OFF. • Connect: Adjustable Pedal Motor C2003. • Connect: Adjustable Pedal Switch C2089. • Ignition OFF. • Disconnect the adjustable brake pedal cable from the adjustable brake pedal. • Operate the adjustable pedal control switch and observe the cable in the conduit. • **Does the adjustable brake pedal cable turn in the conduit?**	**Yes** INSTALL a new brake pedal assembly. REFER to Brake Pedal and Bracket in this section. TEST the system for normal operation. **No** GO to A10 .
A10 ISOLATE THE ADJUSTABLE ACCELERATOR PEDAL ASSEMBLY	
• Disconnect the adjustable brake pedal cable from the adjustable pedal motor. • Operate the adjustable pedal control switch and observe the accelerator pedal.	**Yes** INSTALL a new brake pedal motor. REFER to Brake Pedal Motor in this section. TEST the system for normal operation.

• **Does the adjustable accelerator pedal move according to switch position?**	**No** REPAIR the adjustable accelerator pedal system. REFER to Section 310-02 . TEST the system for normal operation.

Pinpoint Test B: Adjustable Brake Pedal is Inoperative/Does Not Operate Correctly - Using the Adjustable Pedal Switch (With Memory Feature)

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

The adjustable pedal switch receives fused battery voltage from Smart Junction Box (SJB) fuse 1 (20A) along circuit SBP01 (RD).

When the adjustable pedal switch is pressed in the forward position (away from the driver), the switch connects circuit SBP01 (RD) to circuit CPP09 (VT/OG) and the voltage is sent to the Driver Seat Module (DSM) along circuit CPP09 (VT/OG). When the DSM receives this voltage input, it sends voltage to the adjustable pedal motor along circuit CPP01 (WH/OG) and the voltage returns to the DSM along circuit CPP02 (BN).

When the adjustable pedal switch is pressed in the rearward position (toward the driver), the switch connects circuit SBP01 (RD) to circuit CPP10 (BN/BU) and the voltage is sent to the DSM along circuit CPP10 (BN/BU). When the DSM receives this voltage input, it sends voltage to the adjustable pedal motor along circuit CPP02 (BN) and the voltage returns to the DSM along CPP01 (WH/OG).

- DTC B1988 (Pedal Position Forward Switch Circuit Short to Battery) - If during normal operation the DSM detects voltage on circuit CPP09 (VT/OG) for more than 2 minutes or if the DSM detects voltage on circuit CPP09 (VT/OG) at all during an on-demand self test, DTC B1988 will be set.
- DTC B1989 (Pedal Position Rearward Switch Circuit Short to Battery) - If during normal operation the DSM detects voltage on circuit CPP10 (BU/BN) for more than 2 minutes or if the DSM detects voltage on circuit CPP10 (BU/BN) at all during an on-demand self test, DTC B1989 will be set.

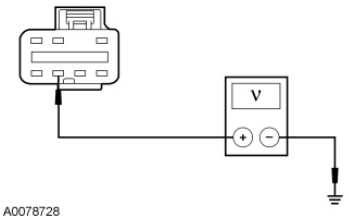
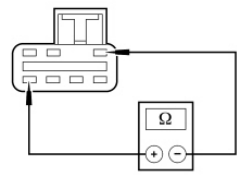
This pinpoint test is intended to diagnose the following:

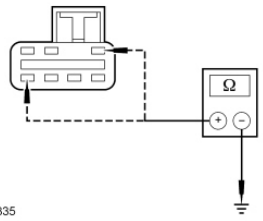
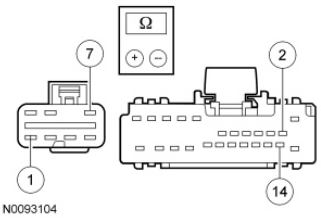
- Foreign material
- Fuse
- Wiring, terminals or connectors
- Adjustable pedal switch
- Adjustable pedal motor
- Adjustable pedal cable
- Brake pedal assembly
- DSM

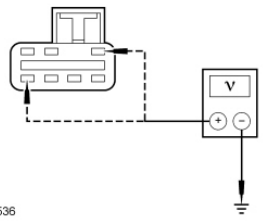
PINPOINT TEST B: ADJUSTABLE BRAKE PEDAL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - USING THE ADJUSTABLE PEDAL SWITCH (WITH MEMORY FEATURE)

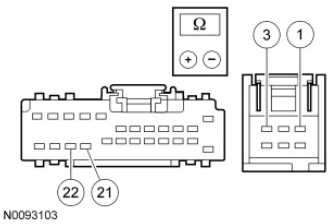
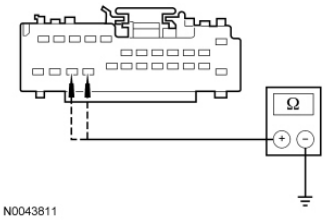
NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

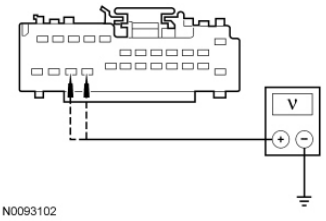
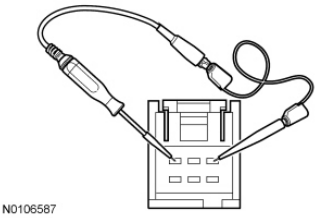
Test Step	Result / Action to Take

B1 CHECK THE DSM DTCs	
• Review the DTCs retrieved during Inspection and Verification. • **Are DTCs B1988 and/or B1989 present?**	**Yes** GO to B7 . **No** GO to B2 .
B2 CHECK THE DSM ADJUSTABLE PEDAL SWITCH (PEDPOSSW) PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM . • Monitor the PEDPOSSW PID while activating the adjustable pedal switch. • **Does the PID display match the switch position within one second of pressing the switch?**	**Yes** GO to B9 . **No** GO to B3 .
B3 CHECK FOR VOLTAGE AT THE ADJUSTABLE PEDAL SWITCH	
• Ignition OFF. • Disconnect: Adjustable Pedal Switch C2089 . • Measure the voltage between adjustable pedal switch C2089-2, circuit SBP01 (RD), harness side and ground.  A0078728 • **Is the voltage greater than 10 volts?**	**Yes** GO to B4 . **No** VERIFY SJB fuse 20 (15A) is OK. If OK, REPAIR circuit SBP01 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible cause for the circuit short. TEST the system for normal operation.
B4 CHECK THE ADJUSTABLE PEDAL SWITCH CIRCUITS FOR A SHORT TOGETHER	
• Disconnect: DSM C341C. • Measure the resistance between adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side and C2089-7, circuit CPP10 (BN/BU), harness side.  N0093105 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B5 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

B5 CHECK THE ADJUSTABLE PEDAL SWITCH CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ♦ adjustable pedal switch C2089-7, circuit CPP10 (BN/BU), harness side. ♦ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side.  N0056335 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to B6 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
B6 CHECK THE ADJUSTABLE PEDAL SWITCH CIRCUITS FOR AN OPEN	
• Measure the resistance between adjustable pedal switch C2089, harness side and DSM C341C, harness side as indicated in the following chart: **Adjustable Pedal Switch** / **Circuit** / **DSM** C2089-7 / CPP10 (BN/BU) / C341C-2 C2089-1 / CPP09 (VT/OG) / C341C-14  N0093104 • **Are the resistances less than 5 ohms?**	**Yes** GO to B7 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
B7 CHECK THE ADJUSTABLE PEDAL SWITCH CIRCUITS FOR A SHORT TO VOLTAGE	
• Disconnect: DSM C341C (if not previously disconnected). • Disconnect: Adjustable Pedal Switch C2235 (if not previously disconnected). • Ignition ON. • Measure the voltage between ground and: ♦ adjustable pedal switch C2089-7, circuit CPP10 (BN/BU), harness side.	**Yes** REPAIR the affected circuit(s) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** GO to B8 .

♦ adjustable pedal switch C2089-1, circuit CPP09 (VT/OG), harness side.  • **Is any voltage present?**	
B8 ISOLATE THE ADJUSTABLE PEDAL SWITCH	
• Ignition OFF. • Carry out the adjustable pedal switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Does the adjustable pedal switch pass the component test?**	**Yes** If DTCs B1988 and/or B1989 are not present, GO to B9 . If DTCs B1988 and/or B1989 are present, GO to B18 . **No** INSTALL a new adjustable pedal switch. CLEAR the DTCs. REPEAT the self-test.
B9 CHECK THE DSM ADJUSTABLE PEDAL ACTIVE COMMANDS	
• Connect: DSM C341C. • Select PARK. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - DSM . • **NOTE:** Toggling the active command ON will cause the pedal to move in the commanded direction for 2 seconds and then the pedal will stop. • Toggle the pedal forward (PEDAL_FWD) active command ON. • Toggle the PEDAL_FWD active command OFF. • Toggle the pedal rearward (PEDAL_RWD) active command ON. • Toggle the PEDAL_FWD active command OFF. • **Do the adjustable pedals respond correctly to the corresponding active commands?**	**Yes** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. **No** GO to B10 .
B10 CHECK THE ADJUSTABLE PEDAL MOTOR AND CABLE INSTALLATION	
• Check the adjustable pedal motor and both cables for correct installation. • **Are the motor and cables correctly installed?**	**Yes** GO to B11 . **No** CORRECT the adjustable pedal motor and/or cable installation. TEST the system for normal operation.

B11 INSPECT FOR FOREIGN MATERIAL	
• Inspect the adjustable brake pedal and accelerator assemblies for foreign material causing a binding condition. • **Are the pedal assemblies free from foreign material?**	**Yes** GO to B12 . **No** REMOVE the foreign material. TEST the system for normal operation.
B12 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: Adjustable Pedal Motor C2159. • Disconnect: DSM C341C. • Measure the resistance between DSM C341C, harness side and adjustable pedal motor C2159, harness side as indicated in the following chart: **DSM** / **Circuit** / **Adjustable Pedal Motor** C341C-21 / CPP02 (BN) / C2159-3 C341C-22 / CPP01 (WH/OG) / C2159-1  N0093103 • **Are the resistances less than 5 ohms?**	**Yes** GO to B13 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
B13 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ♦ DSM C341C-21, circuit CPP02 (BN), harness side. ♦ DSM C341C-22, circuit CPP01 (WH/OG), harness side.  N0043811 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to B14 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

B14 CHECK THE ADJUSTABLE PEDAL MOTOR CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ DSM C341C-12, circuit CPP01 (WH/OG), harness side. ♦ DSM C341C-24, circuit CPP02 (BN), harness side.  N0093102 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to B15 .
B15 CHECK FOR DSM OUTPUT	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** • Connect: DSM C341C. • Connect: Adjustable Pedal Switch C2235. • Connect the positive lead of a test light to C2159-3, circuit CPP02 (BN), harness side. • Connect the negative lead of a test light to C2159-1, circuit CPP01 (WH/OG), harness side.  N0106587 • Press the adjustable pedal switch in the forward position and verify that the test light is illuminated. • Press the adjustable pedal switch in the rearward position and verify that the test light is illuminated. • **Does the test light illuminate when the adjustable pedal switch is pressed in each direction?**	**Yes** GO to B16 . **No** GO to B18 .
B16 INSPECT THE ADJUSTABLE BRAKE PEDAL CABLE	
• Inspect the ends of the brake pedal motor cable for wear or damage.	**Yes** GO to B17 .

• **Are the cable ends OK?**	**No** INSTALL a new brake pedal motor. REFER to Brake Pedal Motor in this section. TEST the system for normal operation.
B17 CHECK THE ADJUSTABLE BRAKE PEDAL CABLE OPERATION	
• Connect: Adjustable Pedal Switch C2235. • Connect: Adjustable Pedal Motor C2159. • Connect: DSM C341C. • Disconnect the adjustable brake pedal cable from the adjustable brake pedal. • Operate the adjustable pedal control switch and observe the cable in the conduit. • **Does the adjustable brake pedal cable turn in the conduit?**	**Yes** INSTALL a new brake pedal assembly. REFER to Brake Pedal and Bracket in this section. TEST the system for normal operation. **No** INSTALL a new brake pedal motor. REFER to Brake Pedal Motor in this section. TEST the system for normal operation.
B18 CHECK THE DSM FOR CORRECT OPERATION	
• Disconnect: DSM C341C (if not previously disconnected). • Check DSM C341C for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: DSM C341C. • Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DSM . REFER to Section 419-10 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Adjustable Brake Pedal is Inoperative/Does Not Operate Correctly - Using the Memory SET Switch Buttons or the Remote Keyless Entry (RKE) Transmitter

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

When the desired memory position is selected using the memory SET switch buttons or the remote transmitter, the Driver Seat Module (DSM) will send voltage to the adjustable pedal motor along circuit CPP01 (WH/OG) to move the pedals forward and along circuit CPP02 (BN) to move the pedals rearward. When voltage is sent to the motor along circuit CPP01 (WH/OG) it returns to the DSM along CPP02 (BN). Likewise, when the voltage is sent to the motor along circuit CPP02 (BN) it returns to the DSM along CPP01 (WH/OG).

The DSM uses a Hall-effect switch attached to the pedal motor to identify the current pedal position. The DSM sends a reference voltage along circuit LPP06 (YE/BU), through the Hall-effect switch and back to the DSM along the signal return circuit, RPP06 (GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Adjustable pedal motor

- DSM

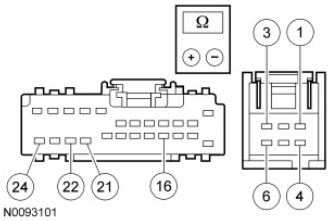
PINPOINT TEST C: ADJUSTABLE BRAKE PEDAL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - USING THE MEMORY SET SWITCH BUTTONS OR THE RKE TRANSMITTER

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
C1 CHECK THE ADJUSTABLE PEDAL OPERATION WITH THE ADJUSTABLE PEDAL SWITCH	
• Press the adjustable pedal switch in each direction for more than one second and observe the adjustable pedals. • **Do the adjustable pedals operate for more than one second in the direction selected using the switch?**	**Yes** GO to C2 . **No** If the pedals do not move at all using the switch, GO to Pinpoint Test B . If the pedals only move in one second intervals regardless of button operation, GO to Pinpoint Test D .
C2 CHECK THE MEMORY SYSTEM OPERATION	
• Set a memory position for the driver seat, exterior mirrors and adjustable pedals to memory SET switch button 1. Refer to Memory Position Programming in Section 501-10 . • Select PARK. • Press the memory SET switch button 1 and observe the following items: ♦ Driver seat ♦ Exterior mirrors ♦ Adjustable pedals • **Do all 3 items move when the button is pressed?**	**Yes** GO to C3 . **No** If all 3 items do not move, REFER to Diagnosis and Testing in Section 501-10 to DIAGNOSE the memory SET switch. If **only** the adjustable pedals do not move, GO to C4 . If **only** the driver seat does not move, REFER to Diagnosis and Testing in Section 501-10 . If **only** the exterior mirrors do not move, REFER to Diagnosis and Testing in Section 501-09 .
C3 CHECK THE RKE TRANSMITTER OPERATION	
• Set a memory position in the Remote Keyless Entry (RKE) transmitter for the driver seat, exterior mirrors and adjustable pedals. Refer to Remote Memory Activation in Section 501-14 . • Select PARK.	**Yes** GO to C4 . **No** If all 3 items do not move, REFER to Diagnosis and Testing in Section 501-14 to DIAGNOSE the

• Press the unlock button on the RKE transmitter and observe the following items: ♦ Driver seat ♦ Exterior mirrors ♦ Adjustable pedals • **Do all 3 items move when the button is pressed?**	RKE transmitter. If **only** the adjustable pedals do not move, GO to C4 . If **only** the driver seat does not move, REFER to Diagnosis and Testing in Section 501-10 . If **only** the exterior mirrors do not move, REFER to Diagnosis and Testing in Section 501-09 .
C4 CHECK THE ADJUSTABLE PEDAL MOTOR AND CABLE INSTALLATION	
• Check the adjustable pedal motor and both cables for correct installation. • **Are the motor and cables correctly installed?**	**Yes** GO to C5 . **No** CORRECT the adjustable pedal motor and/or cable installation. TEST the system for normal operation.
C5 INSPECT FOR FOREIGN MATERIAL	
• Inspect the adjustable brake pedal and accelerator assemblies for foreign material causing a binding condition. • **Are the pedal assemblies free from foreign material?**	**Yes** GO to C6 . **No** REMOVE the foreign material. TEST the system for normal operation.
C6 CHECK THE DSM PEDAL MOTOR AND HALL-EFFECT CIRCUITS FOR AN OPEN	
• Disconnect: Adjustable Pedal Motor C2159. • Disconnect: DSM C341C. • Measure the resistance between DSM C341C, harness side and adjustable pedal motor C2159, harness side as indicated in the following chart:	**Yes** GO to C7 . **No** REPAIR the affected circuit(s). TEST the system for normal operation.

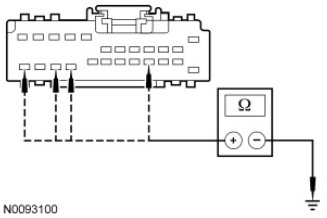
DSM	Circuit	Adjustable Pedal Motor
C341C-22	CPP01 (WH/OG)	C2159-1
C341C-21	CPP02 (BN)	C2159-3
C341C-24	RPP06 (GN)	C2159-6
C341C-16	LPP06 (YE/BU)	C2159-4



- **Are the resistances less than 5 ohms?**

C7 CHECK THE DSM PEDAL MOTOR AND HALL-EFFECT CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between ground and:
  - ♦ DSM C341C-16, circuit LPP06 (YE/BU), harness side.
  - ♦ DSM C341C-21, circuit CPP02 (BN), harness side.
  - ♦ DSM C341C-22, circuit CPP01 (WH/OG), harness side.
  - ♦ DSM C341C-24, circuit RPP06 (GN), harness side.



- **Are the resistances greater than 10,000 ohms?**

Yes
GO to C8 .

No
REPAIR the affected circuit(s). TEST the system for normal operation.

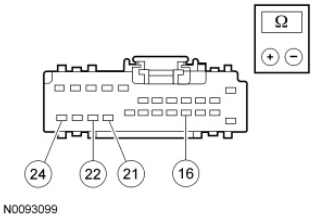
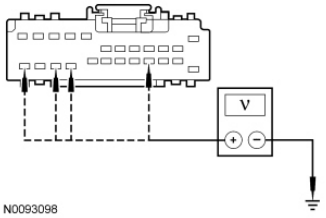
C8 CHECK THE DSM PEDAL MOTOR AND HALL-EFFECT CIRCUITS FOR A SHORT TOGETHER

- Measure the resistance between DSM C341C pins, harness side as indicated in the following chart:

DSM	Circuit	DSM	Circuit
C341C-16	LPP06 (YE/BU)	C341C-21	CPP02 (BN)
C341C-16	LPP06 (YE/BU)	C341C-22	CPP01 (WH/OG)
C341C-16	LPP06 (YE/BU)	C341C-24	RPP06 (GN)
C341C-21	CPP02 (BN)	C341C-22	CPP01 (WH/OG)
C341C-21	CPP02 (BN)	C341C-24	RPP06 (GN)
C341C-22	CPP01 (WH/OG)	C341C-24	RPP06 (GN)

Yes
GO to C9 .

No
REPAIR the affected circuit(s). TEST the system for normal operation.

 • **Are the resistance greater than 10,000 ohms?**	
C9 CHECK THE DSM PEDAL MOTOR AND HALL-EFFECT CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ DSM C341C-16, circuit LPP06 (YE/BU), harness side. ♦ DSM C341C-21, circuit CPP02 (BN), harness side. ♦ DSM C341C-22, circuit CPP01 (WH/OG), harness side. ♦ DSM C341C-24, circuit RPP06 (GN), harness side.  • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). TEST the system for normal operation. **No** INSTALL a new adjustable brake pedal assembly. REFER to Brake Pedal and Bracket in this section. TEST the system for normal operation.

Pinpoint Test D: DTC B1987, B1991 or B2275

Refer to Wiring Diagrams Cell 127 , Adjustable Pedals for schematic and connector information.

Normal Operation

The Driver Seat Module (DSM) uses a Hall-effect switch attached to the pedal motor to identify the current pedal position. The DSM sends a reference voltage along circuit LPP06 (YE/BU), through the Hall-effect switch and back to the DSM along the signal return circuit, RPP06 (GN).

When 1 or more of the following DTCs are set, the adjustable pedals will enter a "jog mode". When the pedals are in jog mode, the memory system recall will not function from either the Remote Keyless Entry (RKE) transmitter or the memory SET switch buttons. When the pedals are operated using the adjustable pedal switch, the motor will move the pedals for one second in the direction selected regardless of the length of time the button is actually pressed.

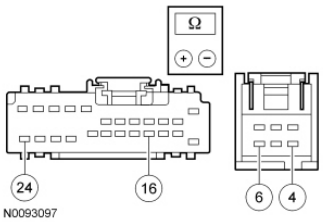
- DTC B1987 (Pedal Forward/Rearward Motor Stalled) - This DTC is only set during a DSM on-demand self test. During the self-test, the adjustable pedal motor will be commanded to move forward and then rearward. If the motor encounters a hard stop while moving, the DSM will attempt to move the pedals in the opposite direction. If the DSM does not see any pedal movement via the Hall-effect switch during this attempt, DTC B1987 will be set and the adjustable pedal system will be disabled.
- DTC B1991 (Pedal Forward/Rearward Potentiometer Feedback Circuit Short to Battery) - If the DSM detects a short to voltage on circuit LPP06 (YE/BU) during normal operation or an on-demand self

test and without any pedal switch input, DTC B1991 will be set.
- DTC B2275 (Pedal Forward/Rearward Potentiometer Feedback Circuit Short to Ground) - If the DSM detects a short to ground on circuit LPP06 (YE/BU) during normal operation or an on-demand self test and without any pedal switch input, DTC B2275 will be set.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Adjustable pedal motor

PINPOINT TEST D: DTC B1987, B1991 OR B2275

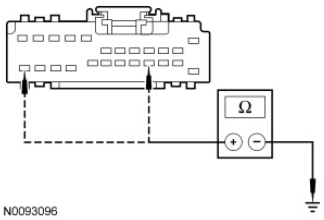
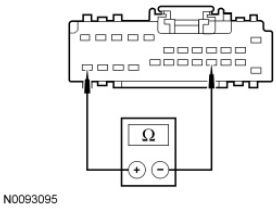
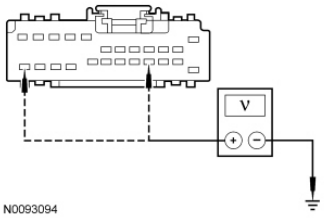
NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>D1 CHECK THE DSM HALL-EFFECT CIRCUITS FOR AN OPEN</td><td></td></tr>
<tr><td>
• Ignition OFF.
• Disconnect: Adjustable Pedal Motor C2159.
• Disconnect: DSM C341C.
• Measure the resistance between DSM C341C, harness side and adjustable pedal motor C2159, harness side as indicated in the following chart:
<table>
<tr><th>DSM</th><th>Circuit</th><th>Adjustable Pedal Motor</th></tr>
<tr><td>C341C-16</td><td>LPP06 (YE/BU)</td><td>C2159-4</td></tr>
<tr><td>C341C-24</td><td>RPP06 (GN)</td><td>C2159-6</td></tr>
</table>


• Are the resistances less than 5 ohms?
</td><td>Yes
GO to D2 .

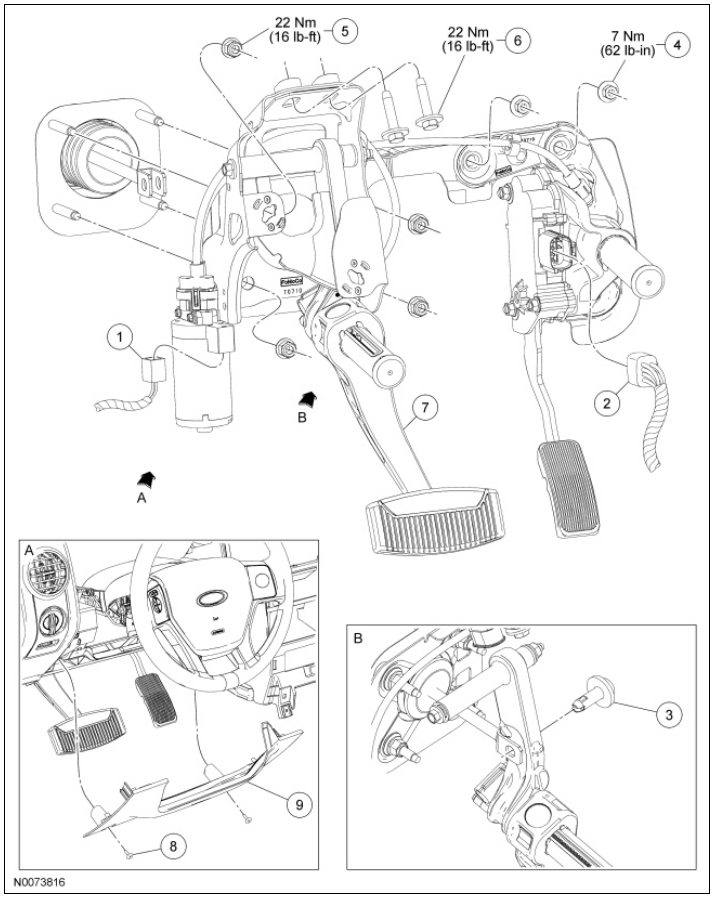
No
REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>D2 CHECK THE DSM HALL-EFFECT CIRCUITS FOR A SHORT TO GROUND</td><td></td></tr>
<tr><td>
• Measure the resistance between ground and:
♦ DSM C341C-16, circuit LPP06 (YE/BU), harness side.
♦ DSM C341C-24, circuit RPP06 (GN), harness side.
</td><td>Yes
GO to D3 .

No
REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.</td></tr>
</table>

 N0093096 • **Are the resistances greater than 10,000 ohms?**	
D3 CHECK THE DSM HALL-EFFECT CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between DSM C341C-24, circuit RPP06 (GN), harness side and DSM C341C-16, circuit LPP06 (YE/BU), harness side.  N0093095 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E4 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
D4 CHECK THE DSM HALL-EFFECT CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ DSM C341C-16, circuit LPP06 (YE/BU), harness side. ♦ DSM C341C-24, circuit RPP06 (GN), harness side.  N0093094 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new adjustable brake pedal assembly. REFER to Brake Pedal and Bracket in this section. CLEAR the DTCs. REPEAT the self-test.

Brake Pedal and Bracket

NOTE: Adjustable pedals shown, fixed pedals similar.



Item	Part Number	Description
1	-	Adjustable pedal motor electrical connector (part of 14398)
2	-	Accelerator pedal electrical connector (part of 14398)
3	2L523	Booster push rod clevis locking pin
4	90907	Accelerator pedal bracket nut (3 required)
5	W520212	Brake booster nut (4 required)
6	W710343	Brake pedal bracket bolt (2 required)
7	2455/2C434	Brake pedal bracket (fixed/adjustable)
8	W705314	Steering column opening cover screw (2 required)
9	78044F08	Steering column opening cover

Removal

1. ***NOTICE:*** **Do not service the brake pedal without first removing the stoplamp switch and speed control deactivator switch. These switches must be removed with the brake pedal in the at-rest position. Switch plungers must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result**

in damage to the switch.

Remove the stoplamp switch. For additional information, refer to Section 417-01 .

2. If equipped, remove the speed control deactivator switch. For additional information, refer to Section 310-03 .

3. **NOTE:** If equipped with adjustable pedals, when removing the adjustable pedal assembly, make sure the pedals are adjusted to the full rearward position.

   NOTE: The booster push rod clevis locking pin is a one-time use only part. Anytime the booster push rod clevis locking pin is removed, a new booster push rod clevis locking pin should be used.

   NOTE: Remove the clevis locking pin by squeezing the locking tabs and pulling outward on the opposite end.

   Remove the booster push rod clevis locking pin and discard.

4. Disconnect the brake booster rod from the brake pedal and position aside.

5. If equipped with power adjustable pedals, disconnect the adjustable pedal motor electrical connector.

6. If equipped with adjustable pedals, disconnect the accelerator pedal motor electrical connector.

7. Remove and discard the 2 brake pedal bracket bolts.

8. Remove and discard the 4 brake booster nuts.

9. Position the brake master cylinder and brake booster assembly forward to allow the brake pedal assembly to clear the studs.

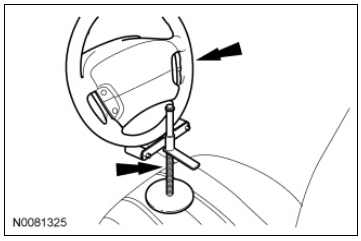
10. Remove the 3 accelerator pedal bracket nuts.

11. Remove the 2 steering column opening cover screws and the steering column opening cover panel.

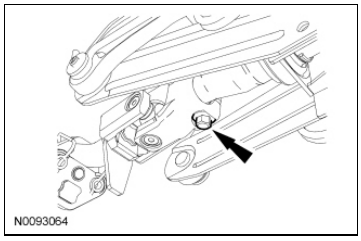
12. ***NOTICE:*** **Do not allow the steering wheel to rotate while the steering column intermediate shaft is disconnected or damage to the clockspring can result. If there is evidence the steering column shaft has rotated, the clockspring must be removed and centered. For additional information, refer to Section 501-20B .**

    NOTE: Use a steering wheel holding device (such as Hunter® 28-75-1 or equivalent).

    Using a suitable holding device, hold the steering wheel in the straight-ahead position.



13. Remove the steering column shaft bolt and disconnect the steering column shaft from the steering column.



14. Remove the brake pedal assembly from the vehicle.

Installation

1. Position the brake pedal assembly in the vehicle.

2. Position the brake master cylinder and brake booster assembly into the brake pedal bracket assembly.

3. Install the 4 new brake booster nuts.
   - Tighten to 22 Nm (16 lb-ft).

4. Install the 2 new brake pedal bracket bolts.
   - Tighten to 22 Nm (16 lb-ft).

5. Install the 3 accelerator pedal bracket nuts.
   - Tighten to 7 Nm (62 lb-in).

6. If equipped with power adjustable pedals, connect the adjustable pedal motor electrical connector.

7. If equipped with adjustable pedals, connect the accelerator pedal electrical connector.

8. Position the brake booster push rod to the brake pedal.

9. Install the new booster push rod clevis locking pin.

10. Connect the steering column to the steering column shaft and install the bolt.
    - Tighten to 30 Nm (22 lb-ft).

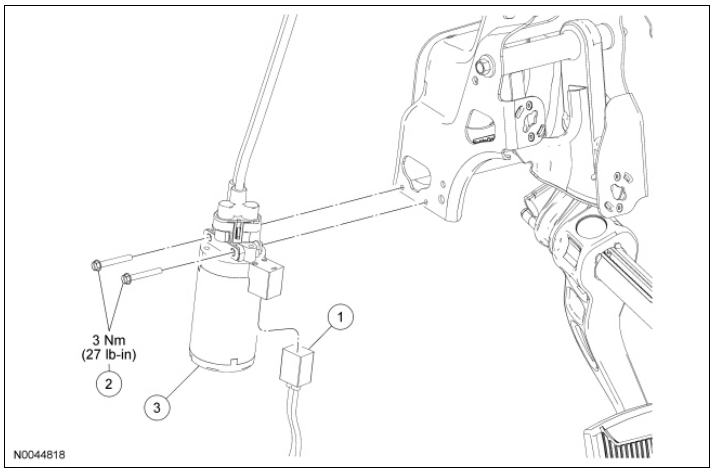
11. Position the steering column opening cover and install the 2 screws.

12. ***NOTICE:*** **Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch or the speed control deactivator switch. These switches must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing these switches with the brake pedal in any other position will result in incorrect adjustment and may damage the switches.**

    Install the stoplamp switch. For additional information, refer to Section 417-01 .

13. If equipped, install the speed control deactivator switch. For additional information, refer to Section 310-03 .

Brake Pedal Motor



Item	Part Number	Description
1	-	Adjustable pedal motor electrical connector (part of 2B325)
2	-	Adjustable pedal motor screws (part of 2C429) (2 required)
3	2C429	Adjustable pedal motor

Removal and Installation

1. Disconnect the accelerator and brake pedal drive cables from the adjustable pedal motor.

2. Disconnect the adjustable pedal motor electrical connector.

3. Remove the 2 adjustable pedal motor screws and then remove the adjustable pedal motor and drive cables as an assembly.
   - To install, tighten to 3 Nm (27 lb-in).

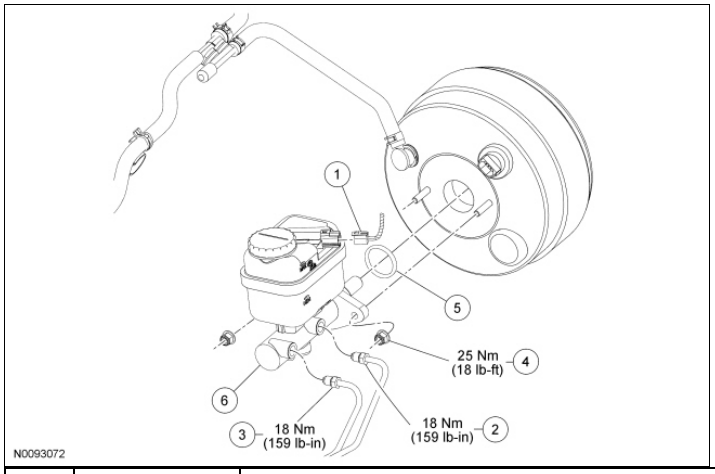
4. **NOTE:** Make sure the brake pedal and the accelerator pedal are in the same position before connecting the drive cable to the adjustable pedals.

   To install, reverse the removal procedure.

Brake Master Cylinder

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1



Item	Part Number	Description
1	-	Brake fluid level warning switch electrical connector (part of 14289)
2	-	Primary brake tube fitting (part of 2234)
3	-	Secondary brake tube fitting (part of 2234)
4	W520212	Brake master cylinder nut (2 required)
5	-	Brake master cylinder-to-booster square cut seal (part of 2004)
6	2004	Brake master cylinder/reservoir assembly

Removal and Installation

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. With the engine off, press the brake pedal several times to deplete the brake booster vacuum.

2. Disconnect the brake fluid level warning switch electrical connector.

3. Disconnect the 2 brake tube fittings from the brake master cylinder.
   - To install, tighten to 18 Nm (159 lb-in).

4. Remove the 2 nuts, the brake master cylinder and the square cut seal.
   - To install, tighten to 25 Nm (18 lb-ft).

5. **NOTE:** Make sure that the square cut seal is properly installed or incorrect brake pedal feel can occur.

   To install, reverse the removal procedure.

   - Bleed the master cylinder. For additional information, refer to Component Bleeding in Section 206-00 .

Torque Specifications

Description	Nm	lb-ft
Brake booster nuts	22	16

Brake Booster

The power brake actuation system consists of the following components:

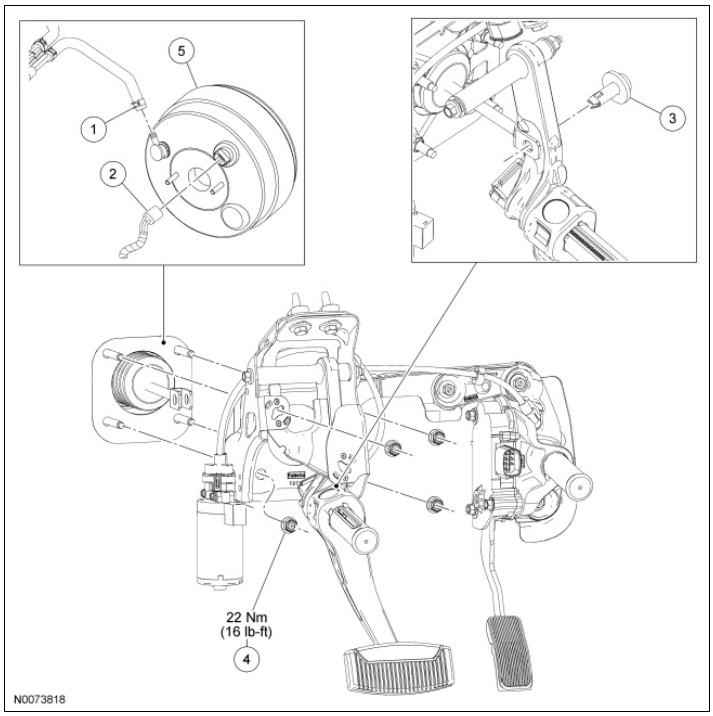
- Brake booster
- Brake booster check valve
- Brake booster vacuum supply hose

The brake booster uses engine vacuum from the intake manifold to create a partial vacuum inside the vacuum booster on both sides of the diaphragm. When the brake pedal is pressed, the booster rod opens a valve, allowing air to enter the booster on one side of the diaphragm while sealing off the opposite side. This increases pressure on that side of the diaphragm so that it helps push the rod, which in turn pushes the piston in the master cylinder. As the brake pedal is released, the valve seals off the outside air supply while opening the vacuum valve. This restores vacuum to both sides of the diaphragm, allowing everything to return to its original position.

Power Brake System

Refer to Section 206-00 .

Brake Booster



Item	Part Number	Description
1	9C482	Brake booster vacuum hose
2	-	Brake booster solenoid and microswitch electrical connector (part of 14289)
3	2L523	Brake booster push rod clevis locking pin
4	W520212	Brake booster nut (4 required)
5	2005	Brake booster assembly

Removal and Installation

1. ***NOTICE:*** **The brake booster check valve must be disconnected from the brake booster prior to removing the master cylinder or the master cylinder seal may be drawn into the brake booster.**

   Disconnect the brake booster check valve from the brake booster to deplete the residual vacuum in the brake booster.

2. Remove the brake master cylinder. For additional information, refer to Section 206-06 .

3. ***NOTICE:*** **Do not service the brake pedal or brake booster without first removing the stoplamp switch. This switch must be removed with the brake pedal in the at-rest position. The switch plunger must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.**

   Remove the stoplamp switch. For additional information, refer to Section 211-04 .

4. **NOTE:** When the repair is complete, make sure that the brake booster solenoid electrical connector is connected, or use of the vehicle with key-on or vehicle running will result in DTCs being set.

   Disconnect the brake booster solenoid electrical connector.

5. **NOTE:** The booster push rod clevis locking pin is a one-time use only part. Anytime the booster push rod clevis locking pin is removed, a new booster push rod clevis locking pin should be used.

   Remove the booster push rod clevis locking pin and discard.

6. Disconnect the brake booster rod from the brake pedal and position aside.

7. Remove and discard the 4 brake booster nuts and the booster.
   - To install, tighten the new nuts to 22 Nm (16 lb-ft).

8. ***NOTICE:*** **Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch. This switch must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing this switch with the brake pedal in any other position will result in incorrect adjustment and may damage the switch.**

   To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	1020 ml (2.15 pt)

Torque Specifications

Description	Nm	lb-ft	lb-in
ABS module screws	2	-	18
Brake tube-to-Hydraulic Control Unit (HCU) extension tube fittings	18	-	159
Floor console center finish panel screws	9	-	80
Front wheel speed sensor bolt	17	-	150
HCU bracket-to-frame nuts	23	17	-
HCU bracket-to- HCU bolt	9	-	80
HCU bracket-to- HCU extension tube retainer nuts	9	-	80
HCU extension tube-to- HCU fittings	18	-	159
LH instrument panel brace nuts and bolts	9	-	80
Master cylinder primary and secondary brake tube-to- HCU fittings	25	18	-
Rear wheel speed sensor bolt	8	-	71
Stability control sensor cluster bracket nuts	7	-	62
Wheel speed sensor harness bolt	8	-	71

Anti-Lock Control

ABS with Traction Control and Roll Stability Control (RSC®)

The ABS consists of the following components:

- ABS module
- Hydraulic Control Unit (HCU)
- Front wheel speed sensors
- Front wheel speed sensors rings
- Rear wheel speed sensors
- Rear wheel speed sensor rings
- Stability control sensor cluster
- Stability traction control switch
- Steering wheel rotation sensor

The ABS prevents wheel lock-up by monitoring the wheel speed sensors and actuating the valves in the HCU which modulates the brake pressure to the brake calipers. By preventing the wheels from locking up, the driver is able to maintain steering control and stop in the shortest possible distance under most conditions. The traction control system utilizes the same components as the ABS to prevent wheel spin and help maintain vehicle control during acceleration. The Roll Stability Control (RSC®) system utilizes the same components as the ABS and the traction control systems and also monitors the steering wheel rotation sensor and the stability control sensor cluster to assist in stabilizing the vehicle during abrupt maneuvers.

The front wheel speed sensor rings are integral to the front hub and bearing assemblies. Refer to Section 204-01A or Section 204-01B .

The rear wheel speed sensor rings are integral to the rear halfshafts. Refer to Section 205-05 .

Anti-Lock Control

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2574-A	Flex Probe Kit 105-R025D or equivalent
 ST3030-A	Rotunda Active Wheel Speed Sensor Tester 105-R0110
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

Anti-Lock Control

The standard ABS module manages anti-lock braking to maintain vehicle control during deceleration.

When the ignition switch is in the RUN position, the ABS module does a preliminary electrical check and, at approximately 40 km/h (25 mph), the hydraulic pump motor is turned on for approximately one half second. During this time, a buzzing or humming noise may be heard and a vibration may be felt in the brake pedal. This is a normal condition. Any malfunction of the ABS disables the stability control and the ABS warning indicator illuminates. However, the power-assist braking system functions normally.

The ABS module monitors and compares the rotational speed of each wheel. Wheel speeds are measured by the wheel speed sensor, which electrically senses each tooth of the sensor ring as it passes through the magnetic field of the sensor. When the ABS module detects an impending wheel lock, the ABS module commands the hydraulic pump motor on and commands the Hydraulic Control Unit (HCU) to open and close the appropriate solenoid valves to modulate the brake pressure to the individual brake caliper(s). Once the affected wheel(s) returns to the desired speed, the ABS module commands the HCU to return the solenoid valves to their normal position and normal base brake operation is restored.

The ABS module must be configured when a new ABS module is installed.

Electronic Brake Distribution (EBD)

The ABS incorporates a strategy called Electronic Brake Distribution (EBD). EBD uses the HCU as an electronic proportioning valve. On initial application of the brake pedal, full pressure is applied to the rear brakes. The ABS module uses wheel speed input to calculate an estimated rate of deceleration. Once vehicle

deceleration exceeds a certain threshold, the ABS module closes the appropriate isolation valves in the HCU to hold the rear brake pressure constant while allowing the front brake pressure to build. This creates a balanced braking condition between the front and rear wheels and minimizes the chance of rear wheel lockup during hard braking. As the vehicle decelerates the valves are opened to increase the rear brake pressure in proportion to the front brake pressure.

Some drivers may feel a slight bump sensation in the brake pedal when EBD is active.

If anti-lock braking is disabled due to DTCs being present in the ABS module, EBD will continue to function unless the DTCs are for 2 wheel speed sensors on the same axle or HCU faults.

ABS With Traction Control, Electronic Stability Control (ESC) and Roll Stability Control (RSC®)

The ABS module with traction control, Electronic Stability Control (ESC) and Roll Stability Control (RSC®) performs the same functions as the standard ABS module. It also performs additional functions specific to traction control, ESC and RSC® .

Traction Control

When the drive wheels lose traction and begin to spin, with vehicle speed under 100 km/h (62 mph), the ABS module commands the hydraulic pump motor on and commands the HCU to open and close the appropriate solenoid valves to modulate the brake pressure to the brake caliper(s) while simultaneously sending a request to the PCM over the High Speed Controller Area Network (HS-CAN) bus to reduce engine torque to maintain vehicle traction. The PCM accomplishes this by minor incremental timing changes and fewer fuel injector pulses until the ABS module ends the request. The request ends when the driven wheel speed returns to the desired speed. After the vehicle speed exceeds 100 km/h (62 mph), the traction control is accomplished only through the PCM torque control.

Electronic Stability Control (ESC)

The ESC system constantly monitors the vehicle motion relative to the intended course. This is done by using sensors to compare the steering input and the yaw rate sensor with that of the actual vehicle motion. The ESC system monitors information from the throttle position sensor, the steering wheel rotation sensor (steering wheel angle and rate of change) and a yaw rate sensor (integral to the stability control sensor cluster) that measures changes in vehicle direction. If the ESC system determines from all these inputs that the vehicle is unable to travel in the intended direction, the system adjusts the brake torque at specific wheels in response to direct measurement of the vehicle motion and reduces engine torque to allow the vehicle to follow the intended course.

When the ESC system activates, any of the following can occur:

- A rumble or grinding sound much like ABS or traction control
- A small deceleration or a reduction in the acceleration of the vehicle
- The stability/traction control indicator "sliding-car icon" flashes
- If the driver's foot is on the brake pedal, a vibration will be felt in the pedal much like ABS

Roll Stability Control (RSC®)

The RSC® system constantly monitors the vehicle roll motion relative to the intended course. This is done by using sensors to compare the steering input and brake application with that of the actual vehicle motion. The system does not activate when the vehicle is traveling in reverse; however, the standard ABS and traction control continue to function as usual. The RSC® system monitors information from the wheel speed sensors, the Throttle Position (TP) sensor, the steering wheel rotation sensor (steering wheel angle and rate of change) and a roll-rate sensor (integral to the stability control sensor cluster) that measures changes in vehicle motion.

If the RSC® system determines from all these inputs that conditions exist for a potential roll-over event, the system adjusts the brake torque at specific wheels in response to direct measurement of the vehicle roll motion and reduces engine torque to make the vehicle more stable. By adjusting brake torque, the system can reduce the cornering forces and, therefore, the total roll motion of the vehicle.

When the RSC® system activates, any of the following can occur:

- A rumble or grinding sound much like ABS or traction control
- A small deceleration or a reduction in the acceleration of the vehicle
- The stability/traction control indicator "sliding-car icon" flashes
- If the driver's foot is on the brake pedal, a vibration will be felt in the pedal much like ABS
- If the event is severe enough and the driver's foot is not on the brake, the brake pedal will move to apply higher brake forces. A whooshing sound can also be heard from under the instrument panel in an event this severe

Some drivers may notice a slight movement of the brake pedal when the system checks itself. The brake pedal moves when an active test of the brake booster is run. During this test a small amount of pressure is generated at the master cylinder, but no pressure is generated in the brake calipers.

Trailer Sway Control

Trailer sway control is a unique function of the RSC® system that uses information from the steering wheel rotation sensor and the yaw information from the stability control sensor cluster to determine if a trailer sway event is taking place. Trailer sway is the undesirable yaw force a trailer can apply to the towing vehicle. If it is determined that an event is taking place, the ABS module will modulate brake pressure to the appropriate brake caliper(s) by opening and closing the appropriate solenoid valves inside the HCU while the hydraulic pump motor is activated. At the same time, the ABS module sends a message over the HS-CAN bus that a trailer sway event is taking place. When the PCM receives this message, it will assist with trailer sway by adjusting engine timing and decreasing fuel injector pulses. When the Instrument Cluster (IC) receives this message, it will flash the stability/traction control message center indicator "sliding-car icon" and display TRAILER SWAY, REDUCE SPEED in the message center. Once the trailer sway has been corrected, the ABS module returns the solenoid valves in the HCU to their normal position, deactivates the hydraulic pump motor and sends another message over the HS-CAN bus indicating that the event has ended. The PCM returns engine timing and fuel injectors to normal operation and the IC extinguishes the "sliding-car icon".

Trailer sway control will only activate with vehicle speed greater than 64 km/h (40 mph). Any malfunction that disables the RSC® system will also disable trailer sway control. Trailer sway control can also be disabled by entering the setup menu in the message center. Refer to the Owner's Literature for the disabling/enabling procedure. Regardless of the chosen state (enabled or disabled), trailer sway control will be re-enabled at each ignition key cycle.

Stability/Traction Control Switch

Unlike the standard anti-lock control system, the individual systems of ESC with RSC® can be deactivated by the driver through the stability/traction control switch. The switch is hard-wired to the ABS module and when pressed sends a voltage signal to the module. The ABS module then sends a message over the HS-CAN bus indicating that the driver has requested that the system be deactivated and illuminates the stability/traction indicator "sliding-car icon". The circumstances present when the switch is pressed and the duration of the button press will determine what systems are disabled.

- Button pressed momentarily - engine traction control, ESC and RSC® systems are disabled and the "sliding-car icon" will illuminate solidly. Brake traction control will continue to function.
- Button pressed and held for more than 5 seconds with vehicle speed under 40 km/h (25 mph) - ESC , RSC® , engine traction control and brake traction control systems are all disabled and the "sliding-car

icon" will flash momentarily and then illuminate solidly.
- Vehicle speed exceeds 40 km/h (25 mph) **after** the button is pressed and held for more than 5 seconds - engine traction control, brake traction control, RSC® and ESC will be enabled, but the "sliding-car icon" will be illuminated solidly.
- Button pressed after deactivation - all systems will be enabled and the "sliding-car icon" will not be illuminated.

Once disabled, the systems will remain in that state until the driver presses the switch again, the ignition key is cycled or the vehicle speed reaches or exceeds 40 km/h (25 mph). Once the vehicle speed reaches or exceeds 40 km/h (25 mph), RSC® and ESC will re-activate but traction control will remain deactivated.

Stability/Traction Control Indicator "Sliding-Car Icon"

Status of the traction control, ESC and RSC® systems is indicated by a stability/traction control indicator "sliding-car icon" located in the Instrument Cluster (IC). The indicator will illuminate solidly when the driver disables the one or more of the systems through the use of the stability/traction control switch or if there are DTCs present in the ABS module directly related to the specific system. The indicator will flash when one or more of the systems is currently active.

Stability Control Sensor Cluster

The sensor cluster (also called the accelerometer) consists of the yaw rate sensor, roll rate sensor, lateral accelerometer and longitudinal accelerometer. The lateral accelerometer measures the acceleration that corresponds to the force involved when the vehicle slides sideways. This acceleration has 2 forms. The first is the centrifugal acceleration that is generated when the vehicle travels around in a circle. The second is the acceleration due to gravity. On level ground there is no contribution from this acceleration. However, if the vehicle is parked sideways on a bank or incline, the sensor measures some lateral acceleration due to gravity, even though the vehicle is not moving.

The longitudinal accelerometer measures the acceleration corresponding to the force involved when the vehicle moves forward and rearward in the horizontal plane, along the centerline of the vehicle's front and rear wheels.

The yaw rate sensor measures the relative vehicle motion about the vertical axis through its center of gravity.

The roll rate sensor measures the rate of rotation along the front to rear horizontal axis.

Steering Wheel Rotation Sensor

The steering wheel rotation sensor measures the rate of rotation of the steering wheel by monitoring the steering wheel rotation ring as it passes through the sensor gap. The rotation sensor uses 2 signal lines to transmit information to the ABS module about whether the steering wheel is being turned left or right and how far it is being turned. The rotation sensor does not indicate the position of the steering wheel relative to straight-ahead. The ESC / RSC® systems learns this position by comparing the steering wheel position with other signals and storing the position it has learned. The ESC / RSC® systems confirm this position and modifies it as necessary during every new driving cycle.

Active Brake Booster

The active brake booster functions like a conventional brake booster with the added feature that it can be actuated electrically by the ABS module. The actuation of the brake booster by the ABS module is necessary in severe stability assist events as it makes sure that the HCU can generate enough brake pressure to maintain vehicle stability. The brake assist from the brake booster is especially useful in cold weather because the HCU

cannot draw the brake fluid from the reservoir quickly at cold temperatures.

The ABS module controls a solenoid/air valve attached to the active brake booster to actuate the booster. The ABS module uses the brake booster pedal force switch (integral to the booster) and the brake pressure transducer (integral to the HCU) to determine if booster actuation is necessary. When actuation is necessary, the ABS module applies increasing current to the solenoid which opens the air valve which allows more air in and increases the boost provided by the brake booster. When actuation is no longer necessary, the ABS module decreases the current to the solenoid which closes the air valve and decreases the boost provided by the brake booster. When the ABS module is actuating the brake booster, the brake pedal will be pulled toward the front of the vehicle as the brake booster input rod moves. The ABS module will continue to actuate the brake booster until it receives brake pedal input from the driver.

Brake pedal input from the driver is determined using the brake booster pedal force switch and the stoplamp switch when all of the following conditions exist:

- The ignition key is in the RUN position
- The ABS module is **not** actuating the active brake booster
- There are no DTCs present in the ABS module

Brake pedal input from the driver is determined using **only** the stoplamp switch when one or more of the following conditions exist:

- The ignition key is in the OFF position
- The ABS module is actuating the active brake booster
- There are DTCs present in the ABS module

When the ignition switch is in the OFF position, failures cannot be detected. If there are failures, several layers of redundancy attempt to keep the driver brake pedal input signal accurate. Control of the stoplamp operation is also required because the stoplamp switch can change states during a stability assist event when the driver is not applying the brake pedal. The switch can also change states during the system check of the brake booster. Only the stability assist system can interpret these changed states and determine which are actually due to driver brake pedal input. Similarly, the stability assist system can take advantage of other sensors to detect stoplamp switch failures.

Stability Control Sensor Calibration

When an ABS system fault has been corrected or an ABS component has been replaced, it will be necessary to calibrate the ABS module. The calibration procedure is required for the stability control sensors to learn the "zero-position" of the vehicle which means the vehicle must be on a level surface and must not be moving.

If a DTC is logged for any component of the stability/traction control system, the DTC must be cleared or repaired before carrying out the calibration procedure except those DTCs indicating a need for calibration. The need to calibrate is also indicated by the stability/traction control indicator "sliding-car icon" flashing once every 2 seconds.

To carry out the calibration procedure, connect the scan tool, proceed to the IVD Initialization sequence and follow the scan tool instructions.

ABS Module Configuration

When a new ABS module is installed it must be configured. To configure the ABS module, refer to Programmable Module Installation (PMI) in Section 418-01 .

Inspection and Verification

NOTE: If a new ABS module is installed, it must be configured. Refer to Programmable Module Installation (PMI) in Section 418-01 .

1. Verify the customer concern.

2. Verify the stoplamps operate correctly by pressing and releasing the brake pedal with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to Section 417-01 . If the stoplamps operate correctly, proceed to the next step.

3. Verify that the PRNDL operates correctly on the Instrument Cluster (IC). If the PRNDL does not operate correctly, refer to Section 307-01A . If the PRNDL operates correctly, proceed to the next step.

4. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Base brake system • Brake booster vacuum hose • Hydraulic Control Unit (HCU) • Steering components • Suspension components • Tire size • Wheel speed sensor ring	• ABS module • Battery Junction Box (BJB) fuse(s): ♦ 6 (40A) ♦ 33 (30A) • Brake booster release switch • Brake booster solenoid • Brake fluid level switch • Brake pressure transducer (integral to the ABS module) • Smart Junction Box (SJB) fuse(s): ♦ 18 (10A) ♦ 22 (15A) • Stability control sensor cluster • Stability/traction control switch • Steering wheel rotation sensor • Stoplamp switch • Wheel speed sensor • Wiring, terminals or connectors

5. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

6. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

7. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

If the scan tool does not communicate with the VCM :

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM .
- refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

8. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

9. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

10. Clear the continuous DTCs and carry out the self-test diagnostics for the ABS module.

11. If the DTCs retrieved are related to the concern, go to ABS Module DTC Chart. For all other DTCs, refer to the Master DTC Chart in Section 419-10 .

12. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Chart

ABS Module DTC Chart

NOTE: If DTC B2900, C1805 and U1900 are set at the same time, diagnose the concern for U1900 first.

DTC	Description	Source	Action
B1342	ECU is Faulted	ABS Module	**NOTE:** If other DTCs are present, REPAIR them before installing a new component. CLEAR the DTCs. CYCLE the ignition switch. RETRIEVE the DTCs. If DTC B1342 is retrieved, INSTALL a new module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	ABS Module	GO to Pinpoint Test A .
B1676	Battery Pack Voltage Out of Range	ABS Module	GO to Pinpoint Test B .
B2477	Module Configuration Failure	ABS Module	RECONFIGURE the ABS module. REFER to Programmable Module Installation (PMI) in Section 418-01 and follow the scan tool directions for the configuration procedure. CLEAR the DTC. REPEAT the self-test. If DTC B2477 returns, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section.
B2741	Sensor Cluster Defective	ABS Module	GO to Pinpoint Test G .
B2900	VIN Mismatch (normally set when a	ABS Module	GO to Pinpoint Test L .

	new ABS module is installed)		
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	GO to Pinpoint Test C .
C1145	Wheel Speed Sensor RF Input Circuit Failure	ABS Module	GO to Pinpoint Test D .
C1155	Wheel Speed Sensor LF Input Circuit Failure	ABS Module	GO to Pinpoint Test D .
C1165	Wheel Speed Sensor RR Input Circuit Failure	ABS Module	GO to Pinpoint Test D .
C1175	Wheel Speed Sensor LR Input Circuit Failure	ABS Module	GO to Pinpoint Test D .
C1233	Wheel Speed LF Input Signal Missing	ABS Module	GO to Pinpoint Test E .
C1234	Wheel Speed RF Input Signal Missing	ABS Module	GO to Pinpoint Test E .
C1235	Wheel Speed RR Input Signal Missing	ABS Module	GO to Pinpoint Test E .
C1236	Wheel Speed LR Input Signal Missing	ABS Module	GO to Pinpoint Test E .
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	ABS Module	GO to Pinpoint Test F .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	ABS Module	GO to Pinpoint Test F .
C1279	Yaw Rate Sensor Circuit Failure	ABS Module	GO to Pinpoint Test K .
C1280	Yaw Rate Sensor Signal Fault	ABS Module	GO to Pinpoint Test K .
C1281	Lateral Accelerometer Circuit Failure	ABS Module	GO to Pinpoint Test K .
C1282	Lateral Accelerometer Signal Fault	ABS Module	GO to Pinpoint Test K .
C1285	Booster Solenoid Circuit Failure	ABS Module	GO to Pinpoint Test H .
C1287	Booster Pedal Force Switch Circuit Failure	ABS Module	GO to Pinpoint Test I .
C1288	Pressure Transducer Main / Primary Input Circuit Failure	ABS Module	GO to Pinpoint Test J .
C1440	Pressure Transducer Main / Primary Signal Faulted	ABS Module	GO to Pinpoint Test J .
C1470	TCS Function Temperature Disabled (the brake fluid temperature is above a pre-set limit)	ABS Module	CLEAR the DTC. ALLOW the fluid time to cool. VERIFY ABS operation.
C1516	Roll Rate Sensor Signal Fault	ABS Module	GO to Pinpoint Test K .

C1517	Roll Rate Sensor Circuit Fault	ABS Module	GO to Pinpoint Test K .
C1805	Mismatched PCM and/or ABS-TC Module	ABS Module	CHECK for correct PCM and ABS module configurations using the scan tool. CONFIGURE the component as necessary. REFER to Programmable Module Installation (PMI) in Section 418-01 and follow the scan tool directions for the configuration procedure. CLEAR the DTC. REPEAT the self-test.
C1963	Stability Control Inhibit Warning	ABS Module	**NOTE:** This DTC will not clear until the vehicle has been driven above 48 km/h (30 mph) with input from the steering wheel rotation sensor. REPAIR all other DTCs before repairing DTC C1963. GO to Pinpoint Test F .
C1991	Module Calibration Failure	ABS Module	CLEAR the DTC. REPEAT the self-test. If DTC C1991 is present, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section.
C1996	Active Yaw and/or Roll Control Disabled	ABS Module	GO to Pinpoint Test M .
C2769	Longitudinal Acceleration Sensor Electrical Failure	ABS Module	GO to Pinpoint Test K .
C2770	Longitudinal Acceleration Sensor Plausibility Failure	ABS Module	GO to Pinpoint Test K .
C2777	Sensor Cluster Bus Failure	ABS Module	GO to Pinpoint Test G .
C2778	Sensor Cluster Power Supply Failure	ABS Module	GO to Pinpoint Test G .
U1900	CAN Communication Bus Fault-Receive Error	Network Fault	REFER to Section 418-00 to diagnose the High Speed Controller Area Network (HS-CAN) bus.
U1901	CAN Network #2 Communication Bus Fault-Receive Error	Network Fault	GO to Pinpoint Test G .
U2023	Fault Received From External Node	Network Fault	REFER to Section 418-00 to diagnose the HS-CAN bus.
U2050	No Application Present	ABS Module	CONFIGURE the ABS module. REFER to Programmable Module Installation (PMI) in Section 418-01 and follow the scan tool directions for the configuration procedure. CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. REPEAT the self-test.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: DTC B1483

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

Fused battery voltage is supplied to the stoplamp switch from Smart Junction Box (SJB) fuse 22 (15A) along circuit SBP22 (BN/RD). When the brake pedal is pressed, the stoplamp switch supplies fused battery voltage to the ABS module, the PCM and the SJB along circuit CCB08 (VT/WH).

- DTC B1483 Brake Pedal Input Circuit Failure - The ABS module compares the stoplamp switch position to the booster pedal force switch and the brake pressure input. If the stoplamp switch position does not match the other 2 inputs, DTC B1483 will be set. Also, if the ABS module detects an open, a short to ground or a short to voltage on the brake pedal input circuit, DTC B1483 will be set.

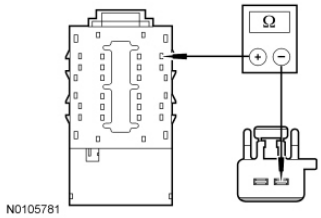
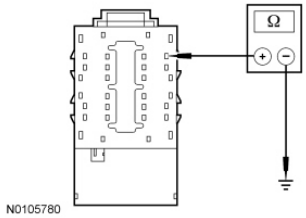
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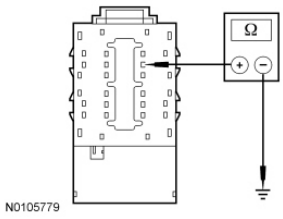
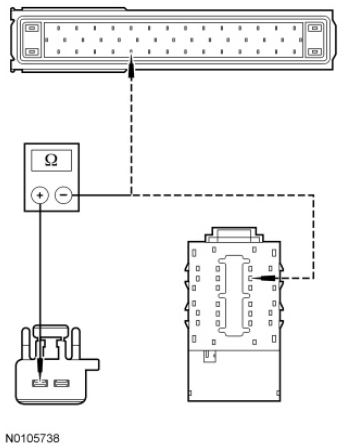
- Fuse
- Wiring, terminals or connectors
- Stoplamp switch
- ABS module

PINPOINT TEST A: DTC B1483

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
A1 CHECK THE STOPLAMP OPERATION	
• Ignition OFF. • Observe the stoplamps while pressing and releasing the brake pedal. • **Do the stoplamps operate correctly?**	**Yes** GO to A2 . **No** REFER to Section 417-01 to diagnose the stoplamps. Clear the DTCs. REPEAT the self-test.
A2 CHECK THE ABS MODULE BRAKE ON/OFF (BOO_ABS) PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module . • Monitor the BOO_ABS PID while pressing and releasing the brake pedal. • **Does the PID agree with the pedal position?**	**Yes** The system is operating correctly at this time. CLEAR the DTC. REPEAT the self-test. **No** GO to A3 .
A3 CHECK THE SJB BRAKE ON/OFF (GEM_BOO) PID	

• Enter the following diagnostic mode on the scan tool: DataLogger - SJB . • Monitor the GEM_BOO PID while pressing and releasing the brake pedal. • **Does the PID agree with the pedal position?**	**Yes** GO to A8 . **No** GO to A4 .
A4 CHECK THE STOPLAMP SWITCH	
NOTE: Stoplamp switch must be installed in the vehicle in order to obtain accurate test results. • Ignition OFF. • Remove the steering column opening trim panel. • Disconnect: Stoplamp Switch C278. • Measure the resistance between stoplamp switch C278 pin-1 and pin-4, component side, while pressing and releasing the brake pedal. • **Is the resistance less than 5 ohms with the pedal pressed and greater than 10,000 ohms with the pedal released?**	**Yes** GO to A5 . **No** INSTALL a new stoplamp switch. REFER to Stoplamp Switch in Section 417-01 . CLEAR the DTC. REPEAT the self-test.
A5 CHECK CIRCUIT SBP22 (BN/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280E. • Measure the resistance between SJB C2280E-28, circuit SBP22 (BN/RD), harness side and stoplamp switch C278-1, circuit SBP22 (BN/RD), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** VERIFY SJB fuse 22 (15A) is OK. If OK, REPAIR circuit SBP22 (BN/RD). If the fuse is not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTC. REPEAT the self-test.
A6 CHECK CIRCUIT SBP22 (BN/RD) FOR A SHORT TO GROUND	
• Measure the resistance between SJB C2280E-28, circuit SBP22 (BN/RD), harness side and ground.  	**Yes** GO to A7 . **No** REPAIR circuit SBP22 (BN/RD). CLEAR the DTC. REPEAT the self-test.

• **Is the resistance greater than 10,000 ohms?**	
A7 CHECK CIRCUIT CCB08 (VT/WH) FOR A SHORT TO GROUND	
• Disconnect: ABS Module C155. • Disconnect: PCM C175B. • Measure the resistance between SJB C2280E-23, circuit CCB08 (VT/WH), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A8 . **No** REPAIR circuit CCB08 (VT/WH). CLEAR the DTC. REPEAT the self-test.
A8 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280E. • Disconnect: ABS Module C155. • Disconnect: Stoplamp Switch C278. • Measure the resistance between stoplamp switch C278-2, circuit CCB08 (VT/WH), harness side and: ♦ ABS module C155-6, circuit CCB08 (VT/WH), harness side. ♦ SJB C2280E-23, circuit CCB08 (VT/WH), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to A9 . **No** REPAIR circuit CCB08 (VT/WH). CLEAR the DTC. REPEAT the self-test.
A9 CHECK FOR CORRECT ABS MODULE OPERATION	

• Check ABS module C155 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: DTC B1676

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to operate the ABS module, hydraulic valves and pump motor is between 10 and 17 volts.

Fused battery voltage is supplied to the ABS module from Battery Junction Box (BJB) fuses 6 (40A) and 33 (30A) along circuits SBB06 (BN/RD) and SBB33 (RD) respectively. Fused ignition voltage is supplied to the ABS module from Smart Junction Box (SJB) fuse 18 (10A) along circuit CBP18 (GY/OG) and ground is provided along GD120 (BK/GN).

- DTC B1676 Battery Pack Voltage Out Of Range - If during normal operation battery voltage is less than 9.7 volts for more than 210 ms with vehicle speed greater than 20 km/h (12 mph) or if battery voltage is greater than 18 volts, DTC B1676 will be set. Also, if during the ABS module self-test battery voltage is greater than 18 volts, DTC B1676 will be set.

This pinpoint test is intended to diagnose the following:
- Fuse(s)
- Wiring, terminals or connectors
- Charging system
- ABS module

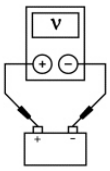
PINPOINT TEST B: DTC B1676

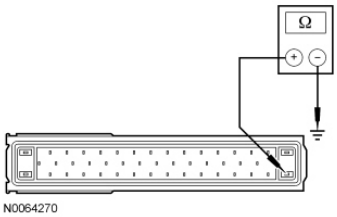
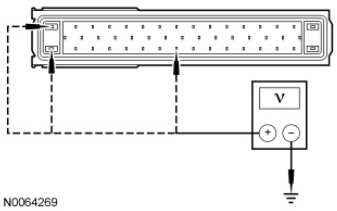
NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

NOTE: DTC B1317, B1318 or B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

NOTE: Carry out a thorough inspection and verification before proceeding with the pinpoint test. Refer to Inspection and Verification in this section.

Test Step	Result / Action to Take

B1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - All CMDTCs . • **Is B1317, B1318 or B1676 present in one or more modules AND P0563, P0620, P0625, P0626 or P065B present in the PCM?**	**Yes** REFER to Section 414-00 for diagnosis of the battery and charging system. **No** GO to B2 .
B2 CHECK BATTERY CONDITION	
• Ignition OFF. • Refer to Section 414-01 and carry out the Battery - Condition Test. • **Does the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). TEST the system for normal operation. If the battery passed the condition test and did not require a recharge, GO to B3 . **No** INSTALL a new battery. CLEAR all CMDTCs . TEST the system for normal operation.
B3 CHECK CHARGING SYSTEM VOLTAGE	
NOTE: Do not allow the engine speed to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine speed goes above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Start the engine. • Measure the voltage of the battery with and without a load on the charging system as follows: ♦ Turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage. ♦ Turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage.  AJ0210-A	**Yes** GO to B4 . **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation.

• **Are the voltages between 13 and 15.2 volts?**	
B4 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the resistance between ABS module C155-16, circuit GD120 (BK/GN), harness side and ground. ♦ Repeat this measurement while wiggling the harness.  N0064270 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR the circuit. CLEAR all CMDTCs . REPEAT the self-test.
B5 CHECK FOR VOLTAGE AT THE ABS MODULE	
• Ignition ON. • Measure the voltage between ground and: ♦ ABS module C155-1, circuit SBB06 (BN/RD), harness side. ♦ ABS module C155-8, circuit CBP18 (GY/OG), harness side. ♦ ABS module C155-32, circuit SBB33 (RD), harness side.  N0064269 • **Are the voltages greater than 10 volts?**	**Yes** GO to B6 . **No** VERIFY that BJB fuses 6 (40A) and 33 (30A) are OK, and SJB fuse SBP18 (10A) is OK. If OK, REPAIR the affected circuit(s). If the fuses are not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs and REPEAT the self-test.
B6 CHECK FOR CORRECT ABS MODULE OPERATION	
• Ignition OFF. • Check the harness and component side connectors for: ♦ corrosion. ♦ pushed-out/bent pins. • Connect the ABS module and make sure the connector seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC C1095

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to operate the hydraulic pump motor is between 10 and 17 volts.

Fused battery voltage for the hydraulic pump motor is supplied to the ABS module from Battery Junction Box (BJB) fuse 6 (40A) along circuit SBB06 (BN/RD), ground is provided along GD120 (BK/GN).

- DTC C1095 ABS Hydraulic Pump Motor Circuit Failure - If a short to voltage or ground is detected, if a locked up pump motor is detected or if there is an internal failure of the ABS module, DTC C1095 will be set.

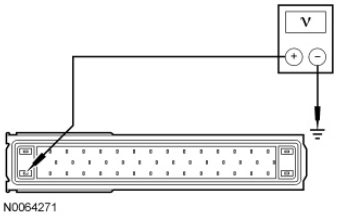
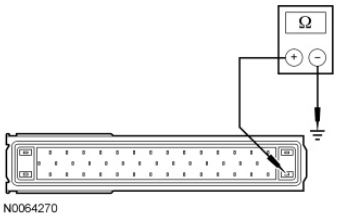
This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Hydraulic Control Unit (HCU)
- ABS module

PINPOINT TEST C: DTC C1095

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
C1 CHECK THE ABS PUMP MOTOR	
• Ignition ON. • **Is the ABS pump motor running all the time?**	**Yes** GO to C5 . **No** GO to C2 .
C2 CHECK THE ABS MODULE PUMP MOTOR (PMP_MOTOR) ACTIVE COMMAND	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module . • Toggle the PMP_MOTOR active command ON. • **Does the ABS pump motor run for approximately 2 seconds?**	**Yes** TOGGLE the PMP_MOTOR active command OFF. CLEAR the DTCs. CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) at greater than 40 km/h (25 mph). If the yellow ABS warning indicator illuminates, RETRIEVE the DTCs. If DTC C1095 is retrieved, GO to C5 . **No** TOGGLE the PMP_MOTOR output command OFF. GO to C3 .
C3 CHECK THE PUMP MOTOR VOLTAGE SUPPLY TO THE ABS MODULE	

• Ignition OFF. • Disconnect: ABS Module C155. • Measure the voltage between ABS module C155-1, circuit SBB06 (BN/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to C4 . **No** VERIFY that BJB fuse 6 (40A) is OK. If OK, REPAIR circuit SBB06 (BN/RD). If the fuse is not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test.
C4 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Measure the resistance between ABS module C155-16, circuit GD120 (BK/GN), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new HCU . REFER to Hydraulic Control Unit (HCU) in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit GD120 (BK/GN). CLEAR the DTCs. REPEAT the self-test.
C5 CHECK FOR CORRECT ABS MODULE OPERATION	
• Ignition OFF. • Disconnect: ABS Module C155. • Check the connector for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC C1145, C1155, C1165 or C1175

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The active wheel speed sensor generates a signal that is sent to the ABS module. The wheel speed sensor circuitry connects to the ABS module connector C155 through 2 wires and a connector at each wheel speed sensor. When the ignition switch is turned to the RUN position, the ABS module carries out a self-test by sending a reference voltage through the right front wheel speed sensor and its circuitry to determine if they are functional.

Voltage is supplied to the active wheel speed sensors from the ABS module. The wheel speed sensor ground is supplied by the ABS module.

DTC Description	Fault Trigger Condition
• DTC C1145 RF Wheel Speed Sensor Input Circuit Failure • DTC C1155 LF Wheel Speed Sensor Input Circuit Failure • DTC C1165 RR Wheel Speed Sensor Input Circuit Failure • DTC C1175 LR Wheel Speed Sensor Input Circuit Failure	If during the ABS module on-demand self test or during normal operation, if the ABS module detects an open, short to ground or voltage or a defective wheel speed sensor input circuit, the appropriate DTC will be set. These DTCs are usually set by a damaged sensor or a circuit fault.

This pinpoint test is intended to diagnose the following:

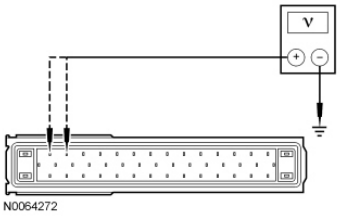
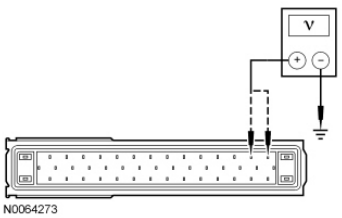
- Wiring, terminals or connectors
- Wheel speed sensor
- ABS module

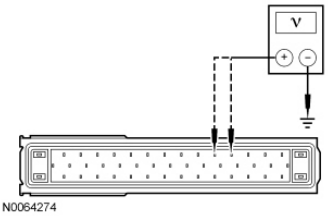
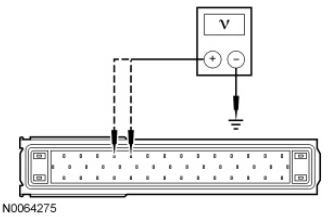
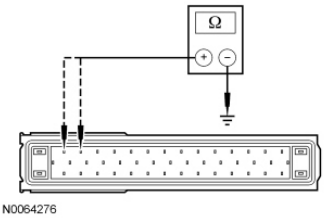
PINPOINT TEST D: DTC C1145, C1155, C1165 OR C1175

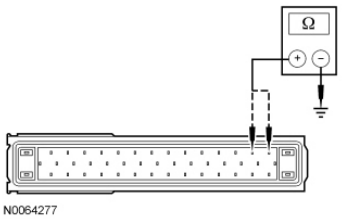
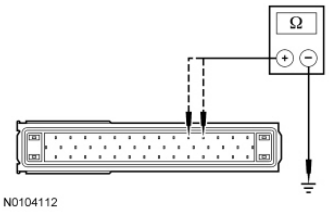
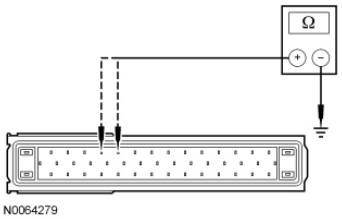
NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
D1 CHECK FOR FAULT REPEATABILITY	
NOTE: Both circuits must be checked for each DTC. • Connect the scan tool.	**Yes** If the active wheel speed sensor tool is not available, GO to D4 . If the active wheel speed sensor tool is available, GO to

• Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Drive the vehicle at least 16 km/h (10 mph). • Retrieve and record continuous DTCs. • **Is DTC C1145, C1155, C1165 or C1175 retrieved?**	D2 . **No** INSPECT the wheel speed sensors, wheel speed sensor wiring and wheel speed sensor tone rings. REPAIR or INSTALL new as necessary. If any other DTCs are retrieved, GO to the ABS Module DTC Chart.
D2 CHECK THE ABS MODULE OUTPUT USING THE ACTIVE WHEEL SPEED SENSOR TESTER	
• Ignition OFF. • Disconnect: Suspect Wheel Speed Sensor. • Connect the active wheel speed sensor tester to the wheel speed sensor connectors. • Ignition ON. • Select the correct system polarity on the active wheel speed sensor tester and turn the power switch to the ON position. • **Is the module output LED illuminated?**	**Yes** GO to D3 . **No** GO to D6 .
D3 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE ACTIVE WHEEL SPEED SENSOR TESTER	
• Raise the suspect wheel until it can spin freely. Refer to Section 100-02 . • While monitoring the active wheel speed sensor tester, slowly spin the suspect wheel. • **Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?**	**Yes** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. **No** If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor - Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. REPEAT the self-test. If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. The front wheel speed sensor tone rings are integral to the front bearing and wheel hub assemblies. REFER to Section 204-01A or Section 204-01B . For the rear wheel speed sensor ring, REFER to Wheel Speed Sensor Ring - Rear in this section. If the tone ring is OK, INSTALL a new wheel speed

	sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor - Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. TEST the system for normal operation.
D4 CHECK THE WHEEL SPEED CIRCUITS FOR A SHORT TO VOLTAGE	
NOTICE: **No measurements should be taken with the wheel speed sensor connected. Damage to the wheel speed sensor will result.** **NOTE:** Both circuits must be checked for each DTC. • Ignition OFF. • Disconnect: ABS Module C155. • Disconnect: Suspect Wheel Speed Sensor. • Ignition ON. • **For DTC C1145** , measure the voltage between ground and: ♦ ABS module C155-34, circuit VCA05 (GY/VT), harness side. ♦ ABS module C155-33, circuit RCA19 (VT), harness side.  N0064272 • **For DTC C1155** , measure the voltage between ground and: ♦ ABS module C155-45, circuit VCA03 (VT/WH), harness side. ♦ ABS module C155-46, circuit RCA17 (YE), harness side.  N0064273 • **For DTC C1165** , measure the voltage between ground and:	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to D5 .

♦ ABS module C155-43, circuit VCA06 (WH/OG), harness side. ♦ ABS module C155-42, circuit RCA20 (BN), harness side.  N0064274 • **For DTC C1175** , measure the voltage between ground and: ♦ ABS module C155-36, circuit VCA04 (BU/OG), harness side. ♦ ABS module C155-37, circuit RCA18 (BN/GN), harness side.  N0064275 • **Is any voltage present?**	
D5 CHECK THE WHEEL SPEED CIRCUITS FOR A SHORT TO GROUND	
NOTE: Both circuits must be checked for each DTC. • Ignition OFF. • **For DTC C1145** , measure the resistance between ground and: ♦ ABS module C155-34, circuit VCA05 (GY/VT), harness side. ♦ ABS module C155-33, circuit RCA19 (VT), harness side.  N0064276	**Yes** GO to D6 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

• **For DTC C1155** , measure the resistance between ground and: ♦ ABS module C155-45, circuit VCA03 (VT/WH), harness side. ♦ ABS module C155-46, circuit RCA17 (YE), harness side.  N0064277 • **For DTC C1165** , measure the resistance between ground and: ♦ ABS module C155-43, circuit VCA06 (WH/OG), harness side. ♦ ABS module C155-42, circuit RCA20 (BN), harness side.  N0104112 • **For DTC C1175** , measure the resistance between ground and: ♦ ABS module C155-36, circuit VCA04 (BU/OG), harness side. ♦ ABS module C155-37, circuit RCA18 (BN/GN), harness side.  N0064279 • **Are the resistances greater than 10,000 ohms?**	
D6 CHECK THE WHEEL SPEED CIRCUITS FOR AN OPEN	

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Disconnect: ABS Module C155.
- Disconnect: Suspect Wheel Speed Sensor.
- Measure the resistance between the ABS module connector, harness side and the suspect wheel speed sensor connector, harness side as indicated in the following chart:

ABS Module	Circuit	Wheel Speed Sensor
DTC C1145		
C155-34	VCA05 (GY/VT)	C160-2
C155-33	RCA19 (VT)	C160-1
DTC C1155		
C155-45	VCA03 (VT/WH)	C150-2
C155-46	RCA17 (YE)	C150-1
DTC C1165		
C155-43	VCA06 (WH/OG)	C426-2
C155-42	RCA20 (BN)	C426-1
DTC C1175		
C155-36	VCA04 (BU/OG)	C440-2
C155-37	RCA18 (BN/GN)	C440-1

- **Are the resistances less than 5 ohms?**

Yes
GO to D7 .

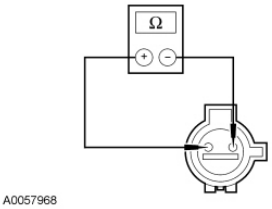
No
REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

D7 CHECK FOR SHORTED WHEEL SPEED SENSOR CIRCUITS

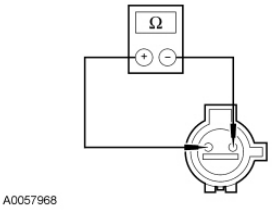
- **For DTC C1145** , measure the resistance between RF wheel speed sensor C160-1, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-2, circuit VCA05 (GY/VT), harness side.

Yes
GO to D8 .

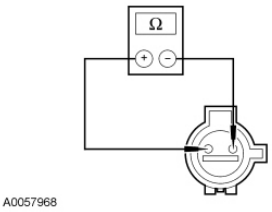
No
REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.



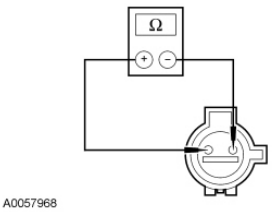
- **For DTC C1155** , measure the resistance between LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side and LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side.

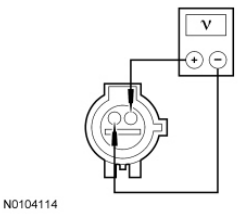


- **For DTC C1165** , measure the resistance between RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-2, circuit VCA06 (WH/OG), harness side.



- **For DTC C1175** , measure the resistance between LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side.



• **Are the resistances greater than 10,000 ohms?**	
D8 CHECK THE ABS MODULE OUTPUT	
• Connect: ABS Module C155. • Ignition ON. • **For DTC C1145** , measure the voltage between RF wheel speed sensor C160-1, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-2, circuit VCA05 (GY/VT), harness side. • **For DTC C1155** , measure the voltage between LF wheel speed sensor C150-1, circuit RCA17 (YE), harness side and LF wheel speed sensor C150-2, circuit VCA03 (VT/WH), harness side. • **For DTC C1165** , measure the voltage between RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-2, circuit VCA06 (WH/OG), harness side. • **For DTC C1175** , measure the voltage between LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-2, circuit VCA04 (BU/OG), harness side.  N0104114 • **Are the voltages greater than 10 volts?**	**Yes** INSTALL a new wheel speed sensor. REFER to Wheel Speed Sensor - Front or Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to D9 .
D9 CHECK FOR CORRECT ABS MODULE OPERATION	
• Ignition OFF. • Disconnect: ABS Module C155. • Check the connector for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155.	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

• Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	

Pinpoint Test E: DTC C1233, C1234, C1235 or C1236

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The wheel speed sensor and sensor ring generate a signal to the ABS module that is proportional to the wheel speed. The ABS module compares the wheel speed inputs from all wheel speed sensors to determine an impending wheel lockup.

DTC Description	Fault Trigger Condition
• DTC C1233 LF Wheel Speed Sensor Input Signal Missing • DTC C1234 RF Wheel Speed Sensor Input Signal Missing • DTC C1235 RR Wheel Speed Sensor Input Signal Missing • DTC C1236 LR Wheel Speed Sensor Input Signal Missing	If the ABS module does not receive a signal from a wheel speed sensor when the vehicle speed is greater than 15 km/h (9 mph), the appropriate DTC will be set. If the difference of 2 wheel speed values is greater than 25 km/h (16 mph), the appropriate DTC will be set. These DTCs are usually set by a damaged wheel speed sensor or damaged sensor tone ring, they can also be set by wheels and/or tires of different sizes being installed on the vehicle.

This pinpoint test is intended to diagnose the following:

- Mismatched tire sizes
- Wheel speed sensor ring
- Wheel speed sensor
- ABS module

PINPOINT TEST E: DTC C1233, C1234, C1235 OR C1236

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take

E1 CHECK THE DTCs FROM THE SELF-TEST	
• Check the DTCs retrieved and recorded during Inspection and Verification. • **Is DTC C1145, C1155, C1165 or C1175 present?**	**Yes** GO to Pinpoint Test D . **No** GO to E2 .
E2 MONITOR THE WHEEL SPEED SENSOR PIDs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module . • Drive the vehicle at a speed greater than 20 km/h (12 mph) while monitoring the following PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • **Are the wheel speed PIDs consistent with each other and the vehicle speed as indicated on the speedometer?**	**Yes** If the active wheel speed sensor tester is available, GO to E4 . If the active wheel speed sensor tester is not available, GO to E5 . **No** GO to E3 .
E3 CHECK FOR RETURNING ABS MODULE DTCs	
• Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Drive the vehicle in a straight line at a speed greater than 40 km/h (25 mph) for at least 60 seconds. • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • **Is DTC C1233, C1234, C1235 or C1236 present?**	**Yes** If the active wheel speed sensor tester is available, GO to E4 . If the active wheel speed sensor tester is not available, GO to E5 . **No** GO to E5 .

E4 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE ACTIVE WHEEL SPEED SENSOR TESTER	
• Ignition OFF. • Disconnect: Suspect Wheel Speed Sensor. • Connect the Active Wheel Speed Sensor Tester to the wheel speed sensor connectors. • Ignition ON. • Select the correct system polarity on the Active Wheel Speed Sensor Tester and turn the power switch to the ON position. • Raise the suspect wheel until it can spin freely. Refer to Section 100-02 . • While monitoring the active wheel speed sensor tester, slowly spin the suspect wheel. • **Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?**	**Yes** INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, the concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. **No** If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor - Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. REPEAT the self-test. If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. The front wheel speed sensor tone rings are integral to the front bearing and wheel hub assemblies. REFER to Section 204-01A or Section 204-01B . For the rear wheel speed sensor ring, REFER to Wheel Speed Sensor Ring - Rear in this section. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor - Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. TEST the system for normal operation.
E5 CHECK FOR CORRECT TIRE SIZE AND AIR PRESSURE	
• Verify that the tires are the correct size for the vehicle as indicated on the Vehicle Certification (VC) label. • Verify that the air pressure in all the tires is correct as indicated on the VC label. • **Are the tires OK?**	**Yes** GO to E6 . **No** INSTALL the correct tires or ADJUST tire pressure as necessary. CLEAR the DTCs. TEST the system for normal operation.
E6 INSPECT THE WHEEL SPEED SENSOR MOUNTING	
• Ignition OFF. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Inspect the suspect wheel speed sensor for looseness.	**Yes** GO to E7 . **No** TIGHTEN the wheel speed sensor to specification. CLEAR the DTCs. TEST the system for normal operation.

• **Is the wheel speed sensor OK?**	
E7 INSPECT THE WHEEL SPEED SENSOR FOR DAMAGE	
• **NOTE:** Examine the wheel speed sensor wire carefully with a good light source. Failure to verify damage in the wheel speed sensor wire can lead to unnecessary installation of a new component. • Inspect the suspect wheel speed sensor for damage or contamination. • **Is the wheel speed sensor OK?**	**Yes** GO to E8 . **No** CLEAN the wheel speed sensor or INSTALL a new wheel speed sensor as necessary. REFER to Wheel Speed Sensor - Front or Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. TEST the system for normal operation.
E8 INSPECT THE WHEEL SPEED SENSOR RING FOR DAMAGE	
• Inspect the suspect wheel speed sensor ring for damaged or missing teeth. Rotate the wheel to verify that no teeth are missing. • **Is the wheel speed sensor ring OK?**	**Yes** GO to E9 . **No** INSTALL a new wheel bearing and wheel hub (front sensor ring) or rear wheel speed sensor ring. REFER to Section 204-01A or Section 204-01B for the front sensor rings. For the rear wheel speed sensor ring, REFER to Wheel Speed Sensor Ring - Rear in this section. CLEAR the DTCs. TEST the system for normal operation.
E9 INSPECT THE WHEEL BEARING FOR DAMAGE	
• Inspect the wheel bearings for damage. Refer to Section 100-04 . • **Are the wheel bearings OK?**	**Yes** GO to E10 . **No** INSTALL a new wheel bearing and wheel hub as necessary. REFER to Section 204-01A or Section 204-01B . CLEAR the DTCs. TEST the system for normal operation.
E10 CHECK FOR CORRECT ABS MODULE OPERATION	
• Ignition OFF. • Disconnect: ABS Module C155. • Check the connector for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155.	**Yes** INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the

• Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	DTCs. TEST the system for normal operation.

Pinpoint Test F: DTCs C1277, C1278 and C1963

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The steering wheel rotation (in degrees) is sent to the ABS module along circuits VSC06 (GY/BN) and VSC07 (VT/OG). Voltage is supplied to the steering wheel angle sensor from the ABS module along circuit CCS01 (VT/WH) and ground is provided by the ABS module through circuit RSC02 (BU/WH).

The steering wheel rotation sensor monitors the steering wheel position when the slotted wheel in the clockspring assembly rotates through the infrared light generated by the sensor.

- DTC C1277 Steering Wheel Angle 1 and 2 Circuit Failure - If during normal operation or the ABS module on-demand self test, the ABS module detects an open circuit, short to voltage or short to ground along circuits VCS06 (GY/BN) or VCS07 (VT/OG), DTC C1277 will be set. An internal failure of the steering wheel rotation sensor may also cause DTC C1277 to set.
- DTC C1278 Steering Wheel Angle 1 and 2 Signal Faulted - If during normal operation or the ABS module on-demand self test, the ABS module does not receive the steering wheel rotation sensor input or if the input received does not agree with the input from other sensors, DTC C1278 will be set.
- DTC C1963 Stability Assist Inhibit Warning - If conditions exist during normal operation that prevents the roll stability control system from operating, DTC C1963 will be set. This DTC is usually set due to the steering wheel rotation sensor or the stability control sensor cluster being damaged or installed incorrectly.

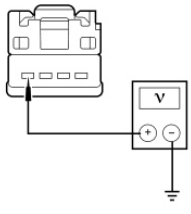
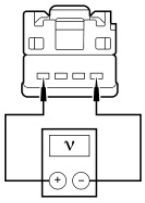
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Steering wheel rotation sensor

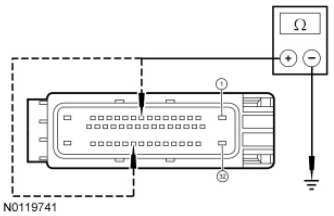
PINPOINT TEST F: DTCs C1277, C1278 AND C1963

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
F1 MONITOR THE STEERING ROTATION SENSOR POSITION (SWA POS) PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • Monitor the SWA POS PID while rotating the steering wheel clockwise and counterclockwise very slowly, from lock to lock.	**Yes** GO to F2 . **No** GO to F3 .

• **Does the PID move in intervals of 1.5 degrees?**	
F2 CHECK RETURNING DTCs	
• Using the scan tool, clear all ABS DTCs. • DRIVE the vehicle above 48 km/h (30 mph) with input from the steering wheel rotation sensor. • Enter the following diagnostic mode on the scan tool: Self Test - ABS module. • **Are any ABS DTCs present?**	**Yes** For DTC C1277 or C1278: GO to F17 . For DTC C1963: DIAGNOSE all other ABS DTCs before proceeding. If DTC C1963 is the only ABS DTC present, GO to F19 . **No** The system is operating correctly at this time.
F3 CHECK THE INSTALLATION AND CONDITION OF THE STEERING WHEEL ROTATION SENSOR	
• Ignition OFF. • Disconnect: Steering Wheel Rotation Sensor C226. • Inspect the steering wheel rotation sensor, for damage and correct installation. • Inspect the tone ring, for correct installation, damage and blocked or contaminated window openings. • Inspect the steering wheel rotation sensor electrical connector C226 for damage, contamination or pushed out pins. • **Is the steering wheel rotation sensor and electrical connector C226 correctly installed and free from damage, contamination and blockages?**	**Yes** GO to F5 . **No** For a steering wheel rotation sensor or tone ring concern REINSTALL or INSTALL a new steering wheel rotation sensor or tone ring as necessary. GO to F4 . For an electrical connector concern. REPAIR the electrical connector as necessary. TEST the system for normal operation.
F4 MONITOR THE STEERING ROTATION SENSOR POSITION (SWA POS) PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • Monitor the SWA POS PID while rotating the steering wheel clockwise and counterclockwise very slowly, from lock to lock. • **Does the PID move in intervals of 1.5 degrees?**	**Yes** CLEAR the DTCs. DRIVE the vehicle above 48 km/h (30 mph) with input from the steering wheel rotation sensor. RETRIEVE the DTCs. If DTC C1277 or C1278 is still present, GO to F17 . If DTC C1963 is present, GO to F19 . **No** GO to F5 .
F5 CHECK THE VOLTAGE TO THE STEERING WHEEL ROTATION SENSOR	
• Ignition ON. • Measure the voltage between steering wheel rotation sensor C226-4, circuit CCS01 (VT/WH), harness side and ground.	**Yes** GO to F6 . **No** GO to F15 .

 N0043015 • **Is the voltage greater than 9.5 volts?**	
F6 CHECK THE STEERING WHEEL ROTATION SENSOR CIRCUIT VOLTAGE	
• Measure the voltage between steering wheel rotation sensor C226-4, circuit CCS01 (VT/WH), harness side and steering wheel rotation sensor C226-1, circuit RSC02 (BU/WH) harness side.  N0043016 • **Is the voltage greater than 9.5 volts?**	**Yes** GO to F7 . **No** GO to F12 .
F7 ELECTRICAL CONNECTOR CHECK	
• Disconnect: ABS Module C155. • Check the electrical connector for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • **Is the connector free from damage, corrosion and pushed out pins?**	**Yes** GO to F8 . **No** REPAIR the electrical connector as necessary. TEST the system for normal operation.
F8 CHECK THE STEERING POSITION SENSOR CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: ABS ModuleC155. • Measure the resistance between ground and: ♦ ABS module C155-40, circuit VSC06 (GY/BN), harness side. ♦ ABS module C155-41, circuit VSC06 (GY/BN), harness side. ♦ ABS module C155-9, circuit VSC07 (VT/OG), harness side.	**Yes** GO to F9 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

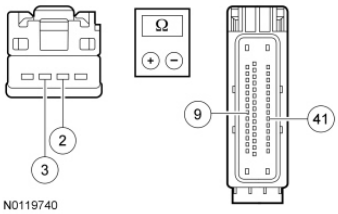


- **Are the resistances greater than 10,000 ohms?**

F9 CHECK THE STEERING POSITION SENSOR HARNESS FOR AN OPEN

- Measure the resistance between the ABS module connector, harness side and the steering wheel rotation sensor connector, harness side as indicated in the following chart:

ABS Module	Circuit	Steering Wheel Rotation Sensor
C155-9	VCS07 (VT/OG)	C226-3
C155-41	VCS06 (GY/BN)	C226-2



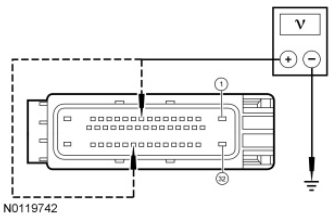
- **Are the resistances less than 5 ohms?**

Yes
GO to F10 .

No
REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

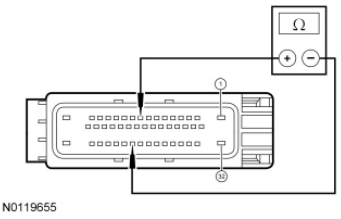
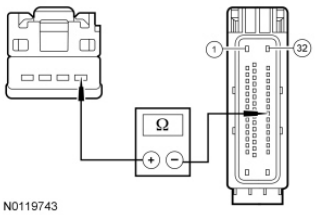
F10 CHECK THE STEERING POSITION SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

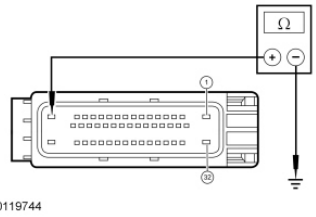
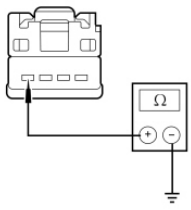
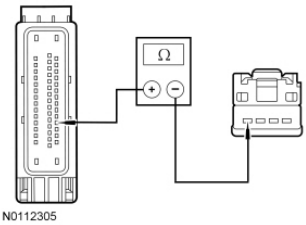
- Ignition ON.
- Measure the voltage between ground and:
  - ABS module C155-41, circuit VSC06 (GY/BN), harness side.
  - ABS module C155-9, circuit VSC07 (VT/OG), harness side.



Yes
REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.

No
GO to F11 .

• **Is any voltage present?**	
F11 CHECK THE STEERING POSITION SENSOR CIRCUITS FOR A SHORT TOGETHER	
• Ignition OFF. • Measure the resistance between ABS C155-41, circuit VSC06 (GY/BN), harness side and ABS C155-9, circuit VSC07 (VT/OG) harness side.  N0119655 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to F18 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F12 ELECTRICAL CONNECTOR CHECK	
• Disconnect: ABS Module C155. • Check the electrical connector for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • **Is the connector free from damage, corrosion and pushed out pins?**	**Yes** GO to F13 **No** REPAIR the electrical connector as necessary. TEST the system for normal operation.
F13 CHECK THE STEERING WHEEL ROTATION SENSOR GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the resistance between the steering wheel rotation sensor C226-1, circuit RCS02 (BL/WH) and ABS C155-40, circuit RCS02 (BL/WH).  N0119743 • **Is the resistance less than 5 ohms?**	**Yes** GO to F14 . **No** REPAIR the circuit RCS02 (BU/WH). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F14 CHECK THE ABS MODULE GROUND CIRCUIT FOR AN OPEN	

• Measure the resistance between ABS C155-16, circuit GD 120 (BK/GN) and ground.  N0119744 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** REPAIR the circuit GD120 (BK/GN). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F15 CHECK THE STEERING WHEEL ROTATION SENSOR SUPPLY CIRCUIT FOR SHORT TO GROUND	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the resistance between steering wheel rotation sensor C226-4, circuit CCS01 (VT/WH), harness side and ground.  N0118679 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to F16 . **No** REPAIR the circuit CCS01 (VT/WH). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F16 CHECK THE STEERING WHEEL ROTATION SENSOR SUPPLY CIRCUIT FOR AN OPEN	
• Measure the resistance between steering wheel rotation sensor C226-4, circuit CCS01 (VT/WH), harness side and C155-5 circuit CCS01 (VT/WH), harness side.  N0112305 • **Is the resistance less than 5 ohms?**	**Yes** GO to F18 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. RECALIBRATE the ABS module. FOLLOW the scan tool directions for the calibration procedure. REPEAT the self-test.
F17 ELECTRICAL CONNECTOR CHECK	
• Disconnect: ABS Module C155. • Disconnect: Steering wheel rotation sensor C226. • Check the electrical connectors for:	**Yes** GO to F18 . **No**

♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • **Is the connector free from damage, corrosion and pushed out pins?**	REPAIR the electrical connector as necessary. TEST the system for normal operation.
F18 CHECK RETURNING DTCs	
• Connect: Steering wheel rotation sensor C226. • Connect: ABS ModuleC155. • Connect the scan tool. • Ignition ON. • Using the scan tool, clear all ABS DTCs. • DRIVE the vehicle above 48 km/h (30 mph) with input from the steering wheel rotation sensor. • Enter the following diagnostic mode on the scan tool: Self Test - ABS module. • **Are DTCs C1277 or C1278 present?**	**Yes** INSTALL a new steering wheel rotation sensor and TEST the system for normal operation. If the concern is still present INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. **No** The system is operating correctly at this time.
F19 CHECK THE STEERING WHEEL ROTATION SENSOR CONDITION AND INSTALLATION	
• Inspect the steering wheel rotation sensor, for damage and correct installation. Inspect the tone ring, for correct installation, damage and blocked or contaminated window openings. • **Is the steering wheel rotation sensor and tone ring correctly installed and free from damage or contamination?**	**Yes** GO to F20 . **No** REINSTALL or INSTALL new steering wheel rotation sensor or tone ring as necessary. TEST for normal operation.
F20 CHECK THE SENSOR CLUSTER CONDITION AND INSTALLATION	
• Inspect the stability control sensor cluster for damage and correct installation. Refer to Stability Control Sensor Cluster in this section. • **Is the stability control sensor cluster installed correctly and undamaged?**	**Yes** DIAGNOSE the stability control sensor cluster GO to Pinpoint Test G . **No** REINSTALL or INSTALL new as necessary, TEST for normal operation.

Pinpoint Test G: DTCs B2741, C2777, C2778 and U1901

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The yaw rate sensor, roll rate sensor, lateral accelerometer and longitudinal accelerometer are contained in one module called the stability control sensor cluster. The sensor cluster measures the vehicle acceleration, roll rate and yaw rate, then sends the signal along a dedicated Controller Area Network (CAN) bus to the ABS module.

Voltage is supplied from the ABS module to the sensor cluster along circuit CCA09 (VT/BN) and ground is provided through the ABS module along circuit RCA09 (GN/VT). Circuits VCA23 (BU/WH) and VCA24 (GN/OG) make up the dedicated CAN bus between the ABS module and the sensor cluster.

DTC Description	Fault Trigger Conditions
• DTC B2741 Sensor Cluster is Defective	This DTC will be set if supply voltage to the sensor cluster is less than 7.5 volts or greater than 17 volts due to a circuit fault on circuit CCA09 (VT/BN) or RCA09 (GN/VT). A defective sensor cluster will also set this DTC.
• DTC C2777 Sensor Cluster Bus Failure • DTC U1901 CAN Network #2 Communication Bus Fault • DTC C2778 Sensor Cluster Power Supply Failure	If during normal operation with vehicle speed greater than 20 km/h (12 mph), the voltage sent to the sensor cluster exceeds 17 volts or drops below 7.5 volts, this DTC will be set. This DTC can also be set if the dedicated CAN circuits are open, shorted to ground or shorted to each other.

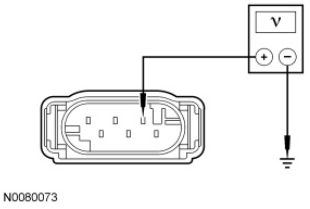
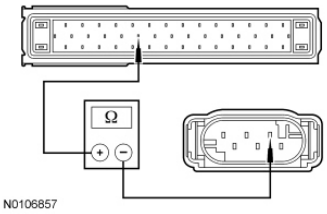
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Stability control sensor cluster
- ABS module

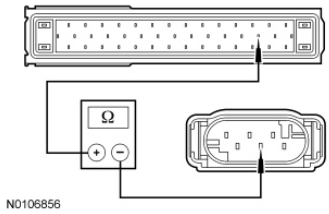
PINPOINT TEST G: DTCs B2741, C2777, C2778 and U1901

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

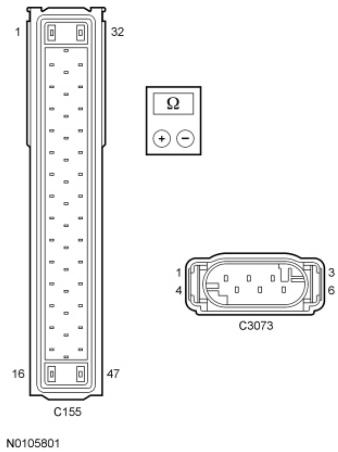
NOTE: The vehicle must be on level ground, not on a hoist and at a complete standstill. Any vehicle movement will result in false values for this test.

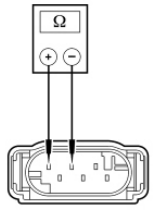
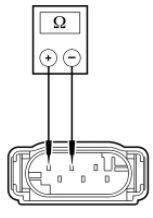
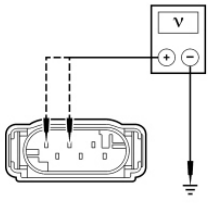
Test Step	Result / Action to Take
G1 CHECK FOR ABS MODULE DTCs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Drive the vehicle in a straight line at a speed greater than 40 km/h (25 mph) for at least 60 seconds. • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • Retrieve and record any ABS module DTCs. • **Is DTC B2741, C2777, C2778 or U1901 present?**	**Yes** GO to G2 . **No** The concern is not present at this time. INSPECT the sensor cluster for damage. VERIFY that the sensor cluster is mounted properly. REPAIR or INSTALL new as necessary. TEST the system for normal operation.

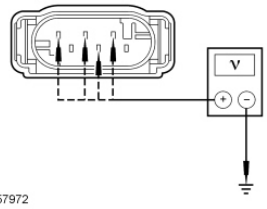
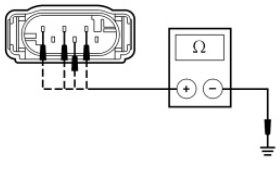
G2 CHECK FOR VOLTAGE TO THE SENSOR CLUSTER	
NOTE: Turning the ignition ON with C3073 disconnected will cause additional DTCs to set in the ABS module. • Ignition OFF. • Disconnect: Sensor Cluster C3073. • Ignition ON. • Measure the voltage between sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side and ground.  N0080073 • **Is the voltage between 7.5 volts and 17 volts?**	**Yes** GO to G4 . **No** GO to G3 .
G3 CHECK THE SENSOR CLUSTER POWER CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the resistance between ABS module C155-22, circuit CCA09 (VT/BN), harness side and sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side.  N0106857 • **Is the resistance less than 5 ohms?**	**Yes** GO to G4 . **No** REPAIR circuit CCA09 (VT/BN). CLEAR the DTCs. REPEAT the self-test.
G4 CHECK THE SENSOR CLUSTER GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155. • Measure the resistance between ABS module C155-29, circuit RCA09 (GN/VT), harness side and sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.	**Yes** GO to G5 . **No** REPAIR circuit RCA09 (GN/VT). CLEAR the DTCs. REPEAT the self-test.



- **Is the resistance less than 5 ohms?**

G5 CHECK THE DEDICATED CAN BUS CIRCUITS FOR AN OPEN	
• Measure the resistance between the ABS module connector, harness side and the sensor cluster connector, harness side as indicated in the following chart: **ABS Module** / **Circuit** / **Sensor Cluster** C155-18 / VCA23 (BU/WH) / C3073-2 C155-19 / VCA24 (GN/OG) / C3073-1  • **Is the resistance less than 5 ohms?**	**Yes** GO to G6 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
G6 CHECK THE DEDICATED CAN BUS CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between sensor cluster connection C3073-2, circuit VCA23 (BU/WH), harness side and C3073-1, circuit VCA24 (GN/OG), harness side.	**Yes** GO to G7 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

 N0093245 • **Is the resistance greater than 10,000 ohms?**	
G7 CHECK THE DEDICATED CAN BUS TERMINATING RESISTANCE	
• Connect: ABS Module C155. • Measure the resistance between sensor cluster connection C3073-2, circuit VCA23 (BU/WH), harness side and C3073-1, circuit VCA24 (GN/OG), harness side.  N0093245 • **Is the resistance approximately 120 ohms?**	**Yes** GO to G8 . **No** GO to G12 .
G8 CHECK THE DEDICATED CAN BUS VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ sensor cluster connection C3073-2, circuit VCA23 (BU/WH), harness side. ♦ sensor cluster connection C3073-1, circuit VCA24 (GN/OG), harness side.  N0093246 • **Is the voltage between 1 and 3 volts?**	**Yes** GO to G11 . **No** GO to G9 .
G9 CHECK THE SENSOR CLUSTER CIRCUITS FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ground and: ♦ sensor cluster C3073-1, circuit VCA24 (GN/OG), harness side. ♦ sensor cluster C3073-2, circuit VCA23 (BU/WH), harness side. ♦ sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side. ♦ sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.  N0057972 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to G10 .
G10 CHECK THE SENSOR CLUSTER CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and: ♦ sensor cluster C3073-1, circuit VCA24 (GN/OG), harness side. ♦ sensor cluster C3073-2, circuit VCA23 (BU/WH), harness side. ♦ sensor cluster C3073-3, circuit CCA09 (VT/BN), harness side. ♦ sensor cluster C3073-5, circuit RCA09 (GN/VT), harness side.  A0091341 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to G12 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
G11 CHECK THE SENSOR CLUSTER ELECTRICAL CONNECTION	
• Check sensor cluster C3073 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: Sensor Cluster C3073.	**Yes** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. TEST the system for normal operation. **No**

• Make sure the connector seats correctly, clear all ABS module DTCs, then operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
G12 CHECK FOR CORRECT ABS MODULE OPERATION	
• Check ABS module C155 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the connector seats correctly, clear all ABS module DTCs, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: DTC C1285

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The active brake booster has internal solenoids that assist driver brake applications or that can apply the brakes when needed if the driver loses control. The booster solenoid is part of the brake booster, if a new solenoid needs to be installed, a new brake booster must be installed.

Voltage is supplied to the solenoid from the ABS module along circuit CCA22 (GY/YE) and ground is provided back to the ABS module along circuit VCA22 (GN/BN).

- DTC C1285 Booster Solenoid Circuit Failure - If the ABS module detects an open, a short to voltage or a short to ground on the booster solenoid circuits, DTC C1285 will be set.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Active brake booster
- ABS module

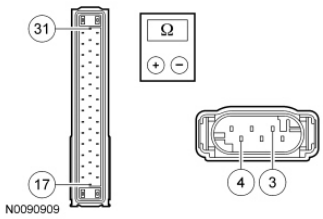
PINPOINT TEST H: DTC C1285

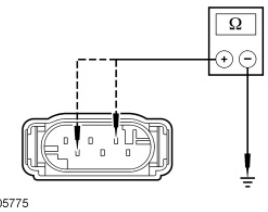
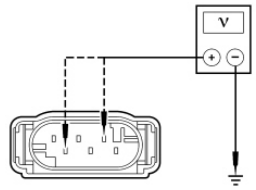
NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
H1 CHECK THE DTCs FROM THE SELF-TEST	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear All CMDTCs .	**Yes** If DTC C1285 is retrieved GO to H2 . If any other DTC is retrieved, GO to the ABS Module DTC Chart.

• Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • Retrieve and record any ABS module DTCs. • **Are any DTCs retrieved?**	**No** The system is operating correctly at this time.
H2 CHECK THE BRAKE BOOSTER SOLENOID	
NOTE: To access C149, position the Battery Junction Box (BJB) aside. • Ignition OFF. • Disconnect: Active Brake Booster C149. • Measure the resistance between active brake booster C149 pin-3 and pin-4, component side. • **Is the resistance between 1 and 2 ohms?**	**Yes** INSPECT C149 for corrosion, pushed-out pins and spread terminals. REPAIR as necessary. If C149 is OK, GO to H3 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTC. REPEAT the self-test.
H3 CHECK CIRCUITS VCA22 (GN/BN) AND CCA22 (GY/YE) FOR AN OPEN	
• Disconnect: ABS Module C155. • Measure the resistance between the ABS module connector, harness side and the active brake booster connector, harness side as indicated in the following chart: • **Are the resistances less than 5 ohms?**	**Yes** GO to H4 . **No** REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test.
H4 CHECK CIRCUITS VCA22 (GN/BN) AND CCA22 (GY/YE) FOR A SHORT TO GROUND	
• Measure the resistance between ground and: ♦ active brake booster C149-4, circuit VCA22 (GN/BN), harness side. ♦ active brake booster C149-3, circuit CCA22 (GY/YE), harness side.	**Yes** GO to H5 . **No** REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test.

ABS Module	Circuit	Active Brake Booster
C155-17	CCA22 (GY/YE)	C149-3
C155-31	VCA22 (GN/BN)	C149-4



 N0105775 • **Are the resistances greater than 10,000 ohms?**	
H5 CHECK CIRCUITS VCA22 (GN/BN) AND CCA22 (GY/YE) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ active brake booster C149-4, circuit VCA22 (GN/BN), harness side. ♦ active brake booster C149-3, circuit CCA22 (GY/YE), harness side.  N0105774 • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTC. REPEAT the self-test. **No** GO to H6 .
H6 CHECK THE ACTIVE BRAKE BOOSTER SOLENOID FOR CORRECT OPERATION	
• Ignition OFF. • Connect: Active Brake Booster C149. • Connect: ABS Module C155. • Ignition ON. • Start the engine and wait approximately one minute to create vacuum in the brake booster and then turn the ignition switch to the OFF position. • Disconnect: ABS Module C155. • Connect a jumper wire between ABS module C155-31, circuit VCA22 (GN/BN), harness side and ground. • While observing the brake pedal for movement, connect a fused jumper wire for approximately 2 seconds between ABS module C155-17, circuit CCA22 (GY/YE), harness side and the positive battery post. • **Does the brake pedal move?**	**Yes** GO to H7 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTC. REPEAT the self-test.
H7 CHECK FOR CORRECT ABS MODULE OPERATION	
• Check ABS module C155 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155.	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No**

• Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: DTC C1287

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The active brake booster has a normally open and a normally closed pedal force switch that operates according to driver brake applications.

In the normally open position, the brake booster pedal force switch connects circuit CCA29 (GN/BU) to circuit CCA25 (VT/GY). In the normally closed position, the switch connects circuit CCA29 (GN/BU) to circuit CCA26 (BU/GY).

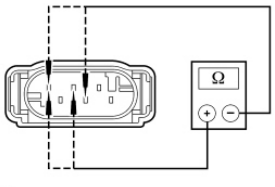
- DTC C1287 Brake Booster Pedal Force Switch Circuit Failure - If the ABS module detects an open, a short to voltage or a short to ground on the booster pedal force switch circuits, or if the switch input does not agree with other brake pedal inputs, DTC C1287 will be set.

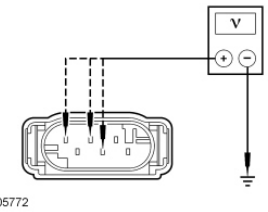
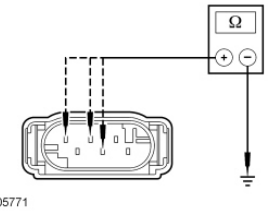
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Active brake booster
- ABS module

PINPOINT TEST I: DTC C1287

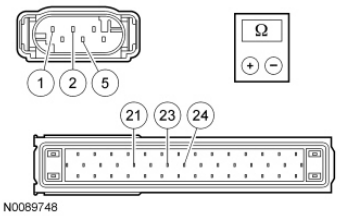
NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
I1 CHECK THE DTCs FROM THE SELF-TEST	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • Retrieve and record any ABS module DTCs. • **Are any DTCs retrieved?**	**Yes** If DTC C1287 is retrieved GO to I2 . If any other DTC is retrieved, GO to the ABS Module DTC Chart. **No** The system is operating correctly at this time.
I2 CHECK THE BRAKE BOOSTER PEDAL FORCE SWITCH NORMALLY CLOSED POSITION	
NOTE: To access C149, position the Battery Junction Box (BJB) aside.	**Yes** GO to I3 . **No**

• Ignition OFF. • Disconnect: Active Brake Booster C149. • Measure the resistance between active brake booster C149 pin-5 and pin-2, component side, while pressing and releasing the brake pedal. • **Is the resistance less than 5 ohms with the brake pedal released and greater than 10,000 ohms with the brake pedal applied?**	INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTC. REPEAT the self-test.
I3 CHECK THE BRAKE BOOSTER PEDAL FORCE SWITCH NORMALLY OPEN POSITION	
• Measure the resistance between active brake booster C149 pin-5 and pin-1, component side, while pressing and releasing the brake pedal. • **Is the resistance greater than 10,000 ohms with the brake pedal released and less than 5 ohms with the brake pedal applied?**	**Yes** GO to I4 . **No** INSTALL a new active brake booster. REFER to Section 206-07 . CLEAR the DTC. REPEAT the self-test.
I4 CHECK THE PEDAL FORCE SWITCH CIRCUITS FOR A SHORT TOGETHER	
• Disconnect: ABS Module C155. • Measure the resistance between: ♦ active brake booster C149-1, circuit CCA26 (BU/GY), harness side and active brake booster C149-2, circuit CCA25 (VT/GY), harness side. ♦ active brake booster C149-2, circuit CCA25 (VT/GY), harness side and active brake booster C149-5, circuit CCA29 (GN/BU), harness side. ♦ active brake booster C149-1, circuit CCA26 (BU/GY), harness side, and active brake booster C149-5, circuit CCA29 (GN/BU), harness side.  N0105773 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to I5 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
I5 CHECK THE PEDAL FORCE SWITCH CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and: ♦ active brake booster C149-1, circuit CCA26 (BU/GY), harness side. ♦ active brake booster C149-2, circuit CCA25 (VT/GY), harness side.	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to I6 .

♦ active brake booster C149-5, circuit CCA29 (GN/BU), harness side.  N0105772 • **Is any voltage present?**	
I6 CHECK THE PEDAL FORCE SWITCH CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and: ♦ active brake booster C149-1, circuit CCA26 (BU/GY), harness side. ♦ active brake booster C149-2, circuit CCA25 (VT/GY), harness side. ♦ active brake booster C149-5, circuit CCA29 (GN/BU), harness side.  N0105771 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to I7 . **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
I7 CHECK THE PEDAL FORCE SWITCH CIRCUITS FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the ABS module connector, harness side and the active brake booster connector, harness side as indicated in the following chart:	**Yes** GO to I8 . **No** REPAIR the affected circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test.

Active Brake Booster	Circuit	ABS Module
C149-1	CCA26 (BU/GY)	C155-23
C149-2	CCA25 (VT/GY)	C155-24
C149-5	CCA29 (GN/BU)	C155-21

 • **Are the resistances less than 5 ohms?**	
I8 CHECK FOR CORRECT ABS MODULE OPERATION	
• Check ABS module C155 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: DTC C1288 and C1440

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module monitors the pressure of the hydraulic brake system through the use of a brake pressure transducer. The brake pressure transducer is internal to the Hydraulic Control Unit (HCU). The brake pressure transducer can not be serviced separately. If a new brake pressure transducer is needed, a new HCU must be installed.

- DTC C1288 Pressure Transducer Main / Primary Input Circuit Failure - If there is an improper connection between the ABS module and HCU , if the brake pressure transducer is faulted or if the ABS module is faulted internally, this DTC will set.
- DTC C1440 Pressure Transducer Main / Primary Signal Faulted - If there is an improper connection between the ABS module and the HCU , if there is air in the hydraulic brake system, if the brake pressure transducer is faulted or if the ABS module is faulted internally, this DTC will set.

This pinpoint test is intended to diagnose the following:

- HCU
- ABS module

PINPOINT TEST J: DTC C1288 AND C1440

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
J1 MONITOR THE PCM BRAKE ON/OFF (BOO) PID	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - PCM. • Press and release the brake pedal while monitoring the BOO PID. • **Does the PID switch to ON with the brake pedal pressed and then to OFF with the brake pedal released?**	**Yes** GO to J2 . **No** RETRIEVE any PCM DTCs. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for non-communication DTCs and REFER to Section 418-00 for any communication DTCs.
J2 REVIEW THE ABS MODULE DTCs	
• Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • Retrieve and record any ABS module DTCs. • **Is DTC C1288 or C1440 present?**	**Yes** GO to J4 . **No** GO to J3 .
J3 CHECK FOR RETURNING DTCs	
• Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Drive the vehicle in a straight line at a speed greater than 40 km/h (25 mph) for at least 60 seconds. • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • Retrieve and record any ABS module DTCs. • **Is DTC C1288 or C1440 present?**	**Yes** For DTC C1288, GO to J5 . For DTC C1440, GO to J4 . **No** The concern is not present at this time. TEST the vehicle for normal operation.
J4 CARRY OUT THE ABS SERVICE BLEED	
• Carry out the Brake System Service Bleed, Refer to Section 206-00 . Clear the DTCs. Repeat the self-test. • Ignition ON.	**Yes** GO to J6 . **No** The system is operating correctly at this time. The concern may have been caused by air trapped in the hydraulic brake system.

• Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Drive the vehicle in a straight line at a speed greater than 40 km/h (25 mph) for at least 60 seconds. • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • **Is DTC C1288 or C1440 present?**	TEST the system for normal operation.
J5 CHECK THE ABS TO HCU CONNECTION	
• Ignition OFF. • Disconnect: ABS Module C155. • Remove the ABS module. Refer to Anti-Lock Brake System (ABS) Module in this section. • Inspect the ABS module-to- HCU mating surfaces for damage or contamination. • **Are the ABS-to- HCU mating surfaces OK?**	**Yes** GO to J7 . **No** INSTALL a new ABS module and a new HCU . REFER to Hydraulic Control Unit (HCU) and Anti-Lock Brake System (ABS) Module in this section.
J6 CHECK THE ABS MAIN BRAKE PRESSURE (MPRETDR) PID	
• If not already done, separate the ABS module from the HCU . Refer to Anti-Lock Brake System (ABS) Module in this section. • With the ABS module separated from the HCU , connect ABS module C155. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module . • Monitor the MPRETDR PID. • **Is the PID value between 21.13K and 22.59K?**	**Yes** INSTALL a new HCU . REFER Hydraulic Control Unit (HCU) in this section. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. TEST the system for normal operation.
J7 CHECK FOR CORRECT ABS MODULE OPERATION	
• Check ABS module C155 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the connector seats correctly, then operate the system and verify the concern is still present.	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

• **Is the concern still present?**	

Pinpoint Test K: DTCs C1279, C1280, C1281, C1282, C1516, C1517, C2769 and C2770

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The yaw rate sensor, roll rate sensor, lateral accelerometer and longitudinal accelerometer are contained in one module called the stability control sensor cluster. The sensor cluster measures the vehicle acceleration, roll rate and yaw rate, then sends the signal along a dedicated Controller Area Network 2 (CAN2) bus to the ABS module.

Voltage is supplied from the ABS module to the sensor cluster along circuit CCA09 (VT/BN) and ground is provided through the ABS module along circuit RCA09 (GN/VT). Circuits VCA23 (BU/WH) and VCA24 (GN/OG) make up the CAN2 bus between the ABS module and the sensor cluster.

DTC Description	Fault Trigger Conditions
• DTC C1279 Yaw Rate Sensor Circuit Failure • DTC C1280 Yaw Rate Sensor Signal Fault • DTC C1281 Lateral Accelerometer Circuit Failure • DTC C1282 Lateral Accelerometer Signal Fault • DTC C1516 Roll Rate Sensor Signal Fault • DTC C1517 Roll Rate Sensor Circuit Failure • DTC C2769 Longitudinal Acceleration Sensor Electrical Failure • DTC C2770 Longitudinal Acceleration Sensor Plausibility Failure	If the sensor cluster is loose or not mounted correctly, if a signal from the sensor cluster is out of range or does not agree with input from the steering wheel rotation sensor or if the one of the sensors internal to the sensor cluster has faulted, the appropriate DTC will set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Stability control sensor cluster

- ABS module

PINPOINT TEST K: DTCs C1279, C1280, C1281, C1282, C1516, C1517, C2769 AND C2770

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

NOTE: The yaw rate sensor, roll rate sensor, lateral accelerometer and longitudinal accelerometer are integral to the sensor cluster.

NOTE: The vehicle must be on level ground, not on a hoist and at a complete standstill. Any vehicle movement will result in false values for this test.

Test Step	Result / Action to Take
K1 CHECK THE ABS MODULE DTCs	
• Review the ABS module DTCs retrieved and recorded during Inspection and Verification. • **Is DTC B2741, C1963, C2777 C2778 or U1901 also present?**	**Yes** GO to Pinpoint Test G . **No** GO to K2 .
K2 CHECK THE SENSOR CLUSTER INSTALLATION AND MOUNTING SURFACE	
• Inspect the sensor cluster installation and make sure that the nuts are fully seated and tightened correctly. Refer to Stability Control Sensor Cluster . • Inspect the mounting surface for damage, corrosion or dirt. • **Is the sensor cluster installed correctly and is the mounting surface clean and free from damage?**	**Yes** GO to K3 . **No** REPAIR or INSTALL new as necessary. CLEAR the DTC. REPEAT the self-test.
K3 CHECK THE STEERING WHEEL ROTATION SENSOR CONDITION AND INSTALLATION	
• Inspect the steering wheel rotation sensor and slotted-wheel for damage and correct installation. Refer to Steering Wheel Rotation Sensor in this section. • **Are the sensor and slotted-wheel installed correctly and undamaged?**	**Yes** GO to K4 . **No** REINSTALL or INSTALL new as necessary. CLEAR the DTCs. REPEAT the self-test.
K4 CHECK FOR RETURNING ABS MODULE DTCs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Clear All CMDTCs . • Drive the vehicle in a straight line at a speed greater than 40 km/h (25 mph) for at least 60 seconds. • Enter the following diagnostic mode on the scan tool: Self Test - ABS Module . • Retrieve and record any ABS module DTCs.	**Yes** GO to K5 . **No** The system is operating correctly at this time. TEST the system for normal operation.

• **Are any of the DTCs listed in Normal Operation for Pinpoint Test K retrieved?**	
K5 ISOLATE THE SENSOR CLUSTER	
• Disconnect: Sensor Cluster C3073. • Check sensor cluster C3073 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: Sensor Cluster C3073. • Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: DTC B2900

Normal Operation

When the ignition is turned to the RUN position, the ABS module and the PCM share Vehicle Identification Number (VIN) information over the High Speed Controller Area Network (HS-CAN) bus.

- DTC B2900 VIN Mismatched - If the VIN information stored in the ABS module does not match the information transmitted by the PCM, DTC B2900 will set.

This pinpoint test is intended to diagnose the following:
- Module configuration
- ABS module

PINPOINT TEST L: DTC B2900

Test Step	Result / Action to Take
L1 VERIFY THE PCM VIN	
• Connect the scan tool. • Ignition ON. • Using the scan tool, carry out the Network Test. • Enter the following diagnostic mode on the scan tool: Log Viewer. • Compare the VIN in Log Viewer to the vehicle VIN plate. • **Does the VIN in Log Viewer match the vehicle VIN plate?**	**Yes** GO to L2 . **No** RECONFIGURE the PCM. FOLLOW the instructions on the scan tool. CLEAR the DTCs. CYCLE the ignition key. REPEAT the self-test.
L2 VERIFY THE ABS MODULE PART NUMBER	
• Retrieve and record the ABS module part number from Log Viewer and verify that the vehicle has the correct	**Yes** CONFIGURE the ABS module. REFER to Section 418-01 , Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original

ABS module installed. • **Is the correct ABS module installed in the vehicle?**	Module is NOT Available. CLEAR the DTC. CYCLE the ignition key. REPEAT the self-test. **No** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTC. CYCLE the ignition key. REPEAT the self-test.

Pinpoint Test M: DTC C1996

Normal Operation

The ABS module uses information received from several sensors (wheel speed sensors, steering wheel rotation sensor, stability control sensor cluster) to determine if a vehicle instability event is about to occur. If an event is going to occur, the ABS module will adjust brake torque at specific wheels and the PCM will reduce engine torque to make the vehicle more stable. Once the ABS module has determined that the stability event has been corrected, it will return brake and engine torque to normal and continue to monitor the vehicle.

- DTC C1996 Active Yaw and/or Roll Control Disabled - The ABS module monitors the stability event and is programmed to set DTC C1996 and disable the stability control system if the stability event lasts longer than 15 seconds.

This pinpoint test is intended to diagnose the following:

- Steering wheel rotation sensor
- Stability control sensor cluster
- Wheel speed sensors
- ABS module

PINPOINT TEST M: DTC C1996

Test Step	Result / Action to Take
M1 CHECK THE WHEEL SPEED SENSOR PIDs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module . • While driving the vehicle, have an assistant monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • **Do all the PIDs match the vehicle speed and match each other?**	**Yes** GO to M6 . **No** GO to M2 .

M2 INSPECT THE WHEEL SPEED SENSOR MOUNTING	
• Ignition OFF. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Verify the bolt of the suspect wheel speed sensor is tightened to specifications. • **Is the bolt tightened to specifications?**	**Yes** GO to M3 . **No** TIGHTEN the wheel speed sensor bolt to specification. REFER to Specifications in this section. CLEAR the DTCs.
M3 INSPECT THE WHEEL SPEED SENSOR AND HARNESS FOR DAMAGE	
• **NOTE:** Examine the wheel speed sensor harness carefully with a good light source. Failure to verify damage in the sensor harness can lead to unnecessary installation of a new component. • Inspect the suspect wheel speed sensor and harness for cuts, broken tabs, broken casing and/or corrosion. • **Are the wheel speed sensor and harness OK?**	**Yes** GO to M4 . **No** INSTALL a new wheel speed sensor. REFER to Wheel Speed Sensor - Front or Wheel Speed Sensor - Rear in this section. CLEAR the DTCs. REPEAT the self-test.
M4 INSPECT THE WHEEL SPEED SENSOR RING FOR DAMAGE	
• **NOTE:** Examine the wheel speed sensor ring carefully with a good light source. Failure to verify damage in the sensor ring can lead to unnecessary installation of a new component. • Inspect the suspect wheel speed sensor ring for cracks, chips or missing teeth. Rotate the wheel to verify that no teeth are missing. • **Is the wheel speed sensor ring OK?**	**Yes** GO to M5 . **No** INSTALL a new wheel hub and bearing assembly (wheel speed sensor rings are part of the wheel hub and bearing assembly). Refer to the appropriate section in Group 204 for the procedure. CLEAR the DTCs. REPEAT the self-test.
M5 INSPECT THE WHEEL BEARING FOR DAMAGE AND LOOSENESS	
• Verify that the wheel bearing has no end-play and is undamaged. • **Is the wheel bearing OK?**	**Yes** GO to M6 . **No** INSTALL a new wheel hub and bearing assembly. Refer to the appropriate section in Group 204 for the procedure. CLEAR the DTCs. REPEAT the self-test.
M6 CHECK THE ABS MODULE YAW RATE (YAWRATE) PID	
• **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement results in false values for this test. • Monitor the YAWRATE PID.	**Yes** GO to M7 . **No** GO to M10 .

• **Is the YAWRATE PID value between -2.0 and +2.0?**	
M7 CHECK THE ABS MODULE LATERAL ACCELERATION (LAT_ACCL) PID	
• **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement results in false values for this test. • Monitor the LAT_ACCL PID. • **Is the LAT_ACCL PID value between -0.4 and 0.4?**	**Yes** GO to M8 . **No** GO to M10 .
M8 CHECK THE ABS MODULE LONGITUDINAL ACCELERATION (LONG_ACCL) PID	
• **NOTE:** The vehicle must be on level ground and at a complete standstill. Any vehicle movement results in false values for this test. • Monitor the LONG_ACCL PID. • **Is the LONG_ACCL PID value between -0.4 and 0.4?**	**Yes** GO to M9 . **No** GO to M10 .
M9 CHECK THE ABS MODULE ROLL RATE (ROLLRAT) PID	
NOTE: The vehicle must be on level ground and at a complete standstill. Any vehicle movement will result in false values for this test. • Monitor the ROLLRAT PID. • **Is the ROLLRAT PID value between -0.05 and 0.05?**	**Yes** GO to M11 . **No** GO to M10 .
M10 CHECK THE SENSOR CLUSTER INSTALLATION AND MOUNTING SURFACE	
• Inspect the sensor cluster installation and make sure that the nuts are fully seated and tightened correctly. Refer to Stability Control Sensor Cluster . • Inspect the mounting surface for damage, corrosion or dirt. • **Is the sensor cluster installed correctly and is the mounting surface clean and free from damage?**	**Yes** INSTALL a new sensor cluster. REFER to Stability Control Sensor Cluster in this section. CLEAR the DTC. REPEAT the self-test. **No** REPAIR or INSTALL new as necessary. CLEAR the DTC. REPEAT the self-test.
M11 CHECK THE STEERING WHEEL ANGLE SENSOR POSITION (SWA POS) PID	
• Monitor the SWA POS PID while rotating the steering wheel clockwise and	**Yes** GO to M12 .

counterclockwise very slowly, from lock to lock. • **Does the PID change in intervals of 4.5 degrees and show a 360-degree increase for each complete revolution of the steering wheel?**	**No** INSTALL a new steering wheel rotation sensor. REFER to Steering Wheel Rotation Sensor in this section. CLEAR the DTCs. REPEAT the self-test.
M12 CHECK FOR CORRECT ABS MODULE OPERATION	
• Disconnect: ABS Module C155. • Check the connector for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the ABS module electrical connector is fully seated, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Traction Control, ESC and RSC® Systems Cannot Be Disabled

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

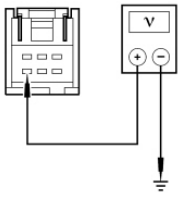
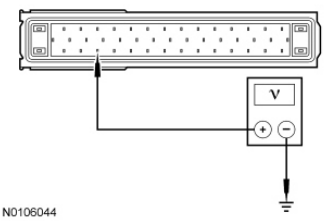
When one or more drive wheels lose traction and begin to spin, the ABS module sends a request to the PCM over the High Speed Controller Area Network (HS-CAN) bus to modulate the engine torque. This is achieved by regulating fuel and spark to the cylinders. At the same time, the ABS module operates the hydraulic pump motor and the appropriate hydraulic valves to actuate the brake calipers and sends a message to the Instrument Cluster (IC) along the HS-CAN bus to flash the stability/traction control indicator "sliding-car icon". The system can be disabled pressing the stability/traction control switch. When the switch is pressed, the ABS receives a voltage signal and will ignore any stability/traction control events until the switch is pressed again or the ignition switch is cycled.

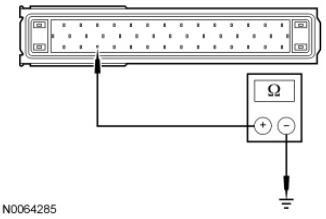
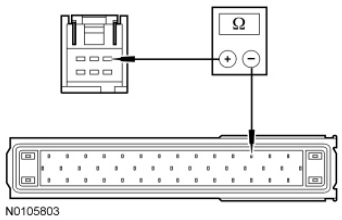
Fused ignition voltage is sent to the stability/traction control switch from Smart Junction Box (SJB) fuse 18 (10A) along circuit CBP18 (GY/OG). When pressed, the switch closes and momentarily connects circuit CBP18 (GY/OG) to circuit CCA15 (YE/GY) sending the voltage to the ABS module along circuit CCA15 (YE/GY). The ABS module sends a message to the IC along the HS-CAN bus to illuminate the stability/traction control indicator.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Stability traction control switch
- ABS module

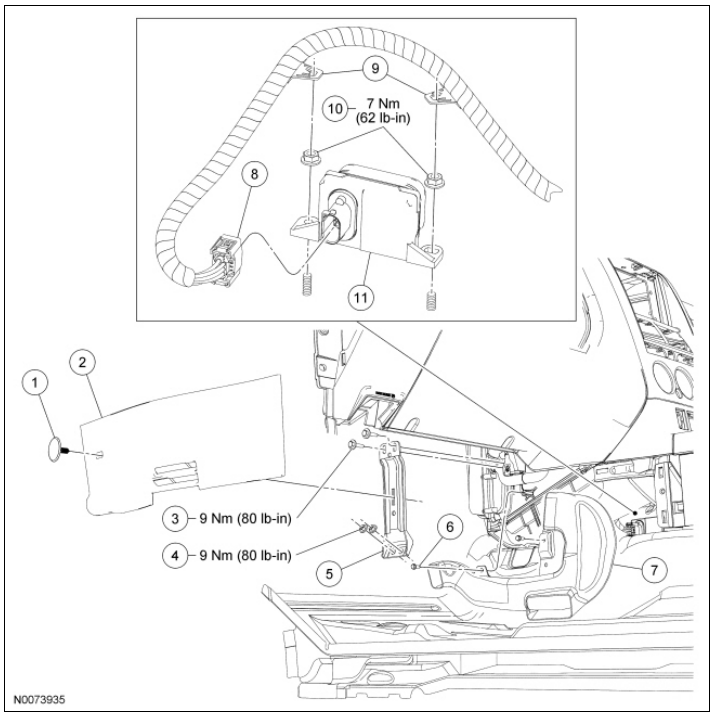
PINPOINT TEST N: THE TRACTION CONTROL, ESC AND RSC® SYSTEMS CANNOT BE DISABLED

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
N1 CHECK THE VOLTAGE TO THE STABILITY/TRACTION CONTROL SWITCH	
• Ignition OFF. • Disconnect: Stability/Traction Control Switch C280. • Ignition ON. • Measure the voltage between stability/traction control switch C280-6, circuit CBP18 (GY/OG), harness side and ground.  N0073750 • **Is the voltage greater than 10 volts?**	**Yes** GO to N2 . **No** VERIFY SJB fuse 18 (10A) is OK. If OK, REPAIR circuit CBP18 (GY/OG). If the fuse is not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. TEST the system for normal operation.
N2 CHECK THE STABILITY TRACTION CONTROL SWITCH	
• Measure the resistance between stability/traction control switch C280 pin-1 and pin-6, component side while pressing and releasing the switch. • **Is the resistance less than 5 ohms with the switch pressed and greater than 10,000 ohms with the switch released?**	**Yes** GO to N3 . **No** INSTALL a new stability/traction control switch. REFER to Stability/Traction Control Switch in this section. TEST the system for normal operation.
N3 CHECK CIRCUIT CCA15 (YE/GY) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between ABS module C155-4, circuit CCA15 (YE/GY), harness side and ground.  N0106044 • **Is any voltage present?**	**Yes** REPAIR circuit CCA15 (YE/GY). TEST the system for normal operation. **No** GO to N4 .

N4 CHECK CIRCUIT CCA15 (YE/GY) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ABS module C155-4, circuit CCA15 (YE/GY), harness side and ground.  N0064285 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to N5 . **No** REPAIR circuit CCA15 (YE/GY). TEST the system for normal operation.
N5 CHECK CIRCUIT CCA15 (YE/GY) FOR AN OPEN	
• Measure the resistance between ABS module C155-4, circuit CCA15 (YE/GY), harness side and stability/traction control switch C280-1, circuit CCA15 (YE/GY), harness side.  N0105803 • **Is the resistance less than 5 ohms?**	**Yes** GO to N6 . **No** REPAIR circuit CCA15 (YE/GY). TEST the system for normal operation.
N6 CHECK FOR CORRECT ABS MODULE OPERATION	
• Check ABS module C155 for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect: ABS Module C155. • Make sure the connector seats correctly, then operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Stability Control Sensor Cluster



Item	Part Number	Description
1	31172	Pin-type retainer
2	04608	LH floor console finish panel
3	W707491	LH instrument panel brace bolt (2 required)
4	W707137	LH instrument panel brace nut (2 required)
5	044F48	LH instrument panel brace
6	W707281	LH floor heater duct bolt
7	18C433A	LH floor heater duct
8	-	Stability control sensor cluster electrical connector (part of 2C011)
9	-	Stability control sensor cluster harness retainers (part of 2C011)
10	W700101	Stability control sensor cluster bracket nuts (2 required)
11	3C187	Stability control sensor cluster

Removal and Installation

NOTE: When installing a new stability control sensor cluster, the ABS module must be calibrated. Follow the scan tool directions for the calibration procedures.

1. Remove the pin-type retainer and the LH floor console finish panel.

2. Remove the 2 bolts, 2 nuts and the LH instrument panel brace.
   - To install, tighten to 9 Nm (80 lb-in).

3. Remove the 2 bolts and LH floor heater duct.

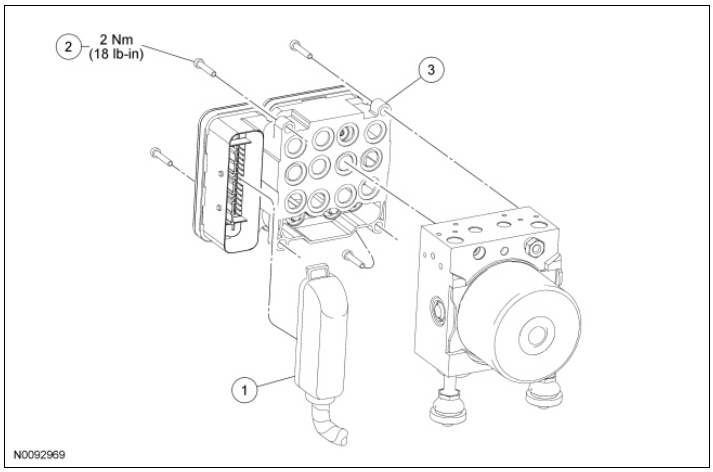
4. Disconnect the stability control sensor cluster electrical connector.

5. Remove the stability control sensor cluster electrical harness retainers and position aside.

6. Remove the 2 stability control sensor cluster bracket nuts and the stability control sensor cluster.
    - To install, tighten to 7 Nm (62 lb-in).

7. To install, reverse the removal procedure.

Anti-Lock Brake System (ABS) Module



Item	Part Number	Description
1	-	ABS module electrical connector (part of 14398)
2	2M101	ABS module screw (4 required)
3	2C219	ABS module

Removal and Installation

NOTICE: **Electronic modules are sensitive to electrical charges. The Anti-lock Brake System (ABS) module can be damaged if exposed to these charges.**

NOTE: When installing a new ABS module, it must be configured (using vehicle as-built data) and calibrated. Follow the scan tool directions for the calibration procedures. For module configuration, refer to Programmable Module Installation in Section 418-01 .

1. Remove the Hydraulic Control Unit (HCU). For additional information, refer to Hydraulic Control Unit (HCU) in this section.

2. Remove the 4 screws and the ABS module.
   - To install, tighten to 2 Nm (18 lb-in).

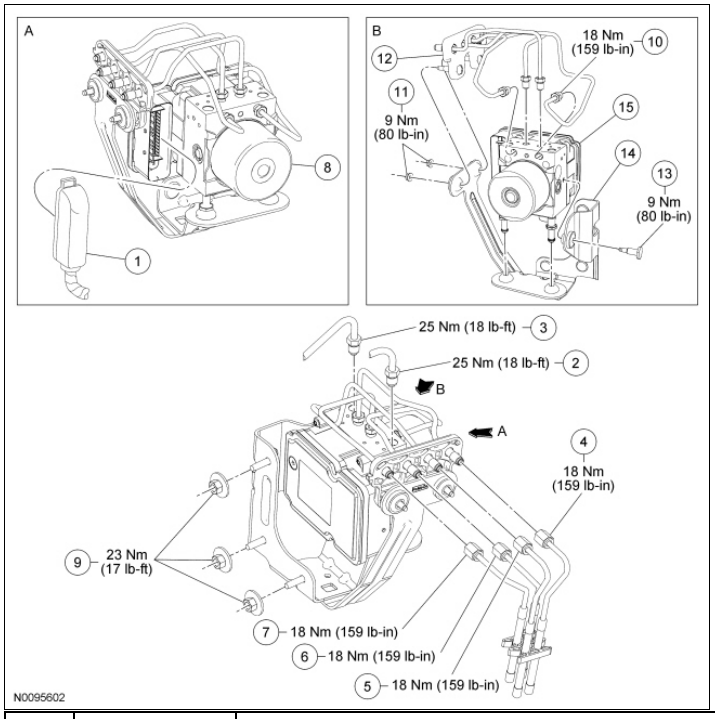
3. ***NOTICE:*** **Make sure that the Anti-lock Brake System (ABS) module is properly seated to the Hydraulic Control Unit (HCU) and that the torque of the ABS module screws is correct, or damage to the components can occur.**

   To install, reverse the removal procedure.

Hydraulic Control Unit (HCU)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1



Item	Part Number	Description
1	-	ABS module electrical connector (part of 14398)
2	2234A	Master cylinder primary brake tube-to-Hydraulic Control Unit (HCU) fitting
3	2234B	Master cylinder secondary brake tube-to- HCU fitting
4	2263	RH front brake tube-to- HCU extension tube fitting
5	2264	LH front brake tube-to- HCU extension tube fitting
6	2C008A	RH rear brake tube-to- HCU extension tube fitting
7	2C008B	LH rear brake tube-to- HCU extension tube fitting
8	2C215	HCU assembly
9	W803826	HCU bracket-to-frame nuts (3 required)
10	-	HCU extension tube-to- HCU fitting (4 required) (part of 2C296)
11	N803826	HCU bracket-to- HCU extension tube retainer nuts

12	2C296	HCU extension tube retainer assembly
13	2M101B	HCU bracket-to- HCU bolt
14	2C304	HCU bracket
15	2C215	HCU

Removal and Installation

⚠ WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the battery tray. For additional information, refer to Section 414-01 .

3. Disconnect the ABS module electrical connector.

4. **NOTE:** The brake tubes must be installed in the same location as removed.

   Disconnect the master cylinder primary and secondary brake tube-to-Hydraulic Control Unit (HCU) fittings and position both brake tubes aside.

   - To install, tighten to 25 Nm (18 lb-ft).

5. **NOTE:** The brake tubes must be installed in the same location as removed.

   Disconnect the 4 brake tube-to- HCU extension tube fittings.

   - To install, tighten to 18 Nm (159 lb-in).

6. Remove the 3 HCU bracket-to-frame nuts and the HCU assembly.
   - To install, tighten the nuts to 23 Nm (17 lb-ft).

7. **NOTE:** The brake tubes must be installed in the same location as removed.

   Disconnect the 4 HCU extension tube-to- HCU fittings.

   - To install, tighten to 18 Nm (159 lb-in).

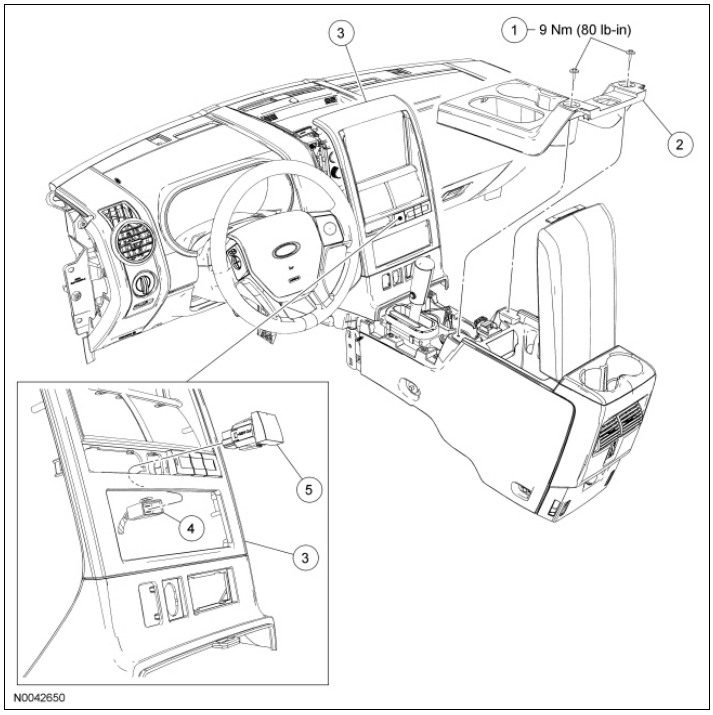
8. Remove the 2 HCU bracket-to- HCU extension tube retainer nuts and the extension tube retainer assembly.
   - To install, tighten the nuts to 9 Nm (80 lb-in).

9. Remove the HCU bracket-to- HCU bolt and the HCU bracket.
   - To install, tighten the bolts to 9 Nm (80 lb-in).

10. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to Section 206-00 .

Stability/Traction Control Switch

Removal and Installation



Item	Part Number	Description
1	W705796	Floor console center finish panel screws
2	78045B44	Floor console center finish panel
3	7804302	Instrument panel center finish panel
4	-	Stability/traction control switch electrical connector (part of 14401)
5	14B079	Stability/traction control switch

1. Remove the 2 floor console center finish panel screws and the floor console center finish panel.
   - To install, tighten to 9 Nm (80 lb-in).

2. Apply the parking brake.

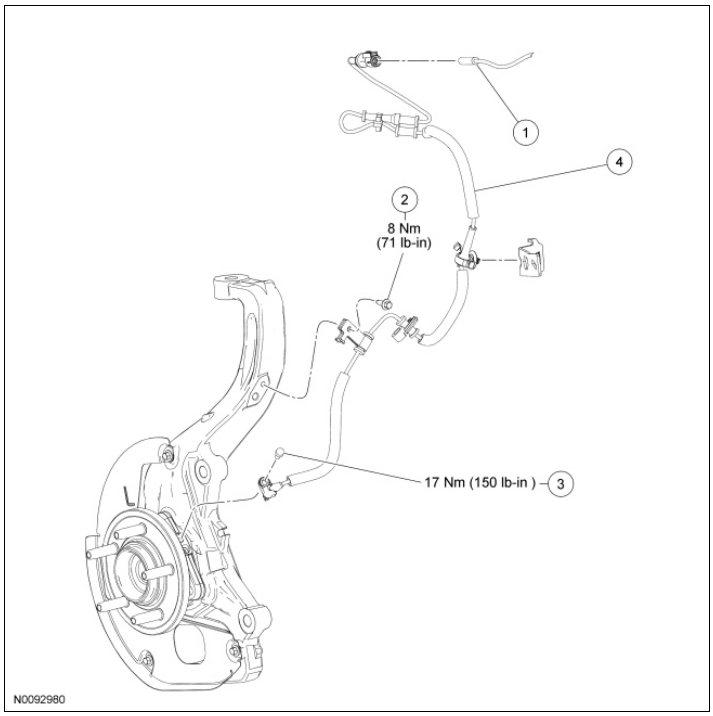
3. Move the gear selector lever to the D1 position.

4. Position the instrument panel center finish panel away from the instrument panel.

5. Disconnect the stability/traction control switch electrical connector and remove the stability/traction control switch from the instrument panel center finish panel.

6. To install, reverse the removal procedure.

Wheel Speed Sensor - Front



Item	Part Number	Description
1	14398	Wheel speed sensor electrical connector
2	W500212	Wheel speed sensor harness bolt
3	-	Wheel speed sensor bolt (part of 2C204)
4	2C204	Wheel speed sensor

Removal and Installation

1. Remove the front brake disc. For additional information, refer to Section 206-03 .

2. Disconnect the wheel speed sensor electrical connector.

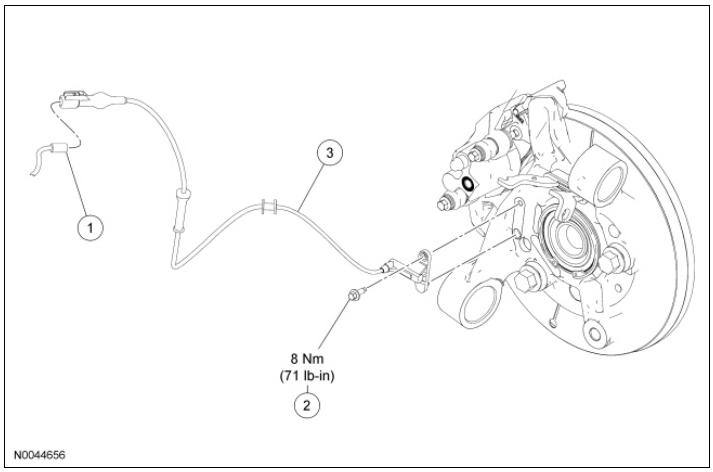
3. Remove the wheel speed sensor harness bolt.
   - To install, tighten to 8 Nm (71 lb-in).

4. Remove the wheel speed sensor harness pin-type retainers.

5. Remove the wheel speed sensor bolt and the wheel speed sensor.
   - To install, tighten the bolt to 17 Nm (150 lb-in).

6. To install, reverse the removal procedure.

Wheel Speed Sensor - Rear



Item	Part Number	Description
1	-	Wheel speed sensor electrical connector (part of 14407)
2	W500212	Wheel speed sensor bolt
3	2C216 LH/ 2C190 RH	Wheel speed sensor

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the wheel speed sensor electrical connector.

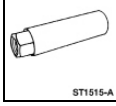
3. Disconnect the wheel speed harness from the retainers.

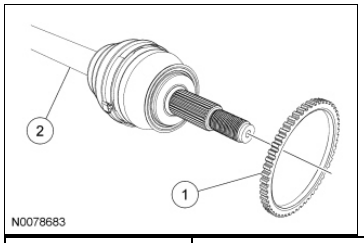
4. Remove the wheel speed sensor bolt and the wheel speed sensor.
   - To install, tighten to 8 Nm (71 lb-in).

5. To install, reverse the removal procedure.

Wheel Speed Sensor Ring - Rear

Special Tool(s)

 ST2132-A	Installer, Wheel Speed Sensor Ring 206-084/1
 ST1515-A	Installer, Wheel Speed Sensor Ring 206-084/2



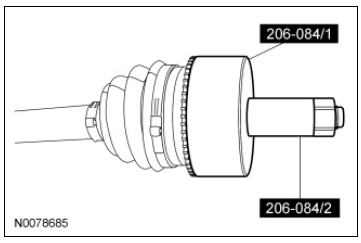
Item	Part Number	Description
1	2C182	Wheel speed sensor ring
2	4K138	Halfshaft

Removal

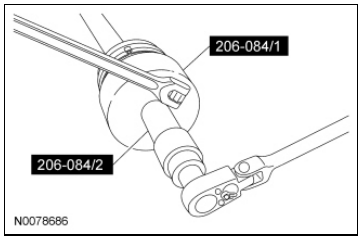
1. Remove the rear halfshaft. For additional information, refer to Section 205-05 .
2. Using a suitable driver, remove the ABS wheel speed sensor ring.

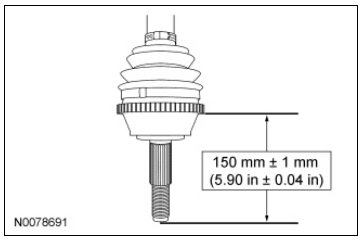
Installation

1. Install the new ABS wheel speed sensor and the Wheel Speed Sensor Ring Installers on the halfshaft as shown.

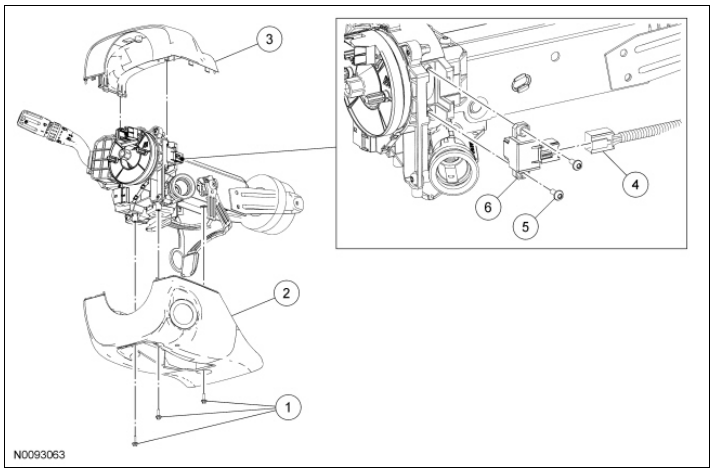


2. Using the Wheel Speed Sensor Ring Installers, install the ABS wheel speed sensor ring as shown.


206-084/1
206-084/2
N0078686


150 mm ± 1 mm
(5.90 in ± 0.04 in)
N0078691

Steering Wheel Rotation Sensor



Item	Part Number	Description
1	W707658	Lower steering column cover bolts
2	3F914	Lower steering column cover
3	3F914	Upper steering column cover
4	-	Steering wheel rotation sensor electrical connector (part of 14401)
5	N807493	Steering wheel rotation sensor screw (2 required)
6	3F818	Steering wheel rotation sensor

Removal and Installation

1. Remove the 3 lower steering column cover bolts and the lower steering column cover.
2. Remove the upper steering column cover.
3. Disconnect the steering wheel rotation sensor electrical connector.
4. Remove the 2 screws and the steering wheel rotation sensor.
5. To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	11.7L (12.4 qt)
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	-

General Specifications

Item	Specification
Transmission Fluid	
NOTICE: **Use transmission fluid that is recommended for this transmission, the use of any other transmission fluid may result in transmission failure.** • Normal maintenance: ♦ Transmission fluid change not necessary, filled for life. • Severe duty maintenance: ♦ Change the transmission fluid at 48,000 km (30,000 mi) intervals.	
NOTE: Approximate dry capacity, includes transmission fluid cooler and transmission fluid cooler tubes. Transmission fluid level procedures in this section should be used to determine actual transmission fluid requirements and transmission fluid specification. DO NOT OVERFILL. If it is necessary to add or change transmission fluid, use only transmission fluid that is recommended for this transmission.	
Transmission Fluid Filter	
In-Line Transmission Fluid Filter Kit	7B155
In-Line Transmission Fluid Filter	7B155

Assembly Weight

Description	Specification
Rear Wheel Drive (RWD)	85.2 kg (188 lb)
Four-Wheel Drive (4WD)	83.2 kg (183 lb)

End Play Specifications

Transmission Overdrive End Play Dimension D	Select Thrust Washer (No. 1 Nylon)		ID: Color
	Part Number	Thickness	
38.05-38.13 mm (1.498-1.501 in)	F7TZ-TA	1.55-1.60 mm (0.061-0.062 in)	White
38.14-38.28 mm (1.50-1.51 in)	F7TZ-MA	1.75-1.80 mm (0.068-0.07 in)	Green
38.29-38.42 mm (1.507-1.513 in)	F7TZ-NA	1.85-1.90 mm (0.072-0.074 in)	Red
38.43-38.61 mm (1.51-1.52 in)	F7TZ-RA	2.05-2.10 mm (0.08-0.082 in)	Black
38.62-38.74 mm (1.52-1.53 in)	F7TZ-SA	2.15-2.20 mm (0.084-0.086 in)	Yellow

End Play Specifications

Rear (No. 4) Dimension E	Selective Needle Bearings (No. 4)		ID: Notches
	Part Number	Thickness	
1.69-1.87 mm (0.066-0.073 in)	XW4Z-7D014-CA	2.65-2.80 mm (0.104-0.11 in)	0
1.88-2.04 mm (0.074-0.08 in)	XW4Z-7D014-DA	2.83-2.98 mm (0.111-0.117 in)	1
2.05-2.22 mm (0.08-0.087 in)	XW4Z-7D014-EA	3.01-3.16 mm (0.118-0.124 in)	2
2.23-2.43 mm (0.087-0.095 in)	XW4Z-7D014-FA	3.21-3.36 mm (0.126-0.132 in)	3

Band Adjustment and Torque Chart

Description	Number of Turns to Back Off	Locknut		Adjusting Screw	
		Nm	Lb-Ft	Nm	Lb-in
Intermediate Band	2.0	54	40	14	124
Overdrive (O/D) Band	2.0	54	40	14	124

Selective Snap Rings

Coast and Direct Clutch Drum				
Part Number	Thickness		Diameter	
	mm	In	mm	In
E860126-S	1.37	0.053	130.1	5.122
E860127-S	1.73	0.068	130.1	5.122
E860128-S	2.08	0.081	130.1	5.122
E860129-S	2.44	0.096	130.1	5.122

Selective Snap Rings

Forward Clutch Cylinder				
Part Number	Thickness		Diameter	
	mm	In	mm	In
XW4Z-7D483-AB	1.73	0.068	141.45	5.568
XW4Z-7D483-AC	2.08	0.081	141.45	5.568
XW4Z-7D483-AD	2.44	0.096	141.45	5.568

Service Identification Model Chart

7000 Prefix and Suffix	C=Column F=Floor	Engine Displacement	Vehicle Application
9LZP-CA	F	4.0L	Rear Wheel Drive (RWD)
9LZP-DA	F	4.0L	Four-Wheel Drive (4WD)

Solenoid Operation Chart

Selector Position	Gear	SSA	SSB	SSC	SSD	PCA	PCB	PCC
P	-	ON	OFF	OFF	ON	L [a]	H/L [b]	L
N	-	ON	OFF	OFF	ON	L	H/L	L
R	-	ON	OFF	OFF	ON	L/H	L	H [c]
(D)	1	ON	OFF	OFF	ON	H	H/L	L
(D)	2	ON	OFF	ON	ON	L/H	H	L
(D)	3	ON	ON	OFF	ON	H	L/H	L
(D)	4	OFF	OFF	OFF	ON	H	L/H	H
(D)	5	OFF	OFF	ON	ON	H	H	H
(D) Canceled	1	ON	OFF	OFF	ON	H	H/L	L
(D) Canceled	2	ON	OFF	ON	ON	L/H	H	L
(D) Canceled	3	ON	ON	OFF	ON	H	L/H	L
(D) Canceled	4	OFF	OFF	OFF	OFF	L/H	H	H

Manual 3	3	ON	ON	OFF	OFF	H	L	H/L
Manual 2	2	ON	OFF	ON	OFF	H	L	H/L
Manual 1	1	ON	OFF	OFF	OFF	H	L	H/L

[a] Low
[b] PCM Controlled
[c] High

Band and Clutch Application Chart A

	Overdrive Band	Intermediate Band	Reverse Band	Forward Clutch	Direct Clutch	Coast Clutch
Reverse			A [a]		A [a]	Ac [b]
1st				A [a]		
2nd	A [a]			A [a]		
3rd		A [a]		A [a]		
4th				A [a]	A [a]	
5th	A [a]			A [a]	A [a]	
1st [c]				A [a]		
2nd [c]	A [a]			A [a]		
3rd [c]		A [a]		A [a]		
4th [c]				A [a]	A [a]	Ac [b]
Manual 3rd		Ac [b]		A [a]		Ac [b]
Manual 2nd	A [a]		Ac [b]	A [a]		
Manual 1st			Ac [b]	A [a]		Ac [b]

[a] A = Applied
[b] Ac = Applied to carry coast torque
[c] (D) Position (overdrive canceled)

Band and Clutch Application Chart B

	Overdrive One-Way Clutch		Low One-Way Clutch		Engine Braking
	Drive	Coast	Drive	Coast	
Reverse	H [a]	OR [b]	NE [c]	NE [c]	NO
1st	H [a]	OR [b]	H [a]	NE [c]	NO
2nd	OR [b]	OR [b]	H [a]	NE [c]	NO
3rd	H [a]	OR [b]	OR [b]	OR [b]	NO
4th	H [a]	OR [b]	OR [b]	OR [b]	NO
5th	OR [b]	OR [b]	OR [b]	OR [b]	YES
1st [d]	H [a]	OR [b]	H [a]	NE [c]	YES
2nd [d]	OR [b]	OR [b]	H [a]	NE [c]	YES
3rd [d]	H [a]	OR [b]	OR [b]	OR [b]	YES

4th [d]	H [a]	OR [b]	OR [b]	OR [b]	Yes
Manual 3rd	H [a]	OR [b]	OR [b]	OR [b]	YES
Manual 2nd	OR [b]	OR [b]	H [a]	NE [c]	YES
Manual 1st	H [a]	OR [b]	H [a]	NE [c]	YES

[a] H = Hold
[b] OR = Overrunning
[c] NE = No Effect
[d] (D) Position (overdrive canceled)

Line Pressure Chart

Transmission Application	Range	Idle		WOT Stall	
		PC C	Line	PC C	Line
4.0L	R	758-862 kPa (110-125 psi)	965-1,551 kPa (140-225 psi)	758-862 kPa (110-125 psi)	2,000-2,482 kPa (290-360 psi)
	N	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)		
	(D) 3, 2, 1	0-103 kPa (0-15 psi)	758-1,034 kPa (110-150 psi)	0-103 kPa (0-15 psi)	1,448-1,793 kPa (210-260 psi)

Stall Speed Chart

Engine	rpm
4.0L	2,660-3,129

Shift Speeds

Throttle Position	(D) Shift	Axle Ratio All Shift Speed
Closed	5-4	43-50 km/h (27-31 mph)
	4-3	27-31 km/h (17-19 mph)
	3-1	7-21 km/h (11-13 mph)
Minimum	1-2	19-23 km/h (12-14 mph)
Monitor PID:	2-3	27-31 km/h (17-19 mph)
TP volt-1.25	3-4	32-37 km/h (20-24 mph)
	4-5	37-63 km/h (23-39 mph)
Wide Open	1-2	66-72 km/h (41-45 mph)
	2-3	93-100 km/h (58-62 mph)
	3-4	140-150 km/h (87-93 mph)

Torque Specifications

Description	Nm	lb-ft	lb-in
Case-to-center support screw	11	-	97
Catalytic converter-to-manifold nuts	40	30	-
Catalytic converter-to-muffler pipe bolts	40	30	-
Control valve spring retainer	10	-	89
Coolant expansion tank bolts	7	-	62
Cooling fan shroud bolts	7	-	62
Crossmember bolts	70	52	-
Crossmember nuts	70	52	-
Cushion spring compressor [a]	-	-	-
CV joint bolts	30	22	-
Extension housing screws	30	22	-
Ground cable nut	13	-	115
Heat shield bolts	20	-	177
Intermediate shaft speed sensor screw	14	-	124
Locknut for band adjustment screw	54	40	-
Main control valve body-to-case screws (all) [a]	-	-	-
Manual control lever shaft nut	48	35	-
Manual control valve detent spring screw	10	-	89
Output Shaft Speed (OSS) sensor screw	14	-	124
Overdrive (O/D) and intermediate band adjustment screw	13	-	115
Pressure tap plug-to-case	13	-	115
Reverse servo assembly screws [a]	-	-	-
Selector lever cable bracket screws	40	30	-
Separator-to-main control screws	7	-	62
Skid plate bolts	24	18	-
Solenoid body screws [a]	-	-	-
Starter motor bolts	25	18	-
Torque converter adapter plate-to-converter nuts	44	32	-
Torque converter-to-flexplate nuts	44	32	-
Transfer case bolts	41	30	-
Transmission Air Test Plate and gasket	10	-	89
Transmission fluid cooler fitting-to-case	56	41	-
Transmission fluid cooler tube nut-to-case fitting	40	30	-
Transmission fluid filter screws	10	-	89
Transmission fluid level indicator plug	10	-	89
Transmission fluid pan drain plug	26	19	-
Transmission fluid pan screws [a]	-	-	-
Transmission fluid pump housing-to-case screws [a]	-	-	-

Transmission Range (TR) sensor screws [a]	-	-	-
Transmission support insulator-to-extension housing screws	90	66	-
Transmission support insulator-to-crossmember nuts	90	66	-
Transmission-to-engine bolts	48	35	-
Transmission vehicle harness connector	5	-	44
Turbine Shaft Speed (TSS) sensor screw	14	-	124
U-joint strap bolts	19	-	168

[a] Refer to the procedure in this section.

Transmission Description

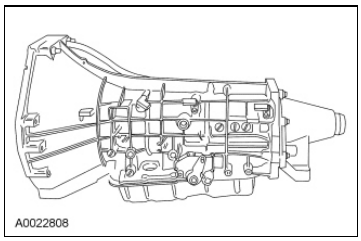
This transmission has:

- five forward speeds.
- electronic shift, pressure and Torque Converter Clutch (TCC) controls.
- three planetary gearsets.
- three bands.
- three multi-plate clutches.
- two One-Way Clutch (OWC).

All hydraulic functions are directed by electronic solenoids. The solenoids control:

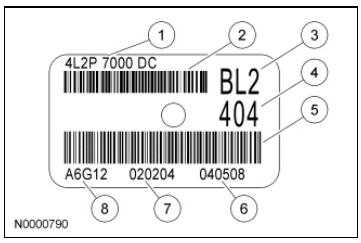
- static engagement feel.
- shift feel.
- shift scheduling.
- modulated TCC applications.
- engine braking utilizing the coast clutch and bands.
- manual 1st and 2nd timing.
- reverse inhibit timing.

Transmission View



Identification Tags

Identification Tag Located on Transmission Case

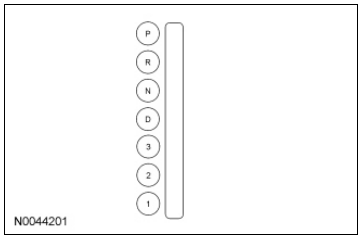


Item	Description
1	Transmission part number
2	Bar code 1
3	Transmission plant model code part 1
4	Transmission plant model code part 2
5	Bar code 2
6	Transmission serial number
7	Transmission build date (DD MM YY)
8	Assembly plant line shift

All vehicles come equipped with a Safety Compliance Certification Label. The location on the label marked TR is reserved for the transmission code. To determine the correct transmission for this vehicle, refer to the Owners's Literature, Transmission Code Designations. For transmission model, service identification level or build date information, refer to the transmission service identification tag located on the transmission case.

Range Selection

The transmission has 7 range positions: P, R, N, (D), 3, 2 and 1.



Park

In the PARK position:

- there is no power flow through the transmission.
- the park pawl locks the output shaft to the case.
- the engine may be started.
- the ignition key may be removed.

Reverse

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.

Neutral

In the NEUTRAL position:

- there is no power flow through the transmission.
- the output shaft is not held and is free to turn.
- the engine may be started.

Drive - Overdrive (O/D) Enabled

OVERDRIVE is the normal position for most forward driving.

The (D) position provides:

- automatic shifts 1-5 and 5-1.
- apply and release of the Torque Converter Clutch (TCC).
- maximum fuel economy during normal operation.
- engine braking in 5th gear.

Drive - O/D Canceled

The OVERDRIVE position provides:

- automatic shifts 1-4 and 4-1.
- apply and release of the TCC .
- maximum fuel economy during normal operation.
- engine braking in 4th gear.

Position 3 - 3rd Gear

The 3rd position provides:

- third gear start and hold.
- TCC apply and release.
- improved traction on slippery roads.
- engine braking.

Position 2 - 2nd Gear

If this position is selected at normal road speeds, the transmission will downshift into the next lower gear and continue downshifting until the vehicle reaches 2nd gear.

The 2nd position provides:

- second gear start and hold.
- TCC apply and release.
- improved traction on slippery roads.
- engine braking.

Position 1 - 1st Gear

If this position is selected at normal road speeds, the transmission will downshift into the next lower gear and continue downshifting until the vehicle reaches 1st gear.

This position provides:

- first gear operation only.
- engine braking for descending steep grades.

Shift Patterns

Upshifts

Transmission upshifting is controlled by the PCM. The PCM receives inputs from various engine or vehicle sensors and driver demands to control shift scheduling, shift feel and Torque Converter Clutch (TCC) operation.

The PCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery has been disconnected or a new battery installed, certain transmission operating parameters may be lost. The PCM must relearn these parameters. During this learning process you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Downshifts

Under certain conditions the transmission will downshift automatically to a lower gear range (without moving the selector lever). There are 3 categories of automatic downshifts: coastdown, torque demand and forced or kickdown shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transmission will disengage the TCC to provide added acceleration.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size and engine and transmission calibration requirements.

Torque Converter

The torque converter transmits and multiplies torque. The torque converter is a 4-element device:

- Impeller assembly
- Turbine and damper assembly
- Reactor assembly
- Clutch

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the transmission fluid in motion.
- The turbine reacts to the transmission fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects transmission fluid going back into the impeller, allowing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

Geartrain

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Bands and clutches are used to hold and drive certain combinations of gearsets. This results in 5 forward ratios and 1 reverse ratio, which are transmitted to the output shaft and differential.

Gear Ratio	
1st	3.22 to 1
2nd	2.29 to 1
3rd	1.55 to 1
4th	1.00 to 1
5th	0.71 to 1
Reverse	3.07 to 1

Planetary Gearset - Overdrive (O/D)

For component location, refer to Transmission in this section.

The planetary gear Overdrive (O/D) carrier is driven by the input shaft.

- The O/D planetary gearset carrier drives the center shaft via the O/D One-Way Clutch (OWC) in 1st, 3rd, 4th and REVERSE gears.
- In 2nd and 5th gears the O/D sun gear is held causing the pinion gears to rotate around the O/D sun gear.
- The pinion gears, in turn, drive the O/D ring gear resulting in the 5th (O/D) gear ratio.
- The O/D planetary gearset is internally splined to the coast clutch for engine braking.

Planetary Gearset - Forward

For component location, refer to Transmission in the Assembly portion of this section.

The forward planetary gearset is splined to the output shaft.

- The forward planetary gearset is driven by the forward ring gear when the forward clutch is applied.
- The forward planetary gearset pinions drive the forward sun gear.
- The forward sun gear is splined to the input shell.
- The forward carrier is splined to the output shaft.

Planetary Gearset - Low/Reverse

For component location, refer to Transmission in the Assembly portion of this section.

The low/reverse planetary gearset is connected to the reverse brake drum by lugs from the low/reverse brake drum to the lugs of the low/reverse planetary gearset.

- The low/reverse planetary gearset is driven by the forward sun gear which is splined to the input shell.
- The forward sun gear drives the pinions in the low/reverse planetary gearset.
- The pinions of the low/reverse planetary gearset drive the output shaft ring gear and output shaft hub which is splined to the output shaft.
- The low/reverse planetary gearset can be held by the low One-Way Clutch (OWC) in the low/reverse brake drum or by the low/reverse band.

Input Shaft

For component location, refer to Transmission in the Assembly portion of this section.

- The radial positioning of the input shaft is controlled by 2 bushings in the stator support.
- Axial positioning of the input shaft is controlled by the splines in the converter turbine hub and the retaining ring in the O/D planetary carrier.

Output Shaft

For component location, refer to Transmission in this Assembly portion of this section.

The output shaft is supported by a bearing in the case and by a bearing in the extension housing. End positioning is controlled by the park gear and by the reverse ring gear hub and snap ring.

Apply Components

Band - Overdrive (O/D)

For component location, refer to Transmission in the Assembly portion of this section.

During 2nd and 5th gear operation, hydraulic pressure is applied to the Overdrive (O/D) servo.

- This pressure causes the piston to move and apply force to the band.
- This action causes the O/D band to hold the O/D drum.
- This causes the O/D sun gear to be held stationary through the adapter plate and the O/D drum.

Band - Low/Reverse

For component location, refer to Transmission in the Assembly portion of this section.

During 2nd gear operation, 1st gear operation and REVERSE, hydraulic pressure is applied to the low/reverse servo.

- This pressure causes the servo to move and apply force to the low/reverse band.
- This action causes the low/reverse brake drum to be held.
- This action causes the low/reverse planetary assembly to be held stationary.

Band - Intermediate

For component location, refer to Transmission in the Assembly portion of this section.

During 3rd gear operation, hydraulic pressure is applied to the intermediate servo.

- This pressure causes the servo to move and apply force to the intermediate band.
- This action causes the direct clutch drum to be held.
- The intermediate band holds the intermediate brake and direct clutch drum to the case in 3rd gear.
- This causes the input shell and forward sun gear to be held stationary.

Clutches - Direct

For component location, refer to Transmission in the Assembly portion of this section.

The direct clutch is a multi-disc clutch made up of steel and friction plates.

- The direct clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- It is housed in the direct clutch drum.
- During 4th, 5th and REVERSE gear application, the direct clutch is applied transferring torque from the forward clutch cylinder to the direct clutch drum.
- This action causes the forward sun gear to drive the pinions of the low/reverse planetary carrier.

Clutches - Forward

For component location, refer to Transmission in the Assembly portion of this section.

The forward clutch is a multi-disc clutch made up of steel and friction plates.

- The forward clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The forward clutch is applied in all forward gears.
- When applied, the forward clutch provides a direct mechanical coupling between the center shaft and the forward ring gear and hub.

Clutches - Coast

For component location, refer to Transmission in the Assembly portion of this section.

The coast clutch is a multi-disc clutch made up of steel and friction plates.

- The coast clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The coast clutch is housed in the O/D drum.
- The coast clutch is applied when in manual 1st and 3rd, 4th with O/D canceled, and REVERSE positions.
- When applied, the coast clutch locks the O/D sun gear to the overdrive planetary carrier, thus preventing the one-way clutch from overrunning when the vehicle is coasting.
    - ♦ This allows the use of engine compression to help slow the vehicle and provide engine braking.

One-Way Clutch (OWC) - Low/Reverse

For component location, refer to Transmission in this section.

The low/reverse One-Way Clutch (OWC) is a sprag-type OWC .

- The low/reverse OWC holds the low/reverse drum and low/reverse planetary assembly to the case in 1st and 2nd gear.
- In all other gears the low/reverse OWC overruns.

OWC - O/D

For component location, refer to Transmission in this section.

The O/D OWC is a sprag-type OWC that connects the input shaft to the center shaft during drive operation.

The O/D OWC transmits torque in REVERSE, 1st, 3rd and 4th gears, as well as in manual 1st, manual 3rd and manual 4th gears.

- The input shaft connects through the O/D planetary carrier to the inner race.
- The outer race is part of the center shaft.
- The inner race contacts the assembly of sprags, and wedges them between the inner and outer races.

- The wedging action causes the input shaft and center shaft to be connected.

Hydraulic System

Transmission Fluid Pump

For component location, refer to Transmission in the Assembly portion of this section.

- The transmission fluid pump provides the transmission fluid pressure necessary to charge the torque converter, main control assembly, transmission cooling system, lubrication system and apply devices.
- The transmission fluid pump is a positive displacement, gear-type pump.
    - The transmission fluid pump is driven by the torque converter impeller hub.

Transmission Fluid Filter

For component location, refer to Transmission in the Assembly portion of this section.

- All transmission fluid drawn from the transmission fluid pan by the fluid pump passes through the transmission fluid filter.
- The transmission fluid filter and its accompanying seals are part of the transmission fluid path from the sump (pan) to the fluid pump.
    - The transmission fluid filter has a bypass section which allows transmission fluid vented at the main regulator valve to be recirculated to the fluid pump, without passing through the transmission fluid filter.

Main Control

For component location, refer to Transmission in the Assembly portion of this section.

- The main control assembly and related components are part of the pressure side of the hydraulic system.
- The main control assembly consists of the solenoids, the valve body assembly and the separator plate.
- These components combine to convert electrical signals into hydraulic actions.
    - All valves in the main control assembly are anodized aluminum and cannot be sanded, filed or dressed in any other way. If there is any damage to the valves that prevents or restricts their movement, install a new main control assembly.

Transmission Electronic Control System

Electronic System Description

The PCM and its input/output network control the following transmission operations:

- Shift timing
- Line pressure (shift feel)
- Torque Converter Clutch (TCC)

The transmission control strategy combined with the engine control provides optimum powertrain operation under all conditions. When determining the best operating strategy for transmission operation, the PCM uses input information from engine-related and driver-demand related sensors and switches.

In addition, the PCM receives input signals from transmission-related sensors and switches. The PCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the PCM can determine when the time and conditions are right for a shift or when to apply or release the TCC . It will also determine the pressure needed to optimize shift feel. To accomplish this, the PCM uses 3 pressure controls, 1 TCC and 4 shift solenoids to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

PCM

The operation of the transmission is controlled by the PCM. Many input sensors provide information to the PCM. The PCM then controls the actuators which determine transmission operation.

A/C Clutch

An electromagnetic clutch is energized when the clutch cycling pressure switch closes. The switch is located on the suction accumulator/drier. The closing of the switch completes the circuit to the clutch and draws it into engagement with the compressor driveshaft. When the A/C is engaged, operating pressures are adjusted to compensate for additional load on the engine.

Brake Pedal Position (BPP) Switch

The Brake Pedal Position (BPP) switch tells the PCM when the brakes are applied. The TCC disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released. The BPP is also used to disengage the Brake Shift Interlock Actuator (BSIA) solenoid.

Engine Coolant Temperature (ECT) Sensor

The Engine Coolant Temperature (ECT) sensor detects temperature of engine coolant and provides this information to the PCM. The ECT sensor is used to control TCC operation.

Electronic Ignition (EI) System

The Electronic Ignition (EI) consists of a Crankshaft Position (CKP) sensor, ignition coils and the PCM. The EI control module operates by sending CKP from the CKP sensor to the EI control module. The EI control module generates a profile ignition pickup signal (engine rpm) and sends it to the PCM. The PCM uses profile ignition pickup signal in the transmission strategy, Wide Open Throttle (WOT) shift control, TCC control and operating pressures.

Intake Air Temperature (IAT) Sensor

The Intake Air Temperature (IAT) sensor provides the Sequential Multi-Port Fuel Injection (SFI) system mixture temperature information. The IAT sensor is used both as a density corrector for air flow calculation and to proportion cold enrichment fuel flow. The IAT sensor is installed in the Air Cleaner (ACL) outlet tube. The IAT sensor is also used in determining control pressures.

Mass Air Flow (MAF) Sensor

The Mass Air Flow (MAF) sensor measures the air flowing into the engine. The MAF sensor output signal is used by the PCM to calculate injector pulse width. For transmission strategies, the MAF sensor is used to regulate Electronic Pressure Control (EPC), shift scheduling and TCC control.

Transmission Control Switch (TCS)

The Transmission Control Switch (TCS) is a momentary contact switch that allows the driver to cancel operation of 5th gear.

The TCS is located on the end of the selector lever.

When the driver presses the TCS , a signal is sent to the PCM.

The PCM uses the shift solenoids to disengage/disable 5th gear operation and activate the coast clutch.

At the same time, the PCM illuminates the Transmission Control Indicator Lamp (TCIL) to notify the driver that 5th gear is canceled.

When the TCS is pressed again, 5th gear operation is enabled, the coast clutch is released and the TCIL is turned off.

Whenever the ignition is cycled, the TCS is turned off and 5th gear will be enabled, even if the TCS had been on when the ignition was cycled off.

Transmission Control Indicator Lamp (TCIL)

The TCIL is located in the Instrument Cluster (IC) and is labeled O/D OFF. It is illuminated in conjunction with the TCS .

Throttle Position (TP) Sensor

The Throttle Position (TP) sensor is a potentiometer mounted on the throttle body. The TP sensor detects the position of the throttle plate and provides this information to the PCM. The TP sensor is used for shift scheduling, EPC and TCC control.

Accelerator Pedal Position (APP) Sensor

The Accelerator Pedal Position (APP) sensor is mounted on the accelerator pedal. The APP sensor detects the position of the accelerator pedal and provides this information as a voltage signal to the PCM. The PCM uses the APP sensor information to aid in determining shift scheduling, EPC and TCC control.

Transmission Range (TR) Sensor

The Transmission Range (TR) sensor is located on the outside of the transmission at the manual control lever. The TR sensor completes the start circuit in PARK, NEUTRAL and the back-up lamp circuit in REVERSE. The TR sensor also opens and closes a set of 4 switches that are monitored by the PCM to determine the position of the manual control lever (P, R, N, (D), 3, 2, 1).

Turbine Shaft Speed (TSS) Sensor

The Turbine Shaft Speed (TSS) sensor is a magnetic pickup that sends the PCM torque converter turbine speed information.

The TSS sensor is mounted externally on the case.

The PCM uses TSS information to help determine appropriate operating pressures and TCC operation.

Output Shaft Speed (OSS) Sensor

The Output Shaft Speed (OSS) sensor is a magnetic pickup, located at the park gear trigger wheel assembly, that sends a signal to the PCM to indicate transmission output shaft speed. The OSS sensor is mounted externally on the case. The OSS is used for TCC control, shift scheduling and to determine line pressure.

Intermediate Shaft Speed Sensor

The intermediate shaft speed sensor is a magnetic pickup that sends planetary sun gear speed information to the PCM. It is mounted externally on the center of the case.

The PCM uses the intermediate shaft speed sensor information to aid in determining pressure requirements.

Pressure Control Solenoids

The pressure control solenoids are a Variable Force Solenoid (VFS) solenoid. The VFS -type solenoid is an electrohydraulic actuator combining a solenoid and a regulating valve.

The line pressure tap is used to verify output pressure from Pressure Control Solenoid A (PCA) or Pressure

Control Solenoid B (PCB) by turning either one off while verifying the output from the other solenoid. The second pressure tap is used to verify the output from the Pressure Control Solenoid C (PCC) solenoid.

There are 3 pressure control solenoids located in the solenoid body assembly used to control line pressure, band and clutch application pressure within the transmission.

The PCM varies the current to the pressure control solenoid.

The PCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery has been disconnected or a new battery installed, certain transmission operating parameters may be lost. The PCM must relearn these parameters. During this learning process you may experience slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Torque Converter Clutch (TCC) Solenoid

The TCC solenoid is a Pulse-Width Modulation (PWM) solenoid which is used to control the apply and release of the TCC .

Shift Solenoids - Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD)

Four ON/OFF shift solenoids allow the PCM to control shift scheduling.

- The solenoids are 3-way, normally closed.
- The shift solenoids, SSA , SSB , SSC and SSD , provide gear selection of 1st through 5th and REVERSE gears by directing fluid pressure to the appropriate elements.

Coast braking and manual gears are also controlled by the shift solenoids.

Transmission Fluid Temperature (TFT) Sensor

- The Transmission Fluid Temperature (TFT) sensor is a thermistor-type sensor that varies a reference voltage signal. The resistance in the TFT varies with temperature. The PCM monitors the voltage signal across the TFT and uses this information to determine the TFT .
- The TFT is located on the solenoid body.
- The PCM uses the TFT signal to determine shift scheduling, TCC control and pressure control requirements.

It sends a voltage signal to the PCM. The voltage signal varies with TFT . The PCM uses this signal to determine whether to use a cold start shift schedule. The shift schedule is compensated when the TFT is cold. The PCM also inhibits TCC operation at low TFT and uses it to determine pressure control solenoid operations.

Preliminary Inspection

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer complaint or condition. Customer contact may be necessary in order to begin to verify the concern. Understand the condition as to when the concern occurs, for example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to verify the concern.

Verification of Condition

This section provides information that must be used in determining the actual cause of customer concerns and executing the appropriate procedures.

The following procedures must be used when verifying customer concerns for the engine.

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An Electronic Pressure Control (EPC) short circuit can cause engine misfiring. The Torque Converter Clutch (TCC) not disengaging may cause the engine to stall.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshift

- Downshift
- Coasting
- Engagement
- Noise/vibration - check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent or temperature dependent.

Check Transmission Fluid Level and Condition

NOTICE: **The vehicle should not be driven if the transmission fluid level is low or internal failure may result.**

NOTE: If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather or while pulling a trailer, the transmission fluid needs to cool down 30 minutes to obtain an accurate reading.

This vehicle is not equipped with a transmission fluid level indicator. An incorrect transmission fluid level may affect the transmission operation and could result in transmission damage. To correctly check and add transmission fluid to the transmission, refer to Transmission Fluid Level Check in this section.

High Transmission Fluid Level

A transmission fluid level that is too high may cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transmission damage. Refer to Transmission Fluid Level Check in this section to correct a possible overfill condition.

Low Transmission Fluid Level

A low transmission fluid level can result in poor transmission engagement, slipping or damage. This can also indicate a leak in one of the transmission seals or gaskets.

Adding Transmission Fluid

NOTICE: **Do not use water-based cleaners, mineral spirits, brake cleaner or solvents that may contain acetone, xylene or heptane to clean and/or flush the transmission assembly, transmission components and the torque converter or transmission damage will occur. Use transmission fluid designated for the transmission/converter being serviced.**

NOTICE: **The use of any type of transmission fluid other than specified may result in transmission damage.**

If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid level plug in the bottom of the transmission fluid pan. Do not overfill the transmission fluid. For transmission fluid filling, refer to Transmission Fluid Level Check in this section. For transmission fluid type, refer to General Specifications in this section.

Transmission Fluid Condition Check

1. Check the transmission fluid level. Only remove the small (center) plug for this procedure.

2. Observe the color and the odor of the transmission fluid. Under normal circumstances the color should be a dark red but not brown or black.

3. Allow the transmission fluid to drip onto a facial tissue and examine the stain.

4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection. Inspect the transmission fluid pan for any visible debris (metal particles or clutch material).

5. If transmission fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, the transmission must be disassembled and completely cleaned. If the vehicle is equipped with an auxiliary transmission fluid cooler a new auxiliary transmission fluid cooler must be installed.

6. Carry out diagnostic checks and adjustments. Refer to Diagnosis By Symptom in this section.

Water in Transmission Fluid

To correctly repair an automatic transmission or transaxle that has had water or coolant introduced into the system, completely disassemble, clean and replace the following parts:

- All internal and external seals
- All friction material; clutches and bands
- Torque converter
- All parts with bonded seals
- All solenoids
- All transmission fluid filters

Prior to installing the transmission or transaxle, the transmission fluid cooler(s), transmission fluid cooler tubes and transmission fluid cooler hoses need to be flushed and cleaned.

Road Testing Vehicle

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: When the battery has been disconnected or a new battery installed, certain transmission operating parameters may be lost. The PCM must relearn these parameters. During this learning process, slightly firm shifts, delayed or early shifts may be experienced. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

The Shift Point Road Test and Torque Converter Clutch (TCC) Operation Test provide diagnostic information on transmission shift controls and torque converter operation.

Shift Point Road Test

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate the vehicle with the selector lever in the (D) position.
3. Apply minimum throttle and observe the speeds at which an upshift occurs and the torque converter engages. Refer to the following Shift Speeds chart.
4. Stop the vehicle. Press Transmission Control Switch (TCS) to cancel the Overdrive (O/D) range. Repeat Step 3. Transmission will make all upshifts except 4-5 and Torque Converter Clutch (TCC) apply should occur above 46 km/h (29 mph).
5. Press the accelerator pedal to the floor, Wide Open Throttle (WOT). The transmission should shift from 3rd to 2nd or 3rd to 1st, depending on vehicle speed and TCC should release.
6. With vehicle speed above 48 km/h (30 mph), move the selector lever from the (D) position to manual 1st gear position and release the accelerator pedal. The transmission should immediately downshift to 3rd gear. When vehicle speed drops below 32 km/h (20 mph), the transmission should downshift into 1st gear.
7. If transmission fails to upshift/downshift or TCC does not apply/release, refer to Diagnosis By Symptom in this section for possible causes.

Shift Speeds

Throttle Position	(D) Shift	Axle Ratio All Shift Speed
Closed	5-4	43-50 km/h (27-31 mph)
	4-3	27-31 km/h (17-19 mph)
	3-1	7-21 km/h (11-13 mph)
Minimum	1-2	19-23 km/h (12-14 mph)
Monitor PID:	2-3	27-31 km/h (17-19 mph)
TP volt-1.25	3-4	32-37 km/h (20-24 mph)
	4-5	37-63 km/h (23-39 mph)
Wide Open	1-2	66-72 km/h (41-45 mph)
	2-3	93-100 km/h (58-62 mph)
	3-4	140-150 km/h (87-93 mph)

Torque Converter Diagnosis

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Prior to installing a new torque converter, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of a good torque converter. Only after a complete diagnostic evaluation can the decision be made to install a new or remanufactured torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary inspection.

2. Know and understand the customer concern.

3. Verify the concern - carry out the Torque Converter Clutch (TCC) Operation Test. Refer to Torque Converter Operation Test in this section.

4. Carry out diagnostic procedures.

- Run On-Board Diagnostic (OBD). See On-Board Diagnostics with Scan Tool. Refer to Diagnostics in this section.
  - ♦ Repair all non-transmission related DTCs first.
  - ♦ Repair all transmission DTCs.
  - ♦ Rerun OBD test to verify repair.
- Carry out the Line Pressure Test. Refer to Special Testing Procedures in this section.
- Carry out the Stall Speed Test. Refer to Special Testing Procedures in this section.
- Carry out the Diagnosis by Symptom Index. Refer to Diagnosis By Symptom in this section.
  - ♦ Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed, diagnose and service as necessary before servicing the torque converter.

Torque Converter Operation Test

This test verifies that the TCC control system and the torque converter are operating correctly.

1. Carry out the Self Test. See On-Board Diagnostics with Scan Tool. Refer to Diagnostics in this section. Check for DTCs. Refer to the Diagnostic Trouble Code (DTC) Charts in this section.

2. Connect a scan tool to the vehicle and monitor engine rpm.

3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds in the (D) position.

4. After normal operating temperature is reached, maintain a constant vehicle speed of about 80 km/h (50 mph) and tap the brake pedal with the left foot.

5. The engine rpm should increase when the brake pedal is tapped and decrease about 5 seconds after the pedal is released. If this does not occur, refer to Torque Converter Operation Concerns in Diagnosis By Symptom in this section.

6. If the vehicle stalls in (D) or MANUAL 2 at idle with the vehicle stopped, move the selector lever to MANUAL 1 position. If the vehicle stalls, refer to Diagnosis By Symptom , Torque Converter Operation Concerns in this section. Repair as necessary. If the vehicle does not stall in (D), refer to Diagnosis By Symptom in this section.

Visual Inspection

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - A/C
  - generator (alternator)
  - engine turbo
  - cellular telephone
  - cruise control
  - CB radio
  - linear booster
  - backup alarm signal
  - computer
- Vehicle modification:

These items, if not installed correctly, will affect the PCM or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size or axle ratio changes.

- Leaks; refer to Leakage Inspection in this section.
- Correct selector lever linkage adjustments; refer to Section 307-05 .

Selector Lever Linkage Check

Check for a misadjustment in selector lever linkage by matching the detents in the selector lever with those in the transmission. If they match, the misadjustment is in the indicator. Do not adjust the selector lever linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the selector lever linkage is not correctly adjusted. Refer to Section 307-05 for selector lever linkage adjustment.

Check TSBs

Refer to all TSBs which pertain to the transmission concern and follow the procedure as described.

Carry Out On-Board Diagnostic (OBD) Key ON Engine OFF (KOEO), Key ON Engine Running (KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Self Test procedure. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the powertrain control system.

Diagnostics

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Diagnosing electronically controlled automatic transmissions is simplified using the following procedures. It is important to remember that there is a definite procedure to follow. Do not take shortcuts or assume that critical checks or adjustments have already been made. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics with Scan Tool

NOTE: For detailed instruction and other diagnostic methods using the scan tool, refer to the scan tool tester and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

These self-tests should be used to diagnose the PCM and should be carried out in order.

- Self Test - Key ON Engine OFF (KOEO)
- Self Test - Continuous Memory
- Self Test - Key ON Engine Running (KOER)
- PCM Reset Mode
- Clearing DTCs
- On-Board Diagnostic (OBD) Drive Cycle

For further information on other diagnostic testing features, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Diagnostic Parameters Identification (PID) Chart

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Using Output State Control and Accessing PIDs

To confirm that the output state control value was sent by the scan tool and the PCM has accepted the output state control substitution, a corresponding PID for each output state control parameter must be monitored. Additional PIDs should be monitored to help the technician adequately diagnose the transmission.

To confirm that the output state control substitution occurred, select the output state control value and monitor the corresponding PID value. If no ERROR MESSAGE was received and the value of the corresponding PID is the same as the value sent from output state control, then the output state control substitution was successful.

PID Name	Description	Units
APP	Accelerator Pedal Position (APP)	Percent
APP1	APP 1	Volts 0 to 5
APP2	APP 2	Volts 0 to 5
APP3	APP 3	Volts 0 to 5
BOO	Brake On/Off	On/Off
BPA	Brake pedal applied	On/Off
CPP/PNP	Clutch Pedal Position (CPP)/park neutral position	Neutral/Drive
DTC CMT	DTC Count	Number
ECT	Engine Coolant Temperature (ECT)	Temp/Voltage (0-5)
ETC_ACT	Electronic Throttle Control Actual	Angle (0-100 degrees)
ETC_DSD	Electronic Throttle Control (ETC) Desired	Angle (0-100 degrees)
GEAR#	Gear Commanded by module	1, 2, 3, 4 or 5
GEAR_MAX	Highest gear available for vehicle speed	1, 2, 3, 4 or 5
GEAR_RAT	Gear ratio	Ratio (0-5:1)
HRSH_SHFT#	Firm shift	On/Off
IAT	Intake Air Temperature (IAT)	Volts 0-5/Temp
ISS_SRC	Intermediate shaft speed	rpm 0-5,000
LOAD	Engine load	Percent 0-100
OSSFM	Output Shaft Speed (OSS) failure mode	Fault/No Fault

OSS_SRC	Unfiltered output speed failure mode	rpm 0-5,000
PCA	Pressure Control Solenoid A (PCA) (solenoid commanded pressure)	kPa/psi 0-3447/0-500
PCA AMP	PCA current	Current 0-1 amp
PCA_F	PCA fault	Fault/No Fault
PCB#	Pressure Control Solenoid B (PCB) (solenoid commanded pressure)	kPa/psi 0-3447/0-500
PCB AMP	PCB current	Current 0-1 amp
PCB_F	PCB fault	Fault/No Fault
PCC#	Pressure Control Solenoid C (PCC) (solenoid commanded pressure)	kPa/psi 0-3447/0-500
PCC AMP	PCC current	Current 0-1 amp
PCC_F	PCC fault	Fault/No Fault
PCFM	Pressure control failure mode	Fault/No Fault
RPM#	Engine revolutions per minute	rpm 0-5,000
SCCS	Speed control commanded switch	Volts 0-10/Mode
SHFT_TYPE	Shift type (selector lever range)	PRND321
SSA/SS1#	Shift Solenoid A (SSA) command	On/Off
SSA/SS1F	SSA fault	Fault/No Fault
SSB/SS2#	Shift Solenoid B (SSB) command	On/Off
SSB/SS2F	SSB fault	Fault/No Fault
SSC/SS3#	Shift Solenoid C (SSC) command	On/Off
SSC/SS3F	SSC fault	Fault/No Fault
SSD/SS4#	Shift Solenoid D (SSD) command	On/Off
SSD/SS4F	SSD fault	Fault/No Fault
TCC#	Torque Converter Clutch (TCC) modulated	Mode 0-100% On/Off
TCCFM	Torque convertor unlocking due to slipping	Fault/No Fault
TCC_F	TCC fault	Fault/No Fault
TCC_OT	Transmission over temperature	Fault/No Fault
TCC_RAT	Transmission slip ratio (engine speed compared with turbine shaft speed)	Ratio 0-5
TCIL	Transmission Control Indicator Lamp (TCIL)	On/Off
TCS	Transmission Control Switch (TCS) Overdrive (O/D) cancel/hold switch	On/Off
TCSLIP_ABSL	Absolute value of slip	rpm 0-2,000
TCCSLIPP ACT	Torque convertor slip actual	rpm (-100-4,000)
TC_SLIPDSD	Torque convertor slip desired	rpm 0-2,000
TFT	Transmission Fluid Temperature (TFT)	Volts 0-5/Temp
TFT_F	TFT status	Fault/No Fault
TORQUE	Net engine torque	Newton Meter -150/500
TP1	Throttle Position (TP) sensor 1	Volts 0-5
TP2	TP sensor 2	Volts 0-5
TR	Transmission Range (TR) switch	Mode PRN(D)321
TR1	TR 1	Open/Closed
TR2	TR 2	Open/Closed

TR3	TR 3	Open/Closed
TR_V	TR 3	Volts 0-5
TR4	TR 4	Open/Closed
TRAN_RAT	Transmission gear ratio	Ratio (0-6:1)
TRIP CNT	Number of On-Board Diagnostic (OBD) trips completed	Number
TR_F	TR status	Fault/No Fault
TSS	Turbine Shaft Speed (TSS)	rpm 0-5,000
TSSFM	TSS failure mode	Fault/No Fault
TSS_SRC	Unfiltered TSS	rpm 0-5,000
VPWR	Module supply voltage	Volts 10-16V
VSS	Vehicle Speed Sensor (VSS)	SPD 0-128 km/h 0-80 mph
VSS_FM	VSS signal status	Fault/No Fault

Transmission Drive Cycle Test

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Transmission failure must occur 4 times consecutively for shift error DTC to be set and 5 times consecutively for continuous Torque Converter Clutch (TCC) DTCs to set.

NOTE: When carrying out the Transmission Drive Cycle Test, use the Solenoid Operation Chart for proper solenoid operation. Refer to Pinpoint Tests - OSC Equipped Vehicle in this section.

After carrying out the Self Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then clear Self Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With the selector lever in (D) position, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into 5th gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in 5th gear and maintaining steady speed and throttle opening, lightly apply and release the brake to operate the stop lamps. Then hold speed and throttle steady for a minimum of 5 seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat Steps 4 through 6 at least 5 times.
8. Carry out Self Test and record continuous DTCs.

After On-Board Diagnostic (OBD)

NOTE: The vehicle wiring harness, PCM and non-transmission sensors may affect transmission operations. Repair these concerns first.

After the On-Board Diagnostic (OBD) procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission related DTCs. Refer to the Diagnostic Trouble Code (DTC) Charts in this section for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the PCM wiring harness and in-line connectors for correct connections, bent or broken terminals, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE: If a concern still exists after electrical diagnosis, refer to Diagnosis By Symptom in this section.

If DTCs appear while carrying out the OBD tests, refer to the Diagnostic Trouble Code (DTC) Charts in this section for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs for transmission concerns.

Diagnostic Trouble Code (DTC) Charts

DTC Chart

**May also be generated by some other non-electric transmission hardware system.					
*Output circuit check, generated only by electrical symptoms.					
DTC	**Component**	**Description**	**Condition**	**Symptom**	**Action**
P0102, P0103, P1100, P1101	Mass Air Flow (MAF) sensor	MAF sensor concerns	MAF system inoperative which may cause a transmission concern.	High/low Electronic Pressure Control (EPC) pressure, incorrect shift schedule. Incorrect Torque Converter Clutch (TCC) engagement scheduling. Symptoms similar to a Throttle Position (TP) sensor failure.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0112	Intake Air Temperature (IAT) sensor	IAT sensor indicates 125°C (254°F) (grounded)	Voltage drop across IAT sensor exceeds scale set for temperature 125°C (254°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0113	IAT sensor	IAT sensor indicates -40°C (-40°F) (open circuit)	Voltage drop across IAT sensor exceeds scale set for temperature -40°C (-40°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0114	IAT sensor	IAT sensor out of On-Board Diagnostic (OBD) range	IAT sensor temperature higher or lower than expected during Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).	Rerun OBD test at normal operating temperature.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	Engine Coolant Temperature (ECT) sensor	ECT sensor indicates 125°C (254°F)	Voltage drop across ECT sensor exceeds scale set for temperature 125°C (254°F) (grounded).	TCC will always be OFF, resulting in reduced fuel economy.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0118	ECT	ECT sensor indicates -40°C (-40°F)	Voltage drop across ECT sensor exceeds scale set for temperature -40°C (-40°F) (open	TCC will always be OFF, resulting in reduced fuel economy.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

			circuit).		
P0121, P0122, P0123, P1120, P1121, P1125, P1124	TP sensor	TP sensor concern	PCM has detected an error. This error may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, TCC does not engage. TCC cycling.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0121- P0124, P0221- P0224, P2100- P2107, P2110- P2112, P2121- P2124, P2126- P2129, P2121- P2135, P2138- P2140	Accelerator Pedal Position (APP) sensor	APP sensor concern	PCM has detected an error. This error may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, TCC does not engage. TCC cycling.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0300- P0308, P0320, P0340, P1351- P1364	Electronic Ignition (EI)	EI concerns	EI system is inoperative which may cause a transmission concern.	Harsh engagements and shifts, late Wide Open Throttle (WOT) shifts, no TCC engagement.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0500, P0503, U1039	ABS	Insufficient Vehicle Speed Sensor (VSS) input from ABS through the communication link	PCM detected a loss of VSS signal through the communication link from ABS.	No transmission symptom. Instrument Cluster (IC) speedometer may be affected.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0705	Transmission Range (TR) sensor	TR sensor circuit failure	TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short to ground or an open in TR 4, TR	Harsh engagements or wrong gear commanded. Defaults to (D) or invalid position.	GO to Pinpoint Test C .

			3, TR 2 and or TR 1 circuits. This DTC cannot be set by an incorrectly adjusted TR sensor.		
P0708	TR sensor	TR sensor circuit TR 3 open	TR sensor circuit TR 3 reading 2.6V - 5.0V (open circuit). This DTC cannot be set by an incorrectly adjusted TR sensor.	Harsh engagements or wrong gear commanded. Defaults to (D) or invalid position.	GO to Pinpoint Test C .
P0711	Transmission Fluid Temperature (TFT) sensor	No change in TFT sensor	PCM has detected no TFT sensor change during operation.	DTC is set.	GO to Pinpoint Test B .
P0712	TFT	157°C (315°F) indicated TFT sensor circuit grounded	Voltage drop across TFT sensor exceeds scale set for temperature of 157°C (315°F).	DTC is set.	GO to Pinpoint Test B .
P0713	TFT	-40°C (-40°F) indicated TFT sensor circuit open	Voltage drop across TFT sensor exceeds scale set for temperature -40°C (-40°F).	DTC is set.	GO to Pinpoint Test B .
P0715	Turbine Shaft Speed (TSS) sensor	Insufficient input from TSS sensor	PCM detected a loss of TSS signal during operation.	-	GO to Pinpoint Test E .
P0717	TSS	Insufficient input from TSS sensor	PCM detected a loss of TSS signal during operation.	-	GO to Pinpoint Test E .
P0718	TSS	TSS sensor signal noisy	PCM has detected a noisy TSS sensor signal.	-	GO to Pinpoint Test E .
P0720	Output Shaft Speed (OSS)	Insufficient input from OSS sensor	PCM detected a loss of OSS sensor signal during operation.	Abnormal shift schedule, harsh shifts.	GO to Pinpoint Test E .
P0721	OSS	OSS sensor signal noisy	PCM has detected an erratic OSS sensor signal.	Abnormal shift schedule, harsh shifts.	GO to Pinpoint Test E .
P0722	OSS	Insufficient input from OSS sensor	PCM detected a loss of OSS sensor signal during operation.	Abnormal shift schedule, harsh shifts.	GO to Pinpoint Test E .
P0731**	Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC) or internal parts	1st gear ratio error	1st gear, not commanded.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck	REFER to Diagnosis By Symptom in this section.

				valves, damaged friction material). Engine rpm could be higher or lower than expected.	
P0732**	SSA , SSB , SSC or internal parts	2nd gear ratio error	2nd gear not commanded.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to Diagnosis By Symptom in this section.
P0733**	SSA , SSB , SSC or internal parts	3rd gear ratio error	3rd gear not commanded.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to Diagnosis By Symptom in this section.
P0734**	SSA , SSB , SSC or internal parts	4th gear ratio error	4th gear not commanded.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to Diagnosis By Symptom in this section.
P0735	SSA , SSB , SSC , Shift Solenoid D (SSD) or internal parts	5th gear ratio error	5th gear not commanded.	Correct gear ratio not achieved for commanded gear. Shift errors may also be due to other transmission concerns (stuck valves, damaged friction material). Engine rpm could be higher or lower than expected.	REFER to Diagnosis By Symptom in this section.

P0740*	TCC solenoid	TCC solenoid circuit failure during OBD test	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: harsh shifts or engagements, engine rpm higher than expected. Short to ground: Engine will stall when in a Drive gear at idle, harsh shifts or engagements, engine rpm lower than expected.	GO to Pinpoint Test A .
P0741**	TCC solenoid	TCC solenoid circuit error or stuck OFF	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	Stuck OFF: harsh shifts or engagements, no TCC operation. Engine rpm may be higher than expected.	GO to Pinpoint Test A . REFER to Diagnosis By Symptom in this section.
P0743*	TCC solenoid	TCC solenoid circuit failure during OBD test	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: harsh shifts or engagements, engine rpm higher than expected. Short to ground: Engine will stall when in a Drive gear at idle, harsh shifts or engagements, engine rpm lower than expected.	GO to Pinpoint Test A .
P0745	Pressure Control Solenoid A (PCA)	PCA or circuit fault	PCA functional fault - low pressure.	Incorrect shift pattern indicating mechanical or hydraulic failure of the transmission.	REFER to Diagnosis By Symptom in this section.
P0748	PCA	PCA solenoid inoperative	Electrical failure of the solenoid detected.	Possible slip in gear and/or 3rd gear ratio.	GO to Pinpoint Test D .
P0750*	SSA	SSA circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: 1st gear ratio incorrect or no gear ratio errors, no 1st gear. Short to ground: no 4th or 5th gear.	GO to Pinpoint Test A .
P0753*	SSA	SSA circuit failure	SSA circuit failed to provide voltage drop across	Open or short to battery power: 1st gear ratio incorrect	GO to Pinpoint Test A .

			solenoid. Circuit open or shorted or PCM driver failure during OBD test.	or no gear ratio errors, no 1st gear. Short to ground: no 4th or 5th gear.	
P0755*	SSB	SSB circuit failure	SSB circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: no 3rd gear. Short to ground: no 1st gear.	GO to Pinpoint Test A .
P0758*	SSB	SSB circuit failure	SSB circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: no 3rd gear. Short to ground: no 1st gear.	GO to Pinpoint Test A .
P0760*	SSC	SSC circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: 2nd and 5th gear ratio incorrect. Short to ground: 1st gear ratio incorrect or no gear ratio errors.	GO to Pinpoint Test A .
P0763*	SSC	SSC circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during OBD test.	Open or short to battery power: 2nd and 5th gear ratio incorrect. Short to ground: 1st gear ratio incorrect or no gear ratio errors.	GO to Pinpoint Test A .
P0765	SSD	SSD circuit failure	SSD circuit failed to provide voltage drop across solenoid. Circuit shorted to ground or PCM driver circuit failure during OBD test.	Short to ground: No engine braking. Open or short to voltage, engine braking in 1st auto only.	GO to Pinpoint Test A .
P0768	SSD	SSD circuit failure	SSD circuit failed to provide voltage drop across solenoid. Circuit shorted to ground or PCM driver circuit failure during OBD test.	Short to ground: No engine braking. Open or short to voltage, engine braking in 1st auto only.	GO to Pinpoint Test A .
P0775	Pressure Control Solenoid B (PCB)	PCB or circuit fault	PCB functional fault - low pressure.	Incorrect shift pattern indicating mechanical or hydraulic failure of the transmission.	REFER to Diagnosis By Symptom in this section.

P0778	PCB	PCB inoperative	Electrical failure of the solenoid detected.	No 2nd and 5th gear.	GO to Pinpoint Test D .
P0791	Intermediate shaft speed sensor	Insufficient input from the intermediate shaft speed sensor	PCM has detected a loss of the intermediate shaft speed sensor signal during operation.	Harsh shifts.	GO to Pinpoint Test E .
P0794	Intermediate shaft speed sensor	Intermediate shaft speed sensor signal noisy	PCM has detected an erratic intermediate shaft speed sensor signal.	Harsh shifts.	GO to Pinpoint Test E .
P0795	Pressure Control Solenoid C (PCC)	PCC or circuit fault	PCC functional fault - low pressure.	Incorrect shift pattern indicating mechanical or hydraulic failure of the transmission.	REFER to Diagnosis By Symptom in this section.
P0798	PCC	PCC inoperative	Electrical failure of the solenoid detected.	Incorrect gear ratio in 4th and 5th gear.	GO to Pinpoint Test D .
P0960	PCA	PCA circuit open	Voltage through PCA is checked. Error is noted if tolerance is exceeded.	Open circuit - causes maximum PCA pressure, harsh engagements and shifts.	GO to Pinpoint Test D .
P0962	PCA	PCA circuit failure, shorted to ground	Voltage through PCA is checked. An error will be noted if tolerance is exceeded.	Short circuit - causes minimum PCA pressure (minimum capacity) and limits engine torque (alternate firm). Slips in gear and no 3rd gear.	GO to Pinpoint Test D .
P0963	PCA	PCA short to power	Voltage through PCA is checked. An error will be noted if tolerance is exceeded.	Short to power - causes maximum PCA pressure, harsh engagements and shifts.	GO to Pinpoint Test D .
P0964	PCB	PCB circuit open	Voltage through PCB is checked. Error is noted if tolerance is exceeded.	Open circuit - causes maximum PCB pressure, harsh engagements and shifts.	GO to Pinpoint Test D .
P0966**	PCB	PCB circuit failure, shorted circuit to ground	Voltage through PCB is checked. An error will be noted if tolerance is exceeded.	Short circuit to ground no 2nd and 5th gear.	GO to Pinpoint Test D .
P0967	PCB	PCB short to battery voltage	Voltage through PCB is checked. An error will be noted if	Short to battery power: harsh shift and engagements.	GO to Pinpoint Test D .

			tolerance is exceeded.		
P0968**	Pressure Control Solenoid C (PCC)	PCC circuit open	Voltage through PCC is checked. Error is noted if tolerance is exceeded.	Open circuit - causes maximum PCC pressure, harsh engagements and shifts.	GO to Pinpoint Test D .
P0970**	PCC	PCC circuit failure, shorted circuit to ground	Voltage through PCC is checked. An error will be noted if tolerance is exceeded.	No 4th and 5th gear.	GO to Pinpoint Test D .
P0971	PCC	PCC short to power	Voltage through PCC is checked. An error will be noted if tolerance is exceeded.	Short to battery power: harsh shift and engagements.	GO to Pinpoint Test D .
P1116	ECT	ECT sensor out of OBD range	ECT sensor temperature higher or lower than expected during KOEO and KOER .	Rerun OBD test at normal operating temperature.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1124	TP	TP sensor voltage high/low for OBD test	TP sensor was not in the correct position for OBD test.	Rerun OBD test at appropriate TP per application.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1460	A/C	A/C clutch cycling pressure switch error	A/C or defrost ON condition may result from A/C clutch being ON during OBD test.	DTC set during OBD test- rerun with A/C OFF. Failed ON - EPC pressure slightly low with A/C OFF.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1501	VSS input	VSS input high during self-test	PCM had detected a VSS input signal during KOER - Self Test.	Cannot run KOER .	STOP vehicle. RERUN KOER - Self Test. If KOER cannot be carried out, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1572	Brake Pedal Position (BPP) switch	BPP switch circuit failed	Brake ON circuit failure during normal operation.	Failed ON or not connected - TCC will not engage at less than one-third throttle. Failed OFF or not connected - TCC will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1636	SSx			-	

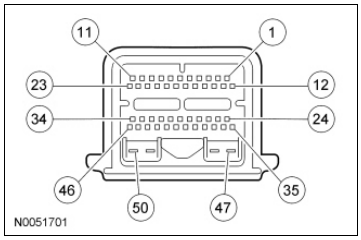
		SSx ISIG communication error	PCM has detected an error with the ISIG chip.		INSTALL a new PCM.
P1700	Transmission	Transmission undetermined failure	Internal component failure. Direct One-Way Clutch (OWC) failure.	Failure Mode Effect Management becomes active - engine rpm limited to 4,000 rpms. Failed a NEUTRAL condition in 1st, 3rd or 4th gear in automatic mode. Only 2nd and 5th gear available. Other DTCs that may set P1700: P0745, P1747, P1760, P1714, P1715, P0750, P0755.	If other solenoid DTCs are present, diagnose and repair them first. CLEAR the DTCs and drive vehicle. If P1700 returns, disassemble transmission and INSPECT the direct OWC . REPAIR as required. CLEAR the DTC. Drive vehicle and verify repair.
P1702	TR sensor	TR sensor signal intermittent, code P0705, P0708 are set	See P0705, P0708 conditions.	See P0705, P0708 symptoms.	GO to Pinpoint Test C .
P1703	BPP	Brake pedal not actuated during OBD KOER	Brake pedal not cycled during KOER .	Failed ON or not connected - TCC will not engage at less than one-third throttle. Failed OFF or not connected - TCC will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP	BPP switch circuit failed	Brake ON circuit failure during KOEO .	Failed ON or not connected - TCC will not engage at less than one-third throttle. Failed OFF or not connected - TCC will not disengage when brake is applied.	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1704	TR sensor	TR sensor not in P or N positions during KOEO / KOER	TR sensor or selector lever cable incorrectly adjusted or TR circuit failure.	DTC is set.	GO to Pinpoint Test C .
P1705	TR sensor	TR sensor not in P or N during KOEO / KOER	KOEO / KOER not run in P or N or TR circuit failure.	DTC is set.	RERUN KOEO / KOER in P or N or GO to Pinpoint Test C .
P1711	TFT	TFT sensor out of OBD range	Transmission not at operating	DTC set - vehicle cold or overheated.	Warm or cool vehicle to normal

			temperature during OBD test.		operating temperature. GO to Pinpoint Test B .
P1714	SSA	SSA inoperative	Mechanical failure of the solenoid detected.	Stuck OFF: 1st gear ratio incorrect or no gear ratio errors, no 1st gear. Stuck ON: no 4th or 5th gear.	GO to Pinpoint Test F .
P1715	SSB	SSB inoperative	Mechanical failure of the solenoid detected.	Stuck OFF: 3rd gear ratio incorrect or no gear ratio errors, no 3rd gear. Stuck ON: 1st gear ratio incorrect or no gear ratio errors, no 1st gear.	GO to Pinpoint Test F .
P1716	SSC	SSC inoperative	Mechanical failure of the solenoid detected.	Stuck OFF: 2nd and 5th gear ratio incorrect. Stuck ON: 1st gear ratio incorrect or no gear ratio errors.	GO to Pinpoint Test F .
P1717	SSD	SSD inoperative	Mechanical failure of the solenoid detected.	Stuck ON: No engine braking. Open or short to voltage, engine braking in 1st auto only.	GO to Pinpoint Test F .
P1740**	TCC solenoid	TCC solenoid inoperative	TCC not commanded. Mechanical failure of the solenoid detected.	Stuck OFF: Harsh shifts or engagements, engine rpm higher than expected. Stuck ON: Vehicle stalls when in drive gear at idle, harsh shifts or engagements, engine rpm lower than expected.	GO to Pinpoint Test F .
P1780	Transmission Control Switch (TCS)	TCS not changing states	TCS not cycled during OBD test. TCS circuit or switch open or shorted.	No O/D cancel when switch is cycled.	RERUN OBD test and cycle switch. REFER to Section 307-05 .
P1783	TFT	Transmission overtemp condition indicated	TFT exceeded 127°C (270°F).	Increase in control pressure.	GO to Pinpoint Test B .

Transmission Connector Layouts

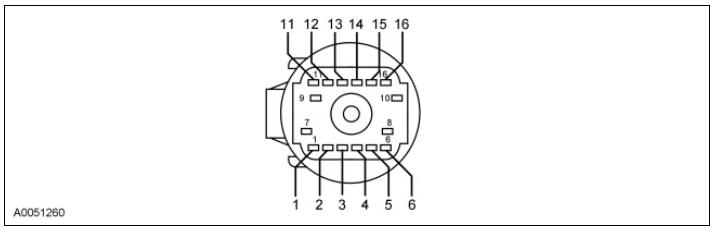
Connector Reference

PCM - C175T



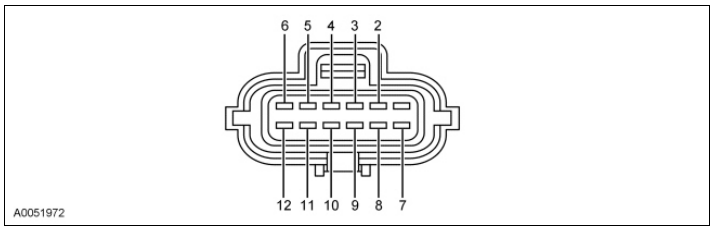
Pin Number	Circuit Description
3	Output Shaft Speed (OSS) sensor signal input
4	Intermediate shaft speed sensor signal input
11	Pressure Control Solenoid A (PCA)
15	Turbine Shaft Speed (TSS) sensor signal input
16	Transmission Range (TR) sensor TR 1
17	TR 2
23	Pressure Control Solenoid B (PCB)
27	TR 3
28	TR 4
29	Transmission Fluid Temperature (TFT) sensor
34	Pressure Control Solenoid C (PCC)
41	Signal return
42	Shift Solenoid A (SSA)
43	Shift Solenoid B (SSB)
44	Shift Solenoid C (SSC)
45	Shift Solenoid D (SSD)
46	Torque Converter Clutch (TCC) solenoid

Transmission Vehicle Harness - C168



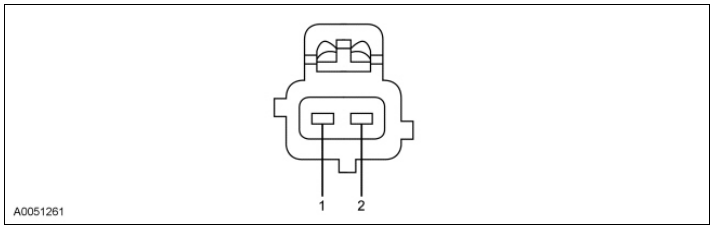
Pin Number	Circuit Description
1	Pressure Control Solenoid B (PCB)
2	Transmission Fluid Temperature (TFT) sensor input
3	Solenoid power
4	Pressure Control Solenoid C (PCC)
5	Shift Solenoid D (SSD)
6	Shift Solenoid C (SSC)
11	Pressure Control Solenoid A (PCA)
12	Signal return
14	Torque Converter Clutch (TCC) solenoid
15	Shift Solenoid B (SSB)
16	Shift Solenoid A (SSA)

Transmission Range (TR) Sensor - C167



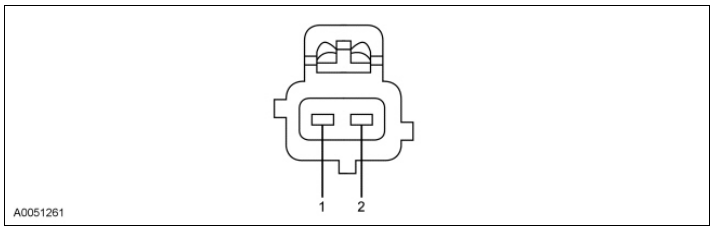
Pin Number	Circuit Description
2	Signal return
3	Transmission Range (TR)3
4	TR 1
5	TR 2
6	TR 4
7	Ground
8	Neutral switch sense input
9	Not used
10	Starter solenoid control power
11	Not used
12	Starter relay

Turbine Shaft Speed (TSS) Sensor - C143



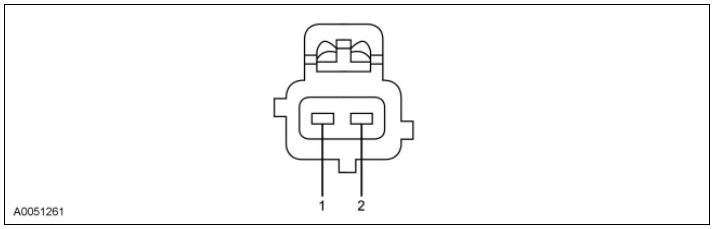
Pin Number	Circuit Description
1	Turbine Shaft Speed (TSS) sensor signal
2	Signal return

Output Shaft Speed (OSS) Sensor - C193



Pin Number	Circuit Description
1	Output Shaft Speed (OSS) sensor signal
2	Signal return

Intermediate Shaft Speed Sensor Harness - C164



Pin Number	Circuit Description
1	Intermediate shaft speed sensor signal
2	Signal return

Transmission Range (TR) Sensor Diagnosis Chart

Selector Position	PID: TR	PID: TR_V (volts)				
		TR4	TR3	TR2	TR1	TR3 (PCM pin 27 to sigrtn)
Park	P	Closed	Closed	Closed	Closed	0.0 volt
Reverse	R	Open	Open	Closed	Closed	1.3 - 1.8 volts
Neutral	N	Closed	Open	Open	Closed	1.3 - 1.8 volts
Overdrive	(D) [a]	Open	Open	Open	Open	1.3 - 1.8 volts
Manual 3	3	Open	Closed	Open	Closed	0.0 volt
Manual 2	2	Open	Closed	Closed	Open	0.0 volt
Manual 1	1	Closed	Closed	Open	Open	0.0 volt

[a] Will read "Drive" if (D) is canceled.

A. TR_V is the voltage at the PCM pin 27 (TR3 Circuit) to signal return.
B. "In Between" reading could be caused by a shift cable or TR sensor misaligned or a TR sensor circuit failure of TR 1, TR 2, TR 3 or TR .
C. TR_D: 1= Open TR switch, 0= Closed TR switch.
D. Readings: Taken from PCM signal pins for TR 1, TR , TR 3 or TR 4 to signal return.
    - **Voltages for TR1, TR2, TR4:**
    - 0 = 0.0 volt.
    - 1 = 9.0 - 14.0 volts.
    - **Voltage for TR3:(TR_V)**
    - 0 = 0.0 volt.
    - 1 = 1.3 - 1.8 volts.

Wiggle Test Information for Open/Shorts

- TR 4, TR 3, TR 2 and TR 1 are all closed in PARK. PARK is a good position to check for intermittent open circuits (with scan tool monitoring TR_V).
- TR 4, TR 3, TR 2 and TR 1 are all open in OVERDRIVE (D), so OVERDRIVE is a good position to check for shorts to ground. To determine the shorted components while observing TR_V, unplug the TR C167 and see if the short goes away. If the short is still present unplug the transmission C168 and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire terminal from the PCM connector. If the short is still present, then the PCM has an internal failure, otherwise the failure is in the vehicle harness.

Pinpoint Tests - OSC Equipped Vehicle

Special Tool(s)

 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST1565-A	Pressure Gauge, Transmission Fluid 307-004 (T57L-77820-A)
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software and appropriate hardware, or equivalent scan tool

Shift Solenoid Pre-Diagnosis

Any time an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install new as necessary.

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Operation Chart

Selector Position	Gear	SSA	SSB	SSC	SSD	PCA	PCB	PCC
P	-	ON	OFF	OFF	ON	L [a]	H/L [b]	L
N	-	ON	OFF	OFF	ON	L	H/L	L
R	-	ON	OFF	OFF	ON	L/H	L	H [c]
(D)	1	ON	OFF	OFF	ON	H	H/L	L
(D)	2	ON	OFF	ON	ON	L/H	H	L
(D)	3	ON	ON	OFF	ON	H	L/H	L
(D)	4	OFF	OFF	OFF	ON	H	L/H	H
(D)	5	OFF	OFF	ON	ON	H	H	H
(D) Canceled	1	ON	OFF	OFF	ON	H	H/L	L
(D) Canceled	2	ON	OFF	ON	ON	L/H	H	L
(D) Canceled	3	ON	ON	OFF	ON	H	L/H	L
(D) Canceled	4	OFF	OFF	OFF	OFF	L/H	H	H

Manual 3	3	ON	ON	OFF	OFF	H	L	H/L
Manual 2	2	ON	OFF	ON	OFF	H	L	H/L
Manual 1	1	ON	OFF	OFF	OFF	H	L	H/L

[a] Low
[b] PCM Controlled
[c] High

Shift Solenoid Failure Mode Chart

Failed ON or OFF due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON or OFF.

SSA , SSB

(D) Position	**Actual Gear**			
Gear	**SSA**		**SSB**	
	ON	**OFF**	**ON**	**OFF**
1	1	1	3	1
2	2	2	2	2
3	3	3	3	1
4	1	4	4	4
5	2	5	5	5
R	R	R	N	R
(D) Canceled Position				
Gear				
1M	M1	M1	M3	M1
2M	M2	M2	1.1	M2
3M	M3	M3	M3	M1
4M	M1	M4	M4	M4

1.1 = Actual ratio with forward clutch, intermediate clutch and overdrive band applied.

SSC , SSD

(D) Position	**Actual Gear**			
Gear	**SSC**		**SSD**	
	ON	**OFF**	**ON**	**OFF**
1	2	1	1	1/M1
2	2	1	2	M2
3	3	3	3	3/M3
4	4/5	4	4	4/M4
5	5	4	5	5

R	R	R	R	R
(D) Canceled Position				
Gear				
1M	M2	M1	1	M1
2M	M2	M1	2	M2
3M	1.1	M3	3	M3
4M	5	M4	4	M4

1.1 = Actual ratio with forward clutch, intermediate clutch and overdrive band applied.

PCA , PCB , PCC

(D) Posi- tion	**Actual Gear**					
Gear	**PCA**		**PCB**		**PCC**	
	L	**H**	**L**	**H**	**L**	**H**
1	1/S	1	1	1	1	1
2	2	2	1	2	2	2
3	1/S	3	3	3	3	3
4	4	4	4	4	1	4
5	5	5	4	5	2	5
R	R/S	R	R/S	R	R	R
(D) Canceled Position						
Gear						
1M	1	M1	1	M1	M1	M1
2M	M2	M2	1	M2	M2	M2
3M	1	M3	3	M3	M3	M3
4M	M4	M4	4	M4	1	M4

H = High

L = Low

Slip = Slip due to low line pressure

1.1 = Actual ratio with forward clutch, intermediate clutch and overdrive band applied.

Pinpoint Tests

Refer to Wiring Diagrams Cell 29 , Transmission Controls - 5R55S for schematic and connector information.

NOTE: Refer to all TSBs and On-Line Automotive Service Information System (OASIS) messages that pertain to the transmission concern and follow the procedure as described.

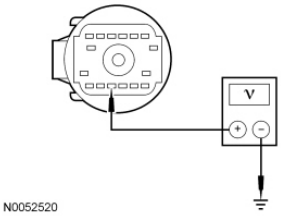
PINPOINT TEST A: SHIFT AND TCC SOLENOIDS

NOTE: Refer to Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE: Refer to the Transmission Internal Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

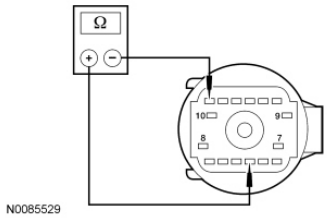
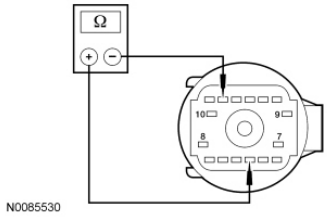
NOTE: Read and record all DTCs.

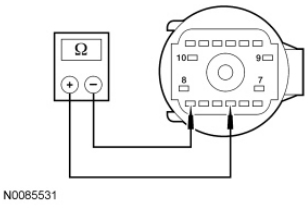
Test Step	Result / Action to Take
A1 ELECTRONIC DIAGNOSTICS	
• Ignition OFF. • Select PARK. • Check to make sure the transmission vehicle harness connector C168 is fully seated and the terminals are fully engaged in the connector and are in good condition before proceeding. • Connect the scan tool. • Ignition ON. • **Was communication with the PCM established and can the PIDs be monitored?**	**Yes** GO to A2 . **No** REPEAT procedure to access the transmission PIDs. If the scan tool did not access the transmission PIDs, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
A2 SOLENOID FUNCTIONAL CHECK	
• Select PIDs to be monitored. ♦ Shift Solenoid A (SSA) ♦ Shift Solenoid B (SSB) ♦ Shift Solenoid C (SSC) ♦ Shift Solenoid D (SSD) ♦ Torque Converter Clutch (TCC) • Select ON to turn suspect solenoid(s) ON. • Select OFF to turn solenoid(s) OFF. • Repeat steps for each solenoid. • **Does the suspect solenoid turn ON and OFF when commanded?**	**Yes** GO to A3 . **No** GO to A4 .
A3 TRANSMISSION DRIVE TEST	
• Select GEAR for shift solenoids. • Select TCC for torque converter clutch solenoid. • **Does the transmission upshift and downshift or torque converter engage/disengage when commanded?**	**Yes** CLEAR the DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose shift or torque converter concern. **No** GO to A4 .
A4 CHECK FOR BATTERY VOLTAGE	

<table>
<tr>
<td>
• Ignition OFF.
• Disconnect: Transmission Vehicle Harness C168.
• Check to make sure the transmission vehicle harness C168 terminals are fully engaged in the connector and are in good condition before proceeding.
• Ignition ON.
• Measure the voltage between C168-3, circuit CBB38 (GY/BU), harness side and ground.

N0052520
• Is the voltage greater than 10 volts?
</td>
<td>
Yes
GO to A5 .

No
REPAIR circuit CBB38 (GY/BU). CLEAR the DTCs. TEST the system for normal operation.
</td>
</tr>
<tr>
<td>A5 ELECTRICAL SIGNAL CHECK</td>
<td></td>
</tr>
<tr>
<td>
• Measure the voltage between the transmission vehicle harness C168-3, circuit CBB38 (GY/BU) and C168 signal circuit, harness side.
• Using the scan tool, cycle the solenoids ON and OFF using the following chart.
<table>
<tr><th>Connector Terminal</th><th>Circuit</th><th>Connector Signal Terminal</th></tr>
<tr><td>C168-3</td><td>CET05 (BU/GN)</td><td>C168-16</td></tr>
<tr><td>C168-3</td><td>CET18 (GY/YE)</td><td>C168-15</td></tr>
<tr><td>C168-3</td><td>CET07 (GY/OG)</td><td>C168-6</td></tr>
<tr><td>C168-3</td><td>CET44 (BU/BN)</td><td>C168-5</td></tr>
<tr><td>C168-3</td><td>CET19 (VT/GY)</td><td>C168-14</td></tr>
</table>
• Is voltage present and does the voltage change?
</td>
<td>
Yes
GO to A7 .

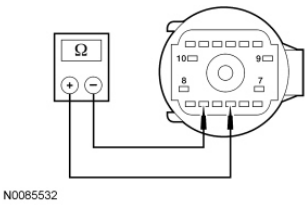
No
GO to A6 .
</td>
</tr>
<tr>
<td>A6 CHECK VEHICLE HARNESS SIGNAL CIRCUITS FOR SHORT TO GROUND</td>
<td></td>
</tr>
</table>

• Disconnect: Transmission Vehicle Harness C175T. • Measure the resistance between transmission vehicle harness C168 harness side and ground using the following chart. **Connector Terminal / Circuit / Ground** C168-16 / CET05 (BU/GN) / Ground C168-15 / CET18 (GY/YE) / Ground C168-6 / CET07 (GY/OG) / Ground C168-5 / CET44 (BU/BN) / Ground C168-14 / CET19 (VT/GY) / Ground • **Is the resistance greater than 10,000 ohms?**	**Yes** REPLACE the PCM. REFER to Section 303-14 . **No** REPAIR the vehicle harness circuit for a short to ground. CLEAR the DTCs. TEST the system for normal operation.
A7 CHECK THE TRANSMISSION INTERNAL HARNESS/COMPONENT FOR AN OPEN	
• For SSA , measure the resistance between C168-3 and C168-16, component side.  N0085529 • For SSB , measure the resistance between C168-3 and C168-15, component side.  N0085530 • For SSC , measure the resistance between C168-3 and C168-6, component side.	**Yes** GO to A8 . **No** INSPECT the transmission internal harness for an open. If no open is found, REPLACE the faulty component. CLEAR the DTCs. TEST the system for normal operation.



N0085531

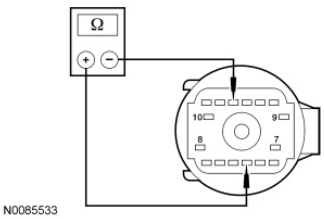
- For SSD , measure the resistance between C168-3 and C168-5, component side.



N0085532

- For TCC , measure the resistance between C168-3 and C168-14, component side.

Component	Resistance
SSA	16-45 ohms
SSB	16-45 ohms
SSC	16-45 ohms
SSD	16-45 ohms
TCC	9-16 ohms



N0085533

- **Is the resistance within specification?**

A8 CHECK THE TRANSMISSION INTERNAL HARNESS FOR A SHORT TO GROUND	
• Measure the resistance between the transmission internal harness C168, component side and ground using the following chart.	**Yes** REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns. **No** INSTALL a new transmission internal harness. CLEAR the DTCs. TEST the system for

Connector Terminal	Component	Ground
C168-3	Power feed	Ground
C168-16	SSA	Ground
C168-15	SSB	Ground
C168-6	SSC	Ground
C168-5	SSD	Ground
C168-14	TCC	Ground

- **Is the resistance greater than 10,000 ohms?**

normal operation.

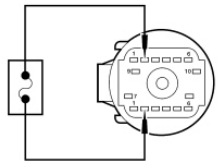
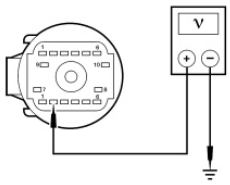
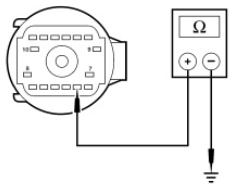
PINPOINT TEST B: TFT SENSOR

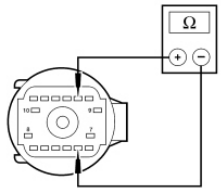
NOTE: Refer to Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE: Refer to the Transmission Internal Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE: Read and record all DTCs.

Test Step	Result / Action to Take
B1 ELECTRONIC DIAGNOSTICS	
• Select PARK. • Ignition OFF. • Check to make sure the transmission vehicle harness C168 is fully seated, the terminals are fully engaged in the connector and are in good condition before proceeding. • Connect the scan tool. • Ignition ON. • Access the transmission PIDs. • **Is the scan tool able to access the transmission PIDs?**	**Yes** GO to B2 . **No** REPEAT procedure to access the transmission PIDs. If the scan tool did not access the transmission PIDs, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
B2 ELECTRICAL SIGNAL CHECK	
• Ignition OFF. • Disconnect: Transmission Vehicle Harness C168. • Ignition ON. • Access the TFT PID. • **Does the scan tool display -40°C (-40°F)?**	**Yes** GO to B3 . **No** REPAIR the transmission vehicle harness circuit CET06 (GN/BN) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.
B3 CHECK THE TRANSMISSION VEHICLE HARNESS SIGNAL CIRCUIT	
• Connect a fused jumper between C168-12, circuit RE406 (GY/VT) and C168-2, circuit CET06 (GN/BN), harness side.	**Yes** GO to B5 . **No** GO to B4 .

 N0085912 • **Does the scan tool display 145°C-151°C (293°F-302°F)?**	
B4 CHECK THE TFT INPUT CIRCUIT	
• Measure the voltage between C168-2, circuit CET06 (GN/BN), harness side and ground.  N0085913 • **Is the voltage between 4.8 and 5.1 volts?**	**Yes** GO to B5 . **No** INSPECT the transmission vehicle harness circuit CET06 (GN/BN) for an open. If an open circuit is not found, REPLACE the PCM. REFER to Section 303-14 . TEST the system for normal operation.
B5 CHECK THE RESISTANCE OF THE TRANSMISSION INTERNAL HARNESS	
• Measure the resistance between the transmission internal harness C168-2, component side and ground.  N0085914 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B6 . **No** REPLACE the transmission internal harness. CLEAR the DTCs. TEST the system for normal operation.
B6 CHECK RESISTANCE OF THE TRANSMISSION INTERNAL HARNESS/ TFT SENSOR	
• Measure the resistance between the transmission internal harness C168-2 and C168-12, component side using the following chart.	**Yes** REFER to Diagnosis By Symptom in this section to diagnose an overheating concern. **No** INSPECT the transmission internal harness for an open. If no open is found, REPLACE the TFT sensor. CLEAR the DTCs. TEST the system for

TRANSMISSION FLUID TEMPERATURE (TFT) **°C** / **°F** / **Resistance (Ohms)** -40 to -20 / -40 to -4 / 967K-284K -19 to -1 / -3 to 31 / 284K-100K 0-20 / 32-68 / 100K-37K 21-40 / 69-104 / 37K-16K 41-70 / 105-158 / 16K-5K 71-90 / 159-194 / 5K-2.7K 91-110 / 195-230 / 2.7K-1.5K 111-130 / 231-266 / 1.5K-0.8K 131-150 / 267-302 / 0.8K-0.54K  N0085915 • **Is the resistance within specification?**	normal operation.

PINPOINT TEST C: TR SENSOR

NOTE: Refer to the Transmission Range (TR) Sensor Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE: Refer to Transmission Range (TR) Sensor Diagnosis Chart within the Transmission Connector Layouts procedure in this section.

NOTE: Read and record all DTCs.

Test Step	Result / Action to Take
C1 VERIFY DTCs	
• Select PARK. • Ignition OFF. • Check to make sure the transmission vehicle harness C167 is fully seated, the terminals are fully engaged in the connector and are in good condition before proceeding. • Connect the scan tool. • Ignition ON. • **NOTE:** DTCs P0705 and P0708 cannot be set by an incorrectly adjusted TR sensor. • Retrieve DTCs. • **Are only DTCs P0705 and P0708 present?**	**Yes** GO to C4 . **No** GO to C2 .

C2 VERIFY TR SENSOR ALIGNMENT	
• Select PARK. • Ignition OFF. • Check to make sure the TR sensor C167 is fully seated, the terminals are fully engaged in the connector and are in good condition before proceeding. • Apply the park brake. • Select NEUTRAL. • Disconnect the selector lever cable from the manual control lever. • Verify that the TR Sensor Alignment Gauge fits in the appropriate slots. • **Is the TR sensor correctly adjusted?**	**Yes** GO to C3 . **No** ADJUST the TR sensor. REFER to Transmission Range (TR) Sensor Adjustment in this section. PLACE selector lever in PARK. CLEAR the DTCs. TEST the system for normal operation. GO to C3 .
C3 VERIFY SELECTOR LEVER CABLE ADJUSTMENT	
• Place the manual control lever in the (D) position. • Re-connect the selector lever cable. • Verify that the selector lever cable is adjusted OK. Refer to Section 307-05 . • **Is the selector lever cable adjusted OK?**	**Yes** GO to C4 . **No** ADJUST the selector lever cable. REFER to Section 307-05 .
C4 CHECK ELECTRICAL SIGNAL OPERATION	
• Select PARK. • Disconnect: TR Sensor C167. • ***NOTICE:*** **Do not pry on connector. This will damage the connector and result in a transmission concern.** • Inspect C167 for damaged or pushed-out terminals, corrosion, loose wires and missing or damaged seals. • **Is there damage to the connector, terminals or harness?**	**Yes** REPAIR as necessary. CLEAR the DTCs. TEST the system for normal operation. **No** If diagnosing a DTC, GO to C5 . If diagnosing a starting concern, GO to C10 .
C5 CHECK ELECTRICAL SYSTEM OPERATION	
• Ignition OFF. • Connect: TR Sensor C167. • Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: TR PIDS: TR_D, TR_V. • Move the selector lever into each gear and stop. • Observe the PIDs, TR_D and TR_V while wiggling the harness, tapping on sensor or driving the vehicle. Use PIDs TR_D for DTCs P0705, P1704 and P1705. Use PIDs TR_V for DTC P0708. • Compare the PIDs to the Transmission Range (TR) Sensor Diagnosis Chart. • **Do the PIDs TR_D and TR_V match the Transmission Range (TR) Sensor Diagnosis Chart and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped ON or the**	**Yes** The problem is not in the TR sensor system. REFER to Diagnosis By Symptom for further diagnosis. **No** If TR_D changes when wiggling the harness, tapping on the sensor or driving the vehicle, the problem may be intermittent. GO to C6 .

vehicle driven?

C6 CHECK TR SENSOR OPERATION

- Ignition OFF.
- Disconnect: TR Sensor C167.
- ***NOTICE:*** **Do not pry on connector. This will damage the connector and result in a transmission concern.**
- Using the Transmission Range (TR) Sensor Diagnosis Chart, measure the resistance of the TR sensor with the selector lever in each range position using the following chart. Compare the measurements to the Transmission Range (TR) Sensor Diagnosis Chart.

TR Sensor

Terminal Number	Range Position	Terminal Number
2	TR 3	3
2	TR 1	4
2	TR 2	5
2	TR 4	6

- **Do the measurements match the Transmission Range (TR) Sensor Diagnosis Chart?**

Yes
Concern is not in the TR sensor, GO to C7 .

No
INSTALL a new TR sensor. CLEAR the DTCs. TEST the system for normal operation.

C7 CHECK TRANSMISSION VEHICLE HARNESS CIRCUITS FOR OPENS

- Ignition OFF.
- Disconnect: PCM C175T.
- Measure the resistance between TR C167 and PCM C175T, harness side using the following chart.

TR	Circuit	PCM
C167-3	VET29 (VT/WH)	C175T-27
C167-4	VET28 (GY/WH)	C175T-16
C167-5	VET30 (YE)	C167T-17
C167-6	VET31 (BU/OG)	C167T-28

- **Are the resistances less than 5 ohms?**

Yes
GO to C8 .

No
REPAIR the vehicle transmission harness circuit which is open. CLEAR the DTCs. TEST the system for normal operation

C8 CHECK TRANSMISSION VEHICLE HARNESS CIRCUITS FOR SHORT TO GROUND

<table>
<tr><td>

- Measure the resistance between the TR C167, harness side and ground using the following chart.

TR	Circuit	Ground
C167-3	VET29 (VT/WH)	Ground
C167-4	VET28 GY/VT)	Ground
C167-5	VET30 (YE)	Ground
C167-6	VET31 (BU/OG)	Ground

- **Are the resistances greater than 10,000 ohms?**

</td><td>

Yes
GO to C9 .

No
REPAIR the vehicle transmission harness circuit shorted to ground. CLEAR the DTCs. TEST the system for normal operation.

</td></tr>
<tr><td colspan="2">

C9 CHECK FOR SHORT BETWEEN TR AND PCM INPUT SIGNAL CIRCUITS

</td></tr>
<tr><td>

- Measure the resistance between the TR sensor C167 terminals, harness side using the following chart.

TR Sensor Pin	Circuit	TR Sensor Pins
2	RE406 (GY/VT)	3, 4, 5, 6
3	VET29 (VT/WH)	4, 5, 6
4	VET28 (GY/VT)	5, 6
5	VET30 (YE)	6

- **Are the resistances greater than 10,000 ohms?**

</td><td>

Yes
REPLACE the PCM. REFER to Section 303-14 . RECONNECT all components. CLEAR the DTCs. TEST the system for normal operation.

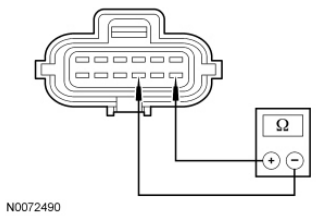
No
REPAIR circuits having less than 10,000 ohms between other TR /PCM input signal circuits that are shorted together. RECONNECT all components. CLEAR the DTCs. TEST the system for normal operation.

</td></tr>
<tr><td colspan="2">

C10 CHECK TR SENSOR OPERATION

</td></tr>
<tr><td>

- Disconnect: TR Sensor C167.
- ***NOTICE:*** **Do not pry on connector. This will damage the connector and result in a transmission concern.**
- Measure the resistance between TR sensor C167-10 and C167-12, component side, with the selector lever in PARK and then NEUTRAL.



- **Are the resistances less than 5 ohms?**

</td><td>

Yes
Concern is not in the TR sensor. REFER to Section 303-06 .

No
INSTALL a new TR sensor. CLEAR the DTCs. TEST the system for normal operation.

</td></tr>
</table>

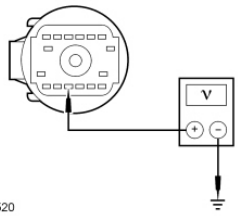
PINPOINT TEST D: PRESSURE CONTROL SOLENOIDS

NOTE: Refer to Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE: Refer to the Transmission Internal Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE: Read and record all DTCs.

Test Step	Result / Action to Take
D1 ELECTRONIC DIAGNOSTICS	
• Select PARK. • Ignition OFF. • Check to make sure the transmission harness C168 is fully seated, the terminals are fully engaged in the connector and in good condition before proceeding. • Install the Transmission Fluid Pressure Gauges into the Line and Pressure Control Solenoid C (PCC) tap. • Connect the scan tool. • Ignition ON. • Access the transmission PIDs. • **Is the scan tool able to access the transmission PIDs?**	**Yes** GO to D2 . **No** REPEAT procedure to access the transmission PIDs. If the scan tool did not access the transmission PIDs, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM or scan tool.
D2 SOLENOID FUNCTIONAL TEST	
• Monitor the Transmission Fluid Pressure Gauges. • **NOTE:** Make sure that the solenoids not being tested are off or at zero. • With the engine running, command the Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB) and PCC solenoids to change the pressure. • **For PCA and PCB : Does the pressure reading for PCA or PCB follow the commanded pressure (actual PCA and PCB pressures will be higher than the commanded pressure)? For PCC : Does the pressure reading match the commanded pressure?**	**Yes** REFER to Diagnosis By Symptom in this section for diagnosis of pressure concerns. TEST the system for normal operation. **No** GO to D3 .
D3 CHECK FOR BATTERY VOLTAGE	
• Ignition OFF. • Disconnect: Transmission Vehicle Harness C168. • Visually inspect the transmission vehicle harness C168 is fully seated, the terminals are fully engaged in the connector and are in good condition before proceeding. • Ignition ON. • Measure the voltage between C168-3, circuit CBB38 (GY/BU), harness side and ground.	**Yes** GO to D4 . **No** REPAIR circuit CBB38 (GY/BU). CLEAR the DTCs. TEST the system for normal operation.

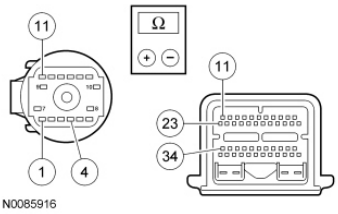


- **Is the voltage greater than 10 volts?**

D4 CHECK CONTROL CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: PCM C175T.
- Measure the resistance between PCM C175T and transmission vehicle harness C168, harness side using the following chart.

PCM Connector	Circuit	Transmission Connector
C175T-11	VET27 (BN/YE)	C168-11
C175T-23	CET45 (YE/BU)	C168-1
C175T-34	CE418 (BU/OG)	C168-4



- **Is the resistance less than 5 ohms?**

Yes
GO to D5 .

No
CHECK the transmission vehicle harness circuit which has high resistance for an open. CLEAR the DTCs. TEST the system for normal operation.

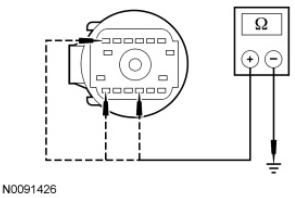
D5 CHECK CONTROL CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between the transmission vehicle harness C168 and ground using the following chart.

Transmission Connector	Circuit	Ground
C168-11	VET27 (BN/YE)	Ground
C168-1	CET45 (YE/BU)	Ground
C168-4	CE418 (BU/OG)	Ground

Yes
GO to D6 .

No
REPAIR the vehicle transmission harness circuit shorted to ground. CLEAR the DTCs. TEST the system for normal operation.



- **Is the resistance greater than 10,000 ohms?**

D6 CHECK SOLENOID RESISTANCE

- Measure the resistance between the transmission internal harness C168, component side power and C169, component side control using the following chart.

Transmission Connector	Component	Transmission Connector
C168-3	PCA	C168-11
C168-3	PCB	C168-1
C168-3	PCC	C168-4

- **Is the resistance within 3.3 ohms and 7.5 ohms?**

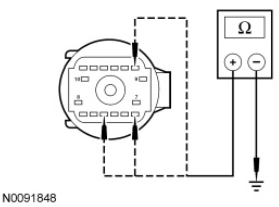
Yes
GO to D7 .

No
REPLACE the transmission internal harness for an open. If no open is found, REPLACE the appropriate solenoid. CLEAR the DTCs. TEST the system for normal operation.

D7 CHECK TRANSMISSION INTERNAL HARNESS/SOLENOID FOR SHORT TO GROUND

- Measure the resistance between the transmission vehicle harness C168, component side and ground using the following chart.

Transmission Connector	Component	Ground
C168-11	PCA	Ground
C168-1	PCB	Ground
C168-4	PCC	Ground



- **Is the resistance greater than 10,000 ohms?**

Yes
REPLACE the PCM. REFER to Section 303-14 . TEST the system for normal operation.

No
REPLACE the transmission internal harness for a short to ground. If no short to ground is found, REPLACE the appropriate solenoid. CLEAR the DTCs. TEST the system for normal operation.

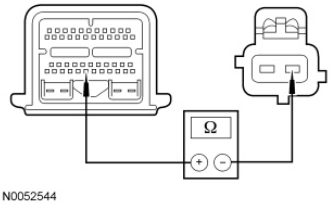
PINPOINT TEST E: TSS , INTERMEDIATE SHAFT SPEED AND OSS SENSORS

NOTE: Refer to the Turbine Shaft Speed (TSS), Intermediate Shaft Speed and Output Shaft Speed (OSS) Sensor Connector illustration within the Transmission Connector Layouts procedure in this section.

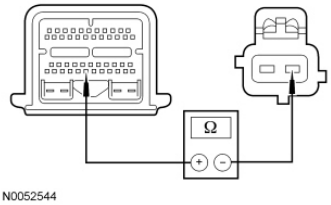
NOTE: Read and record all DTCs.

Test Step	Result / Action to Take
E1 ELECTRONIC DIAGNOSTICS	
• Select PARK. • Ignition OFF. • Check to make sure the transmission harness C168, C143, C164 and C193 are fully seated, the terminals are fully engaged in the connectors and are in good condition before proceeding. • Connect the scan tool. • Ignition ON. • Access the transmission PIDs. • **Is the scan tool able to access the transmission PIDs?**	**Yes** GO to E2 . **No** REPEAT procedure to access the transmission PIDs. If the scan tool did not access the transmission PIDs, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
E2 DRIVE CYCLE TEST	
• While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Does the TSS , intermediate shaft speed or OSS sensor PID increase and decrease with engine and vehicle speed?**	**Yes** GO to E3 . **No** If the TSS , intermediate shaft speed sensor or OSS speed PID does not increase and decrease with engine and vehicle speed, GO to E4 .
E3 DRIVE CYCLE TEST ERRATIC	
• While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Is the TSS , intermediate shaft speed or OSS sensor PID signal erratic (drop to zero or near zero and return to normal operation)?**	**Yes** If the sensor signal is erratic, INSPECT for intermittent concern in the harness, sensor or connector. GO to E4 . **No** CLEAR the DTCs. TEST the system for normal operation.
E4 CHECK TRANSMISSION VEHICLE HARNESS FOR OPENS	
• Ignition OFF. • Disconnect: PCM C175T. • Inspect for damaged or pushed-out terminals, corrosion or loose wires. • Lower the rear of the transmission to gain access to the sensors. • Disconnect: TSS Sensor C143. • Disconnect: Intermediate Shaft Speed Sensor C164. • Disconnect: OSS Sensor C193. • For OSS , measure the resistance between PCM	**Yes** GO to E5 . **No** REPAIR circuits having more than 5 ohms. CLEAR the DTCs. TEST the system for normal operation.

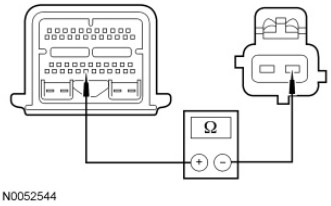
C175T-41, circuit RE406 (GY/VT), harness side and the OSS sensor C193-2, circuit RE406 (GY/VT), harness side.



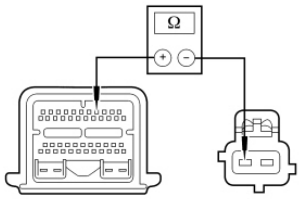
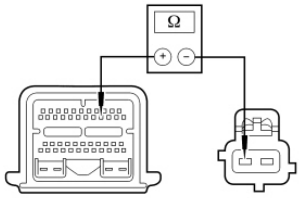
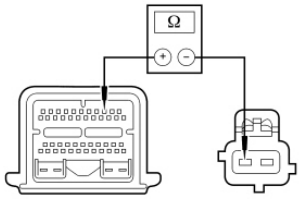
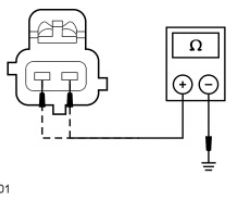
- For intermediate shaft speed, measure the resistance between PCM C175T-41, circuit RE406 (GY/VT), harness side and the intermediate shaft speed sensor C164-2, circuit RE406 (GY/VT), harness side.

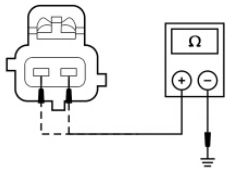


- For TSS , measure the resistance between PCM C175T-41, circuit RE406 (GY/VT), harness side and the TSS sensor C143-2, circuit RE406 (GY/VT), harness side.



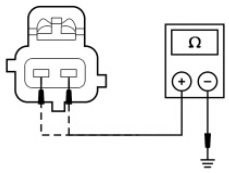
- For intermediate shaft speed, measure the resistance between PCM C175T-4, circuit VE739 (GY/YE), harness side and the intermediate shaft speed sensor C164-1, circuit VE739 (GY/YE), harness side.

 N0052545 • For TSS , measure the resistance between PCM C175T-15, circuit VET33 (WH/OG), harness side and the TSS sensor C143-1, circuit VET33 (WH/OG), harness side.  N0052546 • For OSS , measure the resistance between PCM C175T-3, circuit RET04 (YE/GN), harness side and the OSS sensor C193-1, circuit RET04 (YE/GN), harness side.  N0052547 • **Are the resistances less than 5 ohms?**	
E5 CHECK THE TRANSMISSION VEHICLE HARNESS FOR SHORT TO GROUND	
• For the OSS , measure the resistance between OSS sensor C193-1, harness side and ground and C193-2, harness side and ground.  A0005501 • For the intermediate shaft speed sensor, measure the resistance between intermediate shaft speed sensor C164-1, harness side and ground and C164-2, harness side and ground.	**Yes** GO to E6 . **No** REPAIR circuit(s) having more than 10,000 ohms. CLEAR the DTCs. TEST the system for normal operation.



A0005501

- For the TSS , measure the resistance between TSS C143-1, harness side and ground and C143-2, harness side and ground.

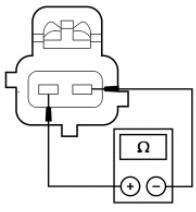


A0005501

- **Are the resistances greater than 10,000 ohms?**

E6 CHECK THE RESISTANCE OF THE TSS , INTERMEDIATE SHAFT SPEED SENSOR OR OSS SENSOR

- Disconnect the appropriate connector from the TSS C143, intermediate shaft speed sensor C164 or OSS sensor C193.
- Measure the resistance between terminal 1 and terminal 2 of the speed sensor using the following chart.



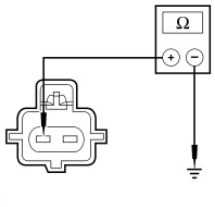
A0005211

- Record the value.

Resistance (ohms)	Temperature °C (°F)
266-390	-20° (4°)
325-485	21° (70°)
492-738	150° (302°)

Yes
GO to E7 .

No
INSTALL a new sensor. CLEAR the DTC. TEST the system for normal operation.

• **Is the resistance within specification?**	
E7 CHECK SENSORS FOR A SHORT TO GROUND	
• Measure the resistance between TSS C143-1 , OSS C193-1 or intermediate shaft speed sensor C164-1 component side of each sensor and ground.  N0085932 • **Is the resistance greater than 10,000 ohms?**	**Yes** REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns. **No** INSTALL a new sensor.

PINPOINT TEST F: SOLENOID MECHANICAL FAILURE

NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1716, P1717 and P1740.

Test Step	Result / Action to Take
F1 ELECTRONIC DIAGNOSIS	
• Select PARK. • Connect the scan tool. • Ignition ON. • Perform the Key ON Engine OFF (KOEO) Test. • If any of the following DTCs are present, P1714, P1715, P1716, P1717 and P1740, continue with this test. • **Are other DTCs present for the Transmission Fluid Temperature (TFT) or shift solenoids?**	**Yes** REPAIR the DTCs for TFT or shift solenoids first. CLEAR the DTCs and PERFORM the Transmission Drive Cycle Test. RERUN KOEO test. **No** INSTALL a new solenoid and/or body. REFER to Diagnostic Trouble Code (DTC) Charts in this section for code description. GO to F2 .
F2 TRANSMISSION DRIVE CYCLE TEST	
• Perform the Transmission Drive Cycle Test. Refer to Transmission Drive Cycle Test in this section. • **Does the transmission upshift and downshift OK?**	**Yes** GO to F3 . **No** REFER to Diagnosis By Symptom in this section to diagnose shift concerns.
F3 RETRIEVE DTCs	
• Select PARK. • Connect the scan tool. • Ignition ON. • Perform the KOEO test.	**Yes** INSTALL a new PCM. PERFORM the Transmission Drive Cycle Test. RERUN KOEO test. **No**

• **Are DTCs P1714, P1715, P1716, P1717 and P1740 still present?**	Testing complete. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.

Special Testing Procedures

Special Tool(s)

 ST1565-A	Pressure Gauge, Transmission Fluid 307-004 (T57L-77820-A)
 ST2538-A	Transmission Air Test Plate and Gaskets 307-433-01, 307-433-02, 307-433-03
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portion of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

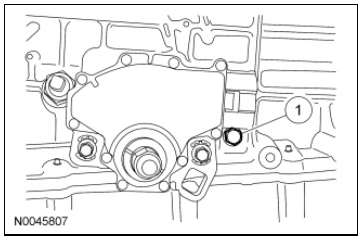
Pressure Test - PCA , PCB

NOTICE: **Carry out Pressure Tests for Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB) and Pressure Control Solenoid C (PCC) prior to carrying out Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur. Do not maintain Wide Open Throttle (WOT) in any gear range for more than 5 seconds.**

NOTE: Some sensor failures may cause high line pressure, failure mode effect management actions. Make sure that the electrical repairs and self-test have been performed or test results may be incorrect.

NOTE: The line pressure tap is used to verify output pressure from Pressure Control Solenoid A (PCA) or Pressure Control Solenoid B (PCB). Use pressure control PIDs and take note which solenoid, PCA or PCB , is commanded higher. Use the higher commanded pressure control solenoid value when referencing the Line Pressure Charts A and B. The second pressure tap is used to verify the output from the Pressure Control Solenoid C (PCC) solenoid.

This test verifies that the line pressure is within specifications.



Item	Part Number	Description
1	1390685-S430	Line pressure tap

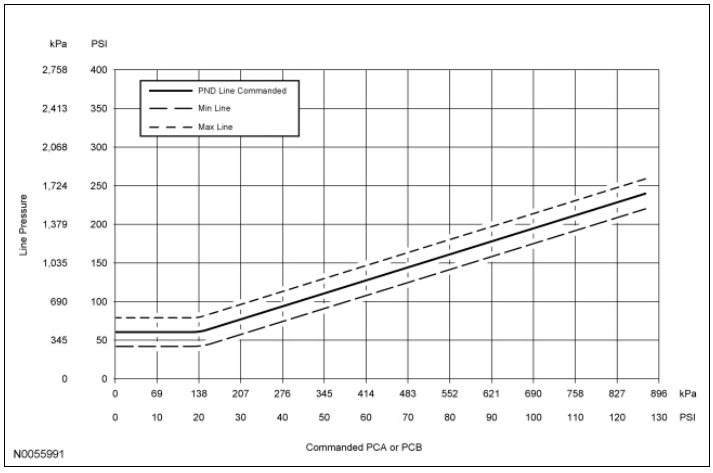
1. Connect the Transmission Fluid Pressure Gauge to the line pressure tap.

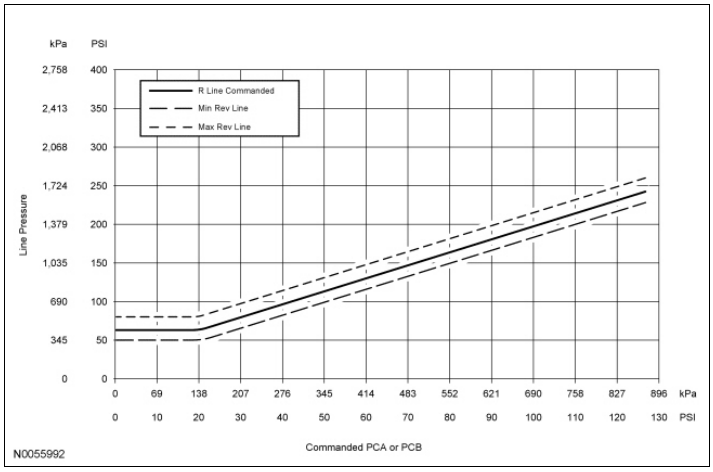
2. Connect the scan tool and monitor the PCA and PCB PIDs. Note which PID is commanded higher. Use the higher commanded pressure control solenoid value when referencing the Line Pressure Charts A and B.

3. Start the engine and check the line pressure reading from the Transmission Fluid Pressure Gauge. Refer to the Line Pressure Chart for the correct selector lever position.

4. If the line pressure is not within ranges given in Line Charts A and B, refer to Line Pressure Diagnosis Chart in this section for line pressure concern causes.

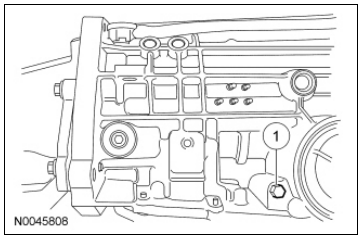
5. Go to the PCC Pressure Test in this section.





Pressure Test - PCC

This test verifies that PCC is functioning correctly within specifications.



Item	Part Number	Description
1	390685-S430	Pressure Control Solenoid C (PCC) tap

1. If not previously connected, install the scan tool.
2. Connect the Transmission Fluid Pressure Gauge to the PCC pressure tap.
3. Using the scan tool, monitor the PCC PID and note the commanded pressure.
4. Start the engine and check the PCC pressure. If the Transmission Fluid Pressure Gauge reading does not match within ± 15 psi of PID value displayed for PCC , GO to Pinpoint Test D to diagnose PCC operation. If PCC operation is OK, refer to Line Pressure Diagnosis Chart in this section for line pressure concern causes.
5. When pressure tests are completed, install the pressure tap plugs.
    - Tighten to 13 Nm (115 lb-in).

Line Pressure Diagnosis Chart

Test Results	Possible Source
High at Idle - All Ranges	• Wiring Harnesses • Pressure Control Solenoid C (PCC) Boost Valve • PCC Solenoid • Main Regulator Valve
Low at Idle - All Ranges	• Low Transmission Fluid Level • Transmission Fluid Filter/Seal • Main Control Valve Body • Cross Leaks • Gaskets • Pump • Separator Plate
Low - All Forward Ranges	• Forward Clutch • Main Control Valve Body • Overdrive Servo

	• Intermediate Servo
Low in PARK Only	• Main Control Valve Body
Low in REVERSE Only	• Separator Plate • Reverse Servo Piston, Cover Seal • Reverse Clutch • Overdrive (O/D) Servo • Intermediate Servo • Main Control Valve Body • Forward Clutch
Low in NEUTRAL Only	• Main Control Valve Body • O/D Servo • Intermediate Servo
Low in O/D Only	• Forward Clutch • O/D Servo • Intermediate Servo • Main Control Valve Body
Low in DRIVE Only (O/D Canceled)	• Forward Clutch • O/D Servo • Intermediate Servo • Main Control Valve Body
Low in 1st Position	• Forward Clutch • Main Control Valve Body
Low in 2nd Position	• Intermediate Servo • O/D Servo • Forward Clutch
Low in 3rd Position	• Intermediate Servo • O/D Servo • Forward Clutch

Stall Speed Test

This test checks operation of the following items:

- Torque Converter Clutch (TCC)
- Forward clutch
- Low One-Way Clutch (OWC) assembly
- Engine driveability concerns
- Overdrive (O/D) OWC assembly

⚠ WARNING: Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Always perform the Line Pressure Test procedures prior to performing the Stall Speed Test. If line pressure is low at stall, do not perform the Stall Speed Test or further transmission damage will occur.**

NOTICE: **After testing each of the following ranges D, 3, 2, 1 and R, move the selector lever to NEUTRAL and run the engine at 1,000 rpm for about 15 seconds to allow the torque converter to cool before testing the next range. Failure to follow this instruction may result in transmission damage.**

NOTICE: **Do not maintain Wide Open Throttle (WOT) in any range for more than 5 seconds. Failure to follow this instruction may result in transmission damage.**

NOTICE: **If the engine rpm recorded by the scan tool exceeds maximum specified rpm, release the accelerator pedal immediately. Failure to follow this instruction may result in transmission damage. Clutch or band slippage is indicated.**

NOTE: The Stall Speed Test should be performed with the engine and transmission at normal operating temperatures.

NOTE: Prolonged use of this procedure may set DTC P0712 or P1783. After performing the Stall Speed Test, run the On-Board Diagnostic (OBD) Test and clear the DTCs.

1. Connect a scan tool to the vehicle.

2. Press the accelerator pedal, Wide Open Throttle (WOT) in each range. Record rpm reached in each range. Stall speeds should be as follows:

Stall Speed Chart

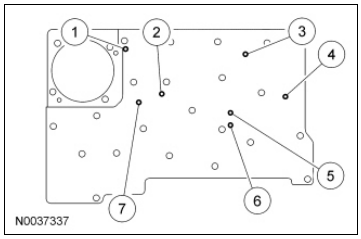
Vehicle	Engine	RPM
Explorer, Mountaineer, Explorer Sport Trac	4.0L	2,660-3,129

If the stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If the stall speeds were too low, first check the engine idle speed. If engine idle is OK, remove the transmission and replace the torque converter.

Stall Speed Diagnosis Chart

Selector Lever Position	Stall Speeds High	Stall Speeds Low
(D), D with O/D canceled and 1	Overdrive (O/D) One-Way Clutch (OWC), rear OWC	-
D with O/D canceled, 2 and 1	Forward clutch, O/D OWC	-
(D)	Forward clutch, O/D OWC	-
(D), D with O/D canceled, 2, 1 and R	General pressure concerns, forward clutch, O/D OWC	Converter OWC or engine driveability concerns
R Only	High/reverse, high clutch, low and reverse band/servo	-
2 Only	Intermediate band/servo	-
1 Only	Low/reverse band/servo	-

Air Pressure Tests



Item	Description
1	Reverse servo
2	Intermediate servo
3	Overdrive (O/D) servo
4	Coast clutch
5	Forward clutch
6	Direct clutch
7	Reverse servo modulator

A no-drive or erratic shift condition may be due to inoperative bands and clutches. To diagnose these conditions a series of checks can be made by substituting air pressure for transmission fluid pressure to determine the location of the damaged or obstructed component.

Follow the procedure to determine the location of the inoperative clutch or band by substituting air pressure into the various test plate passages.

NOTE: Use only dry, regulated air pressure, 276 kPa (40 psi) maximum.

1. Remove the main control valve body. Refer to Main Control Valve Body in this section.
2. Install the Transmission Air Test Plate and Gasket. Tighten bolts to 10 Nm (89 lb-in).
3. **NOTE:** Do not apply air to the test plate vent hole.

   Apply air to the appropriate clutch or servo port (refer to plate layout diagram). Refer to the Air Pressure Test Diagnostic Chart for conditions, possible causes and actions.
4. After the testing is completed, remove the Transmission Air Test Plate and Gasket and proceed with any repairs that are needed.
5. After the repairs are completed, install the main control valve body. Refer to Main Control Valve Body in this section.

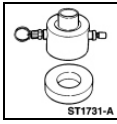
Air Pressure Test Diagnostic Chart

Condition	Possible Causes	Actions

Dull Thud Heard or Movement Felt When Air is Applied and Released	Clutches, bands and fluid passages are OK.	Concerns may not be in the transmission. Check the PCM, wiring harness and non-transmission related components.
No Drive	Clutches and bands inoperative.	Disassemble the transmission, clean and inspect to locate area of concern.
Erratic Shifts	Clutches and bands inoperative due to incorrect pressures.	Disassemble the transmission, clean and inspect to locate area of concern.
No Dull Thud Heard	Clutches, bands and fluid passages may be damaged or obstructed.	Disassemble the transmission, clean and inspect to locate area of concern.
No Movement Felt	Clutches, bands and fluid passages may be damaged or obstructed.	Disassemble the transmission, clean and inspect to locate area of concern.
Hissing Sound Heard	Clutch seals or check ball may be damaged or leaking.	Disassemble the transmission, clean and inspect to locate area of concern.
Servos Do Not Operate	Seals and pistons may be damaged. Supply and release ports may be obstructed. Spring may be broken.	Disassemble the transmission, clean and inspect to locate area of concern.
Multiple Clutches are Applied	Fluid passages in center support or clutch cylinders may be obstructed.	Disassemble the transmission, clean and inspect to locate area of concern. Check fluid passages in the center support for obstructions.

Leakage Inspection

Special Tool(s)

 ST1731-A	Leak Tester, Torque Converter 307-421

Material

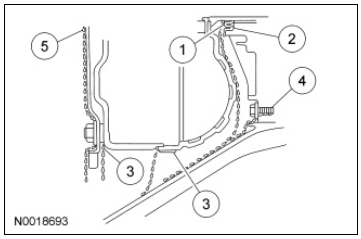
Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-

NOTE: When diagnosing transmission leaks, the source of the leak must be positively identified prior to repair. If the vehicle is driven extensively between adding the fluorescent additive and performing the leak test, the leaking oil can spread and make identifying the location of the leak difficult.

1. Clean off any transmission fluid from the top and bottom of the torque converter housing, the front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a nonflammable solvent and blow dry with compressed air.

2. Add Dye-Lite® ATF Power Steering Fluid Leak Detection Dye to the transmission fluid. Use one 30 ml (1 fl. oz) of dye solution for every 3.8 L (4 qt) of transmission fluid.

3. Start and run the engine until the transmission reaches its normal operating temperature. Raise the vehicle on a hoist and run the engine occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transmission. Using a black light, observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Run the engine until transmission fluid leakage is evident and the probable source of leakage can be determined.



4. If the source of the leak is obvious, repair as required. Leaks from the torque converter housing can originate from several locations. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 5 steps following correspond with the numbers in the illustration.
    1. Transmission fluid leaking by the converter hub seal lip will tend to move along the drive hub and onto the back of the torque converter. Except in the case of a total seal failure, transmission fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing.

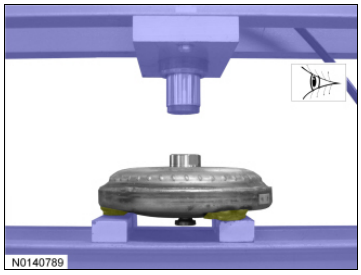
2. Transmission fluid leakage by the outside diameter of the converter impeller hub seal and the case will follow the same path that leaks by the ID of the converter hub seal follow.
3. Transmission fluid leakage from the converter cover weld or the converter-to-flexplate stud weld will appear at outside diameter of torque converter on the back face of the flexplate and in the converter housing only near the flexplate. If a converter-to-flexplate lug, lug weld or converter cover weld leak is suspected, remove the converter and pressure check.
4. Transmission fluid leakage from the bolts inside the converter housing will flow down the back of the torque converter housing. Leakage may be from loose or missing bolts.
5. Engine oil leaks from the rear main oil.

5. Remove the torque converter.

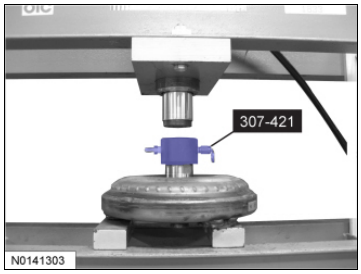
6. Using a black light, observe the torque converter housing. Inspect for evidence of dye from the pump bolts, pump seal, and torque converter hub seal. Repair as required.

7. If the source of the leak is not evident, continue with this procedure to leak test the torque converter.

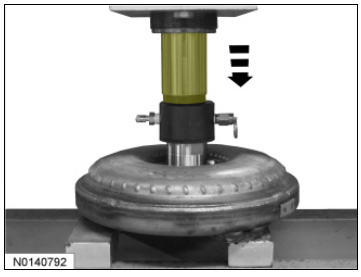
8. Install the torque converter in the arbor press. Support the torque converter on the mounting pads.



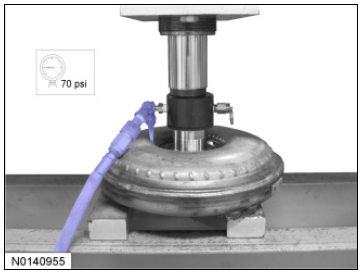
9. Install the Leak Tester, Torque Converter 307-421 into the torque converter hub.



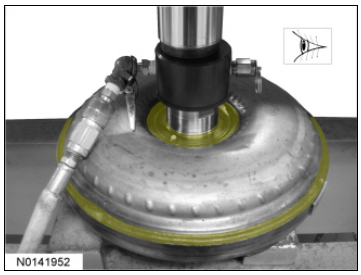
10. Secure the press. Only apply enough force from the press to seal of the Leak Tester, Torque Converter 307-421 into the torque converter hub.



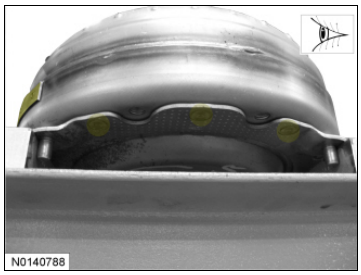
11. Connect a compressed air supply to the Leak Tester, Torque Converter 307-421.



12. With air pressure applied to the valve, inspect for leaks at the converter hub weld and seams. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new torque converter.



13. With air pressure applied to the valve, inspect for leaks at the stud or mounting pad and balance weight welds. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new torque converter.



14. After leaks are repaired, clean remaining transmission fluid dye from serviced areas.

Diagnosis By Symptom

The Diagnosis by Symptom Index gives the technician diagnostic information, direction and suggests possible components, using a symptom as a starting point.

Diagnosis by Symptom Index - Directions

1. Using the Symptom Index, select the Concern/Symptom that best describes the condition.

2. Refer to the routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with:
    1. preliminary inspections.
    2. verifications of condition.
    3. checking the transmission fluid levels.
    4. carrying out other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a DTC. Be aware that the components listed may still be the cause.

   NOTE: When the vehicle battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The PCM must relearn these parameters. During this learning process, slightly firm shifts, delayed or early shifts may be experienced. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

   Begin with the ROUTINE, if indicated. Follow the reference or action statements. Always carry out the On-Board Diagnostic (OBD) Tests as necessary. Never skip steps. Repair as necessary.

5. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure of correct repair.

Diagnosis by Symptom Index

Diagnosis by Symptom Index

5R55S	Routines
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• No Forward Only (All Positions)	201B
• No Reverse Only	202
• Harsh Reverse Only	203

• Harsh Forward Only	204A
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• Delayed/Soft Reverse Only	205
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• No Forward and No Reverse	207
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- Erratic/Hunting (Some/All)	212
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• Soft/Slipping 4-3 Shift	229
• Soft/Slipping 3-2 Shift	230
• Soft/Slipping 2-1 Shift	231
• Harsh 1-2 Shift	232
• Harsh 2-3 Shift	233
• Harsh 3-4 Shift	234
• Harsh 4-3 Shift	235
• Harsh 3-2 Shift	236
• Harsh 2-1 Shift	237
• No 4-5 Shift	270
• No 5-4 Shift	271
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Diagnostic Routines

Engagement Concern: No Forward in (D) Only

Possible Component	Reference/Action
201A - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.

Main Control	
• Screw not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Filter damaged or missing	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Case	
• Damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: No Forward Only (All Positions)

Possible Component	Reference/Action
201B - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out the Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Main Control	
• Screw not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.

• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Forward Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Low One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Case	
• Damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: No Reverse Only

Possible Component	Reference/Action
202 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid C (PCC), Shift Solenoid B	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

(SSB)	
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damage	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Torque Converter	
• Internal component damage	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the checks or is damaged, install a new or remanufactured torque converter.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect or damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Reverse Drum Assembly	
• One-Way Clutch (OWC) damaged	• Inspect for damage. Install a new drum assembly.
• Bearing damaged	• Inspect for damage. Install a new drum assembly.

Engagement Concern: Harsh Reverse Only

Possible Component	Reference/Action
203 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid C (PCC)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, spring damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.

Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Reverse Drum Assembly	
• One-Way Clutch (OWC) damaged	• Inspect for damage. Install a new drum assembly.
• Bearing damaged	• Inspect for damage. Install a new drum assembly.

Engagement Concern: Harsh Forward Only

Possible Component		Reference/Action
204A - ROUTINE		
Powertrain Control System		
	• PCM, vehicle wiring harnesses, Pressure Control Solenoid A (PCA), Pressure Control Solenoid C (PCC)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
		• GO to Pinpoint Test D .
		• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures		
	• High pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control		
	• Screws not tightened to specification	• Tighten to specification.
	• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
	• Contamination	• Disassemble and clean.
	• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
	• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Center Support		
	• Screw not tightened to specification	• Tighten to specification.
	• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
		• Inspect for damage. Repair as necessary.

	• Outside diameter of case bore damaged	
	• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly		
	• Seals, piston damaged	• Inspect for damage. Repair as necessary.
	• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
	• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
	• Return springs damaged	• Inspect for damage. Repair as necessary.
	• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: Harsh Manual 1st Gear Only

Possible Component	Reference/Action
204B - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PCB), Turbine Shaft Speed (TSS) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.

Engagement Concern: Delayed or Soft Reverse Only

Possible Component	Reference/Action
205 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid C	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

(PCC)	
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• Low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	

• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: Delayed/Soft Forward Only

Possible Component	Reference/Action
206 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• Low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, spring damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.

• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damage	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction element damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: No Forward and No Reverse

Possible Component	Reference/Action
207 - ROUTINE	
Powertrain Control System	

• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Selector Lever Cable/Transmission Range (TR) Sensor	
• Selector lever cable system or TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Main Control	
• Screws not tightened to specification	• Tighten screws to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Torque Converter	
• Damaged flexplate or adapter plate	• Inspect for damage. Remove transmission.
• Damaged impeller hub • Damaged turbine hub	• Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the checks or is damaged, install a new or remanufactured torque converter.

Input Shaft	
• Damaged	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Overdrive (O/D) Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Center Shaft Assembly	
• Damaged. One-Way Clutch (OWC) damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Forward Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.

Reverse Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Output Shaft	
• Damage	• Inspect for damage. Repair as necessary.
Direct OWC	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Engagement Concern: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test B and GO to Pinpoint Test C .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.

• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.

Engagement Concern: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test B .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.

• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves and springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.

Shift Concern: Some/All Shifts Missing (Automatic Mode Only)

Possible Component	Reference/Action

210 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor, Intake Air Temperature (IAT) sensor, Vehicle Speed Sensor (VSS) input	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS .
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Some Shifts Missing Only	
	• If only some shifts are missing, determine which shift(s) is missing.
	• Refer to the following routine(s) for further No Shift concerns: ♦ No 1-2 Shift, Routine 220 ♦ No 2-3 Shift, Routine 221 ♦ No 3-4 Shift, Routine 222 ♦ No 4-5 Shift, Routine 270 ♦ No 5-4 Shift, Routine 271 ♦ No 4-3 Shift, Routine 223 ♦ No 3-2 Shift, Routine 224 ♦ No 2-1 Shift, Routine 225
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to correct level, refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Selector Lever Cable/ TR Sensor	
• Selector Lever Cable system or TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Section 307-05 .
Incorrect Pressures	

• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Overdrive (O/D) Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.

• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Timing Concerns - Early/Late

Possible Component	Reference/Action
211 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Output Shaft Speed (OSS) sensor, Intake Air Temperature (IAT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and IAT .
	• GO to Pinpoint Test E .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Some Shifts Early/Late Only	
	• If only some shifts are early/late, determine which shift(s) is missing.
	• Refer to the following routine(s) for further No Shift concerns: ♦ Soft/Slipping 1-2 Shift, Routine 226 ♦ Soft/Slipping 2-3 Shift, Routine 227 ♦ Soft/Slipping 3-4 Shift, Routine 228 ♦ Soft/Slipping 4-5 Shift, Routine 272 ♦ Soft/Slipping 5-4 Shift, Routine 273 ♦ Soft/Slipping 4-3 Shift, Routine 229 ♦ Soft/Slipping 3-2 Shift, Routine 230 ♦ Soft/Slipping 2-1 Shift, Routine 221
Transmission Fluid	

• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Timing Concerns - Erratic/Hunting (Some/All)

Possible Component	Reference/Action
212 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Output Shaft Speed (OSS) sensor, Intake Air Temperature (IAT)	• Carry out Overdrive (O/D) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and IAT .

sensor	
	• GO to Pinpoint Test E .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Further Diagnosis	
• For further diagnosis for timing issues, refer to Reference/Actions	• Refer to the following routine(s) for specific diagnosis: ♦ No 1-2 Shift, Routine 220 ♦ No 2-3 Shift, Routine 221 ♦ No 3-4 Shift, Routine 222 ♦ No 4-5 Shift, Routine 270 ♦ No 5-4 Shift, Routine 271 ♦ No 4-3 Shift, Routine 223 ♦ No 3-2 Shift, Routine 224

		♦ No 2-1 Shift, Routine 225 ♦ Soft/Slip 1-2 Shift, Routine 226 ♦ Soft/Slip 2-3 Shift, Routine 227 ♦ Soft/Slip 3-4 Shift, Routine 228 ♦ Soft/Slip 4-5 Shift, Routine 272 ♦ Soft/Slip 5-4 Shift, Routine 273 ♦ Soft/Slip 4-3 Shift, Routine 229 ♦ Soft/Slip 3-2 Shift, Routine 230 ♦ Soft/Slip 2-1 Shift, Routine 231 ♦ Harsh 1-2 Shift, Routine 232 ♦ Harsh 2-3 Shift, Routine 233 ♦ Harsh 3-4 Shift, Routine 234 ♦ Harsh 4-5 Shift, Routine 274 ♦ Harsh 5-4 Shift, Routine 275 ♦ Harsh 4-3 Shift, Routine 235 ♦ Harsh 3-2 Shift, Routine 236 ♦ Harsh 2-1 Shift, Routine 237

Engagement Concern: Feel - Soft/Slipping (Some/All)

Possible Component		Reference/Action
213 - ROUTINE		
Powertrain Control System		
	• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC), intermediate shaft speed sensor, Transmission Fluid Temperature (TFT) sensor, Intake Air Temperature (IAT) sensor, Vehicle Speed Sensor (VSS) input	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS .
		• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
		• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Some Shifts Soft/Slipping Only		
		• If only some of the shifts are soft/slipping, determine which shift(s) is missing.

		• Refer to the following routine(s) for further Soft/Slipping concerns: ♦ Soft/Slipping 1-2 Shift, Routine 226 ♦ Soft/Slipping 2-3 Shift, Routine 227 ♦ Soft/Slipping 3-4 Shift, Routine 228 ♦ Soft/Slipping 4-5 Shift, Routine 272 ♦ Soft/Slipping 5-4 Shift, Routine 273 ♦ Soft/Slipping 4-3 Shift, Routine 229 ♦ Soft/Slipping 3-2 Shift, Routine 230 ♦ Soft/Slipping 2-1 Shift, Routine 231
Transmission Fluid		
	• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
	• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures		
	• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control		
	• Screws not tightened to specification	• Tighten to specification.
	• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
	• Contamination	• Disassemble and clean.

	• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
	• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Torque Converter		
	• Internal component damage	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.
Pump Assembly		
	• Screws not tightened to specification	• Tighten screws to specification.
	• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
	• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
	• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
	• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Coast Clutch Assembly		
	• Seals, piston damaged	• Inspect for damage. Repair as necessary.

	• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
	• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
	• Return springs damaged	• Inspect for damage. Repair as necessary.
Center Support		
	• Screw not tightened to specification	• Tighten to specification.
	• Seal rings or bearings damaged	• Inspect for damage. Repair as necessary.
	• Outside diameter of case bore damage	• Inspect for damage. Repair as necessary.
	• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Intermediate Servo		
	• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
	• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band		
	• Band damaged	• Inspect for damage. Repair as necessary.
	• Servo worn or damaged	• Inspect for damage. Repair as necessary.
	• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly		
	• Seals, piston damaged	• Inspect for damage. Repair as necessary.
	• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
	• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.

	• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly		
	• Seals, piston damaged	• Inspect for damage. Repair as necessary.
	• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
	• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
	• Return springs damaged	• Inspect for damage. Repair as necessary.
	• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo		
	• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
	• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band		
	• Band damaged	• Inspect for damage. Repair as necessary.
	• Servo worn or damaged	• Inspect for damage. Repair as necessary.
	• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Case		
	• Damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Feel - Harsh (Some/All)

Possible Component	Reference/Action
214 - ROUTINE	
Powertrain Control System	

• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC), intermediate shaft speed sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor, Intake Air Temperature (IAT) sensor, Vehicle Speed Sensor (VSS) input	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM, IAT and VSS .
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Some Shifts Harsh Only	
	• If only some of the shifts are harsh, determine which shift(s) is missing.
	• Refer to the following routine(s) for further No Shift concerns: ♦ Harsh 1-2 Shift, Routine 232 ♦ Harsh 2-3 Shift, Routine 233 ♦ Harsh 3-4 Shift, Routine 234 ♦ Harsh 4-5 Shift, Routine 274 ♦ Harsh 5-4 Shift, Routine 275 ♦ Harsh 4-3 Shift, Routine 235 ♦ Harsh 3-2 Shift, Routine 236 ♦ Harsh 2-1 Shift, Routine 237
Transmission Fluid	
• Incorrect level	• Check transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	

• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Input Shaft	
• Damaged	• Inspect for damage. Install new as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Center Shaft Assembly	
• Center shaft assembly damaged	• Inspect for damage. Repair as necessary.
• One-Way Clutch (OWC) damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
Intermediate Servo	

• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Output Shaft	

• Damaged	• Inspect for damage. Install new as necessary.
Case	
• Damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 1st Gear in Drive, Engages in a Higher Gear

Possible Component	Reference/Action
215 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test C .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	

• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low OWC	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Engagement Concern: No 1st Gear in Manual 1 Position

Possible Component	Reference/Action
216 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will

	remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low OWC	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: No 2nd Gear in Manual 2 Position

Possible Component	Reference/Action
217 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification.	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.

• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install a new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low OWC	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: No 1-2 Shift

Possible Component	Reference/Action
220 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor, Vehicle Speed Sensor (VSS) input	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM and VSS .
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .

	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Servo bore	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
O/D Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 2-3 Shift

Possible Component	Reference/Action
221 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid B (SSB), Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoid A (PCA), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball, damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Servo bore	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 3-4 Shift

Possible Component	Reference/Action
222 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Pressure Control Solenoid C (PCC), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.

• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Center Support	
• Screws not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	

	• Inspect for mislocation, poor seating, damage. Install a new cylinder.

Shift Concern: No 4-3 Shift

Possible Component	Reference/Action
223 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Pressure Control Solenoid A (PCA), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

• Servo bore	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 3-2 Shift

Possible Component	Reference/Action
224 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
	• Inspect for damage. Repair as necessary.

• Transmission fluid filter damaged or missing	
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 2-1 Shift

Possible Component	Reference/Action
225 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	

• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 1-2 Shift

Possible Component	Reference/Action
226 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Transmission Fluid Temperature (TFT) sensor, Vehicle Speed Sensor (VSS) input	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

• Servo bore	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 2-3 Shift

Possible Component	Reference/Action
227 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Pressure Control Solenoid A (PCA), intermediate shaft speed sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
	• Inspect for damage. Repair as necessary.

• Transmission fluid filter damaged or missing	
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Servo bore	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 3-4 Shift

Possible Component	Reference/Action
228 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Pressure Control Solenoid C (PCC), Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to	• Tighten to specification.

specification	
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Feel - Soft/Slipping 4-3 Shift

Possible Component	Reference/Action

229 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Pressure Control Solenoid A (PCA), Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 3-2 Shift

Possible Component	Reference/Action
230 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid C (PCC), intermediate shaft speed sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Servo bore	• Inspect for damage. Repair as necessary.

O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Feel - Soft/Slipping 2-1 Shift

Possible Component	Reference/Action
231 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or

	transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 1-2 Shift

Possible Component	Reference/Action
232 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Turbine Shaft Speed (TSS) sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	

• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 2-3 Shift

Possible Component	Reference/Action
233 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid B (SSB), Pressure Control Solenoid A (PCA), Turbine Shaft Speed (TSS) sensor, intermediate shaft speed sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or

	sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 3-4 Shift

Possible Component	Reference/Action
234 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Pressure Control Solenoid C (PCC), Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Center Support	
• Screws not tightened to specification	• Tighten to specification.
• Seal rings or bearing damaged	• Inspect for damage. Repair as necessary.
• Outside diameter of case bore damaged	• Inspect for damage. Repair as necessary.
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.

• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 4-3 Shift

Possible Component	Reference/Action
235 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Pressure Control Solenoid A (PCA), Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
	• Inspect for damage. Repair as necessary.

• Transmission fluid filter damaged or missing	
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 3-2 Shift

Possible Component	Reference/Action
236 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Turbine Shaft Speed (TSS) sensor, intermediate shaft speed sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	

• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 2-1 Shift

Possible Component	Reference/Action
237 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Turbine Shaft Speed (TSS) sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.

• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Torque Converter Operation Concerns: Does Not Apply

Possible Component	Reference/Action
240 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid, Transmission Fluid Temperature (TFT) sensor and Engine Coolant Temperature (ECT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test B .
	• Repair as necessary. Clear the DTCs, road test and rerun O/D Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Pump Assembly	

• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Torque Converter Assembly	
• Torque converter internal failure preventing engagement, piston application	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Torque Converter Operation Concern: Always Applied/Stalls Vehicle

Possible Component	Reference/Action
241 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged,	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand

misassembled, missing, stuck or bore damaged	valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Torque Converter Assembly	
• Torque converter internal failure preventing engagement, piston release	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.
Low One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Torque Converter Operation Concern: Cycling/Shudder/Chatter

Possible Component	Reference/Action
242 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A .
	• Repair as necessary. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Condition - contaminated, degraded	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section. If contaminated, locate source of contamination. If burnt, inspect mechanical bands, clutches. Repair as necessary. Change transmission fluid. Carry out transmission fluid drain and refill procedure. Refer to Transmission Fluid Drain and Refill in this section. Carry out transmission fluid cooler cleaning procedure. Refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.
Main Control	

• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve, springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Torque Converter Assembly	
• Torque converter internal leakage, clutch material damaged	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If torque converter fails to pass the criteria or is damaged, install a new or remanufactured converter.

Other Concerns: Selector Lever Efforts High

Possible Component	Reference/Action
251 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test C .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Selector Lever Cable, TR sensor	
• Selector lever cable system or TR sensor damaged,	• Inspect and adjust the selector lever cable or adjust the TR sensor. Refer to Transmission Range (TR) Sensor

misaligned	Adjustment in this section or Section 307-05 .
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Case	
• Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged	• Inspect for damage. If damaged, install a new part.
• Manual valve lever shaft retaining pin damaged	• Inspect for damage. If damaged, repair as necessary.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 - ROUTINE	
Powertrain Control System	
• Output Shaft Speed (OSS) sensor, intermediate shaft speed, Turbine Shaft Speed (TSS) sensor, Transmission Range (TR) sensor	• Inspect for transmission fluid leakage. If areas around the sensors show signs of transmission fluid leakage, install a new sensor O-ring seal. If area behind TR sensor shows signs of a leak, a new manual lever shaft seal may need to be installed.
Transmission Fluid	
• Incorrect level	• Check transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.

• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Case	
• Case vent damaged, output shaft flange damaged	• Inspect for damage. If damaged, repair as necessary.
Seals/Gaskets	
• Leakage at gaskets, seals, cooler lines, torque converter studs, venting	• Refer to Leakage Inspection in this section for potential leak locations.
	• Remove all traces of lubricant on exposed surfaces of the transmission. Check vent for free breathing. Operate the vehicle at normal temperatures and perform leak check test. Refer to Leakage Inspection in this section. Repair as necessary.
Vents	
• Transmission fluid leakage through the vent system into the bellhousing	• Incorrect transmission fluid level may cause the transmission fluid to vent. If not already carried out, verify and adjust the transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
	• Verify the transmission operating temperature by monitoring Transmission Fluid Temperature (TFT) with a scan tool while driving the vehicle for 32 km (20 mi). If the TFT exceeds 102°C (215°F) during the drive, refer to Routine No. 257 Transmission Overheating, Main Control, Thermostatic bypass valve.
	• Remove all traces of transmission fluid on exposed surfaces of the transmission.
	• Check the vent for damage and obstructions. Verify that the vent is operating correctly by applying air through the vent tubes. If the vent is damaged or obstructed, repair as necessary.

Other Concern: Noise/Vibration - Forward or Reverse

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

Possible Component	Reference/Action
254 - ROUTINE	
Powertrain Control System	

• PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Selector Lever Cable/Transmission Range (TR) Sensor	
• Selector lever cable or TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 for the selector lever cable adjustment.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged, thermostatic bypass valve damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.

Low One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Flexplate or Adapter Plate	
• Damaged	• Inspect for damage. Repair as necessary.
• Nuts not tightened to specification	• Tighten nuts to specification.
• Adapter plate not aligned correctly	• Remove transmission and, using a special service tool and procedure in this section, align adapter plate.
Torque Converter Assembly	
• Damaged	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the checks or is damaged, install a new or remanufactured torque converter.
Clutch Assemblies	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Other Concern: Engine Will Not Crank

Possible Component	Reference/Action
255 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test C .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Selector Lever Cable/ TR Sensor	

• Selector lever cable or TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Main Control/Park System/ TR Sensor Alignment	
• Detent spring, rooster comb, manual control lever and TR sensor are not correctly aligned together	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Flexplate or Adapter Plate	
• Damaged	• Inspect for damage. Repair as necessary.

Other Concern: No Park Range

Possible Component	Reference/Action
256 - ROUTINE	
Selector Lever Cable/Transmission Range (TR) Sensor	
• Selector lever cable system or TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Case	
• Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged	• Inspect for damage. If damaged, repair as necessary.
• Manual valve lever shaft retaining pin damaged	• Inspect for damage. If damaged, repair as necessary.

Park System	
• Park gear, park pawl, park pawl return spring, park or guide plate, park actuating rod, park pawl shaft, manual lever, manual lever detent spring damaged or misassembled	• Inspect for damage. If damaged, repair as necessary.
• External linkages/brackets damaged	• Inspect for damage. If damaged, repair as necessary.

Other Concern: Transmission Overheating

Possible Component	Reference/Action
257 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC), Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Hydraulic/Mechanical	
• Thermostatic bypass valve is the main control valve body assembly	• Verify correct thermal valve function while monitoring TFT . Drive the vehicle for about 32 km (20 mi). If the temperature exceeds 102°C (215°F) during the drive, install a new main control valve body assembly.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	

• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged, thermostatic bypass valve damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Thermostatic bypass valve damaged or malfunctioning	• If the verification procedure confirms the malfunction, install a new main control valve body assembly. If not malfunctioning, inspect for damage. If damaged, install a new main control valve body assembly.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Case	
• Case vent damaged	• Inspect for damage. If damaged, repair as necessary.
Torque Converter Assembly	
• Seized torque converter One-Way Clutch (OWC)	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If torque converter fails to pass the criteria or is damaged, install a new or remanufactured converter.
• Excessive slip detected	
Other	

• Restriction in the transmission cooling system	• Refer to Section 307-02 for information and diagnosis of cooling issues.
• Excessive trailer tow load	• Refer to Owner's Literature for specifications on trailer towing.
• Engine driveability concerns	• Check engine. Refer to Section 303-00 .

Other Concerns: No Engine Braking in Manual 2nd Position

Possible Component	Reference/Action
258 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Pressure Control Solenoid A (PCA)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 1st Position

Possible Component	Reference/Action
259 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level, refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.

Other Concerns: Fluid Venting/Foaming

Possible Component	Reference/Action
261 - ROUTINE	
Transmission Fluid	
• Incorrect level	

	• Check the transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
Case	
• Case vent damaged	• Inspect for damage. If damaged, repair as necessary.
Other	
• Transmission overheating	• Refer to Routine 257 in this section.

Other Concern: Vehicle Movement with Gear Selector in N Position

Possible Component	Reference/Action
262 - ROUTINE	
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Selector Lever Cable/Transmission Range (TR) sensor	
• Selector lever cable system or TR sensor damaged, misaligned	• Inspect and repair as necessary. Refer to Transmission Range (TR) Sensor Adjustment in this section or Section 307-05 .
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.

• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
Clutch Assemblies	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Case	
• Manual control lever assembly damage, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged	• Inspect for damage. If damaged, repair as necessary.
• Manual valve lever shaft retaining pin damaged	• Inspect for damage. If damaged, repair as necessary.

Other Concern: Slips/Chatters in Manual 1st Position

Possible Component	Reference/Action
263 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .

	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Pump Assembly	
• Screws not tightened to specification	• Tighten screws to specification.
• Gasket damaged	• Inspect for damage. If damaged, install a new gasket.
• Porosity, cross leaks, ball missing, plugged hole	• Inspect for damage. If damaged, repair as necessary.
• Pump gears cracked and/or seized	• Inspect for damage. Install a new pump.
• Flow control valves, springs or seals damaged, stuck or not assembled correctly	• Inspect for damage. Install a new seal or flow control valve.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.

• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Reverse Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Reverse Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: Slips/Chatters in Manual 2nd Position

Possible Component	Reference/Action
264 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid

	Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
O/D Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.

Shift Concern: No 4-5 Shift

Possible Component	Reference/Action
270 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED)

Control Solenoid B (PCB), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	manual for diagnosis and testing of the PCM.
• Transmission Control Switch (TCS)	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
	• For TCS diagnosis, refer to Section 307-05 .
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Servo bore	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: No 5-4 Shift

Possible Component	Reference/Action
271 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid C (PCC), Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
• Transmission Control Switch (TCS)	• GO to Pinpoint Test A , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
	• For TCS diagnosis, refer to Section 307-05 .
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.

• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Soft/Slipping 4-5 Shift

Possible Component	Reference/Action
272 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.

• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Servo bore	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Feel - Soft/Slipping 5-4 Shift

Possible Component	Reference/Action
273 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid C (PCC), Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valves/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or

	transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Shift Concerns: Harsh 4-5 Shift

Possible Component	Reference/Action
274 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid B (PCB), Turbine Shaft Speed (TSS) sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.

• Separator plate damaged	• Inspect for damage. If damaged, install a new separator.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seal (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Shift Concern: Harsh 5-4 Shift

Possible Component	Reference/Action
275 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid C (SSC), Pressure Control Solenoid C (PCC), Turbine Shaft Speed (TSS) sensor, Transmission Range (TR) sensor, Transmission Fluid Temperature (TFT) sensor	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A , GO to Pinpoint Test B , GO to Pinpoint Test C , GO to Pinpoint Test D and GO to Pinpoint Test E .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Incorrect Pressures	

• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 3rd Position

Possible Component	Reference/Action
280 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), Pressure Control Solenoid A (PCA),	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.

Pressure Control Solenoid B (PCB)	
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Incorrect Pressures	
• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.
• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Coast Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
Center Support	
• Screw not tightened to specification	• Tighten to specification.
• Seals rings or bearing damaged	• Inspect for damage. Repair as necessary.
	• Inspect for damage. Repair as necessary.

• Outside diameter of case bore damaged	
• Support damaged or leaking	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Other Concern: No Engine Braking in Manual 4th (D) Position

Possible Component	Reference/Action
281 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid D (SSD), Reverse Pressure (RP) switch, Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A and GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to correct level. Refer to Transmission Fluid Level Check in this section.
Main Control	
• Screws not tightened to specification	• Tighten to specification.
• Separator plate damaged	• Inspect for damage. If damaged, install a new separator plate.

• Contamination	• Disassemble and clean.
• Valve/springs damaged, misassembled, missing, stuck or bore damaged	• If damaged or parts are missing, install new main control assembly. If misassembled, reassemble correctly. DO NOT stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
• Transmission fluid filter damaged or missing	• Inspect for damage. Repair as necessary.
Coast Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.

Other Concern: Slip/Chatters in Manual 3rd Position

Possible Component	Reference/Action
282 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Transmission Fluid	
• Incorrect level	• Check the transmission fluid level. Adjust transmission fluid to the correct level. Refer to Transmission Fluid Level Check in this section.
• Condition	• Carry out Transmission Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	

• High/low pressure	• Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
• Seals, piston damaged	• Inspect for damage. Repair as necessary.
• Check ball damaged, missing, not seating, off location	• Inspect for mislocation, poor seating, damage. Install a new cylinder.
• Friction elements damaged or worn	• Inspect for damage. Repair as necessary.
• Return springs damaged	• Inspect for damage. Repair as necessary.
• Bronze seal ring on bearing damaged	• Inspect for damage. Repair as necessary.
Direct One-Way Clutch (OWC)	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.
Low OWC	
• Worn, damaged or assembled incorrectly	• Inspect for damage. Repair as necessary.

Other Concern: Engine Braking in ALL Gears

Possible Component	Reference/Action
283 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Shift Solenoid D (SSD)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test A .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Torque Converter Assembly	
• Torque converter internal failure preventing engagement, piston release	• Remove transmission. Inspect for damage. Refer to Torque Converter Contamination Inspection in this section. If the torque converter fails to pass the criteria or is damaged, install a new or remanufactured torque converter.

Other Concern: No 2nd and 5th Gears (Manual 2nd is OK)

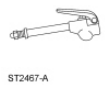
Possible Component	Reference/Action
284 - ROUTINE	
Hydraulic/Mechanical	
	• Verify that Manual 2nd is present and functions correctly. If Manual 2nd is not operating correctly, go to Shift Concerns: Routine 210 - Some/All Shifts Missing (Automatic Mode) and continue diagnosis. If Manual 2nd is operating correctly, continue with this routine.
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid B (PCB), Pressure Control Solenoid C (PCC)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.

Other Concern: No 3rd, 4th and 5th Gears

Possible Component	Reference/Action
285 - ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, Pressure Control Solenoid A (PCA), Pressure Control Solenoid B (PCB)	• Carry out On-Board Diagnostic (OBD) Tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the PCM.
	• GO to Pinpoint Test D .
	• Repair as required. Clear the DTCs, road test and rerun OBD Test.
Overdrive (O/D) Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
• Servo bore	• Inspect for damage. Repair as necessary.
O/D Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.
O/D Planetary Assembly	
• Planetary damaged	• Inspect for damage. Repair as necessary.
Intermediate Servo	
• Servo retaining screws damaged	• Inspect for damage. Repair as necessary.
• Seals (piston and cover) damaged	• Inspect for damage. Repair as necessary.
Intermediate Band	
• Band damaged	• Inspect for damage. Repair as necessary.
• Servo worn or damaged	• Inspect for damage. Repair as necessary.
• Not adjusted correctly	• Inspect for damage. Repair as necessary.

Transmission Fluid Level Check

Special Tool(s)

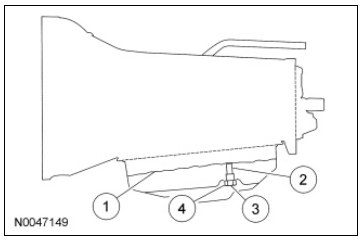
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST2581-A	Transmission Fluid Fill Tool 307-437
 ST2715-A	Transporter Fluid Evacuator/Injector 307-D465
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Transmission Fluid Fill Reference

NOTE: Left side of case shown.



Item	Part Number	Description
1	-	Transmission fluid level
2	7A010	Transmission fluid level tube
3	W704999-S309	

		Transmission fluid level and fill plug (small) (in-vehicle)
4	7A010	Transmission fluid drain plug (large)

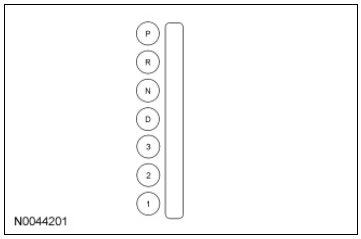
1. Using the scan tool, monitor the Transmission Fluid Temperature (TFT).

2. Start the engine.

3. **NOTE:** Engine idle speed is approximately 650 rpm.

   Run the engine until the TFT is between 27-49°C (80-120°F).

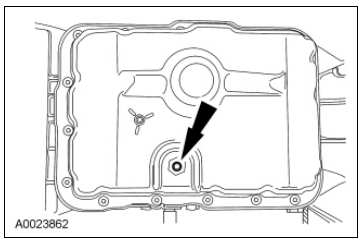
4. Move the selector lever slowly through each gear, stopping in each position and allowing the transmission to engage.



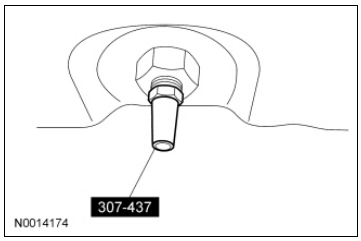
5. Place the selector lever in the PARK position.

6. With the engine running and the vehicle set as close to level as possible, position it on a hoist. For additional information, refer to Section 100-02 .

7. Hold the larger transmission fluid drain plug with a wrench and remove the small (center) transmission fluid level indicating plug.

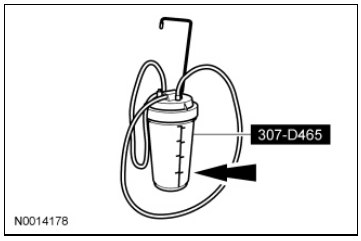


8. Install the Transmission Fluid Fill Tool into the pan.

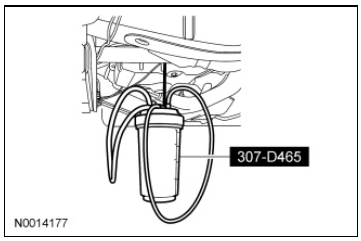


9. **NOTE:** Prior to filling the Transporter Fluid Evacuator/Injector with transmission fluid, make sure that the canister is clean.

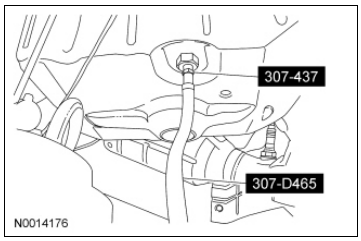
   Fill the Transporter Fluid Evacuator/Injector with transmission fluid.



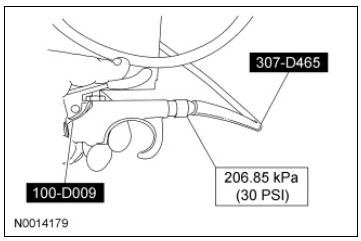
10. Hang the Transporter Fluid Evacuator/Injector under the vehicle. Position it upright and close to the transmission.



11. Connect the Transporter Fluid Evacuator/Injector.
    - Connect the open end of the fluid hose from the Transporter Fluid Evacuator/Injector to the Transmission Fluid Fill Tool at the bottom of the transmission fluid pan.



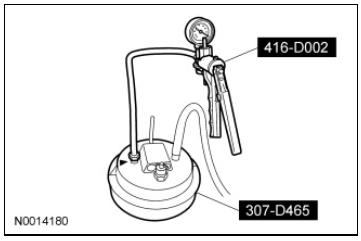
12. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the Rubber Tip Air Nozzle. Transmission fluid will immediately start flowing out of the Transporter Fluid Evacuator/Injector into the transmission fluid pan.



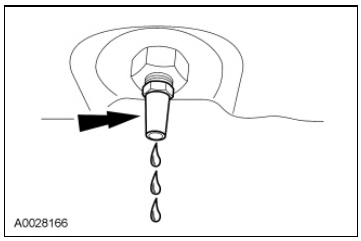
13. Add 0.5L (1 pt) of transmission fluid into the transmission fluid pan. Stop the process by releasing the air pressure and removing the Rubber Tip Air Nozzle from the end of the hose.

14. Inspect the transmission fluid level in the Transporter Fluid Evacuator/Injector. If the transmission fluid drains back into the canister, the transmission is full. If no transmission fluid drains back, more transmission fluid will need to be added. Repeat Steps 12 and 13.

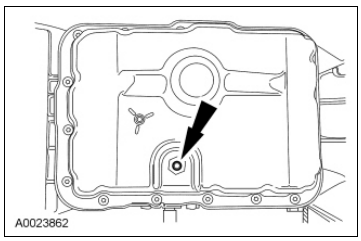
15. Once the transmission is full, place a Vacuum Pump Kit on the open end of the vacuum/pressure hose on the Transporter Fluid Evacuator/Injector and apply vacuum to the system. This will pull out any extra transmission fluid trapped in the system and direct it into the container.



16. Allow the transmission fluid to drain. Make sure that the TFT is between 27-49°C (80-120°F). When the transmission fluid comes out as a thin stream or drip, the transmission fluid is at the correct level.



17. Reinstall the small (center) transmission fluid level indicating plug.
    - Tighten to 10 Nm (89 lb-in).



18. Check the operation of the transmission by moving the selector lever slowly through each gear, stopping in each position and allowing the transmission to engage.

Transmission Fluid Exchange

Special Tool(s)

 ST3088-A	Heavy-Duty Transmission and Power Steering Fluid X-Changer 078-00531 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

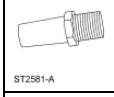
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTICE: **Use transmission fluid specific for this transmission. Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products can cause internal transmission components to fail, which will affect the operation of the transmission.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Use the Heavy-Duty Transmission and Power Steering Fluid X-Changer to change the fluid.
3. Connect the Heavy-Duty Transmission and Power Steering Fluid X-Changer to the transmission fluid cooler tube after the transmission fluid cooler on the return tube. This will help remove any foreign material trapped in the transmission fluid coolers.
4. Perform the transmission fluid exchange using the Heavy-Duty Transmission and Power Steering Fluid X-Changer. Follow the manufacturer's instructions included with the machine.
5. Once the transmission fluid exchange is completed, disconnect the Heavy-Duty Transmission and Power Steering Fluid X-Changer. Reconnect any disconnected transmission fluid cooler tubes.
6. Using the scan tool with the engine running, check and make sure that the transmission is at normal operating temperature 66-77°C (150-170°F). Check and adjust the transmission fluid level and check for any leaks. If transmission fluid is needed, add transmission fluid in increments of 0.24L (0.5 pt) until the correct level is achieved.

Transmission Fluid Drain and Refill

Special Tool(s)

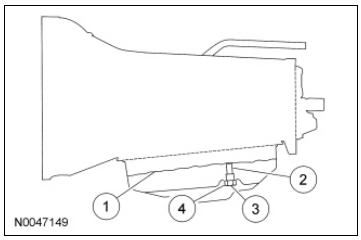
 ST2581-A	Adapter, Fluid Level and Fill Plug 307-437
 ST2715-A	Fluid Transporter/Evacuator/Injector 307-D465
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A)
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Fluid Fill Reference

NOTE: Left side of case shown.



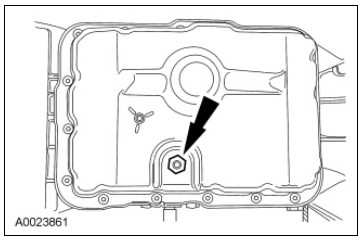
Item	Part Number	Description
1	-	Transmission fluid level
2	7A010	Transmission fluid level tube
3	W704999	

		Transmission fluid level and fill plug (small) (in-vehicle)
4	7A010	Transmission fluid drain plug (large)

Draining

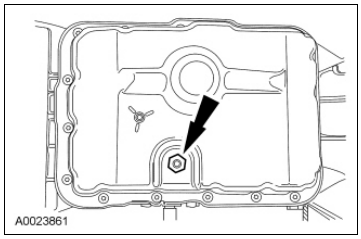
1. With the vehicle in PARK, position it on a hoist. Set the vehicle as close to level as possible. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid drain plug (large plug) and allow the transmission fluid to drain.

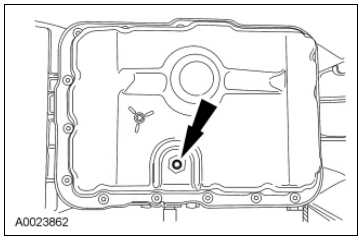


Refill

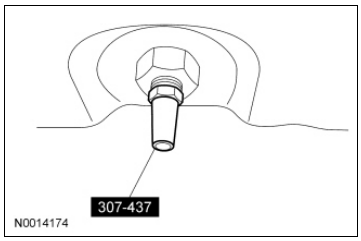
1. Install the transmission fluid drain plug.
   - Tighten to 26 Nm (19 lb-ft).



2. Hold the larger transmission fluid drain plug with a wrench and remove the small (center) transmission fluid level indicating plug.

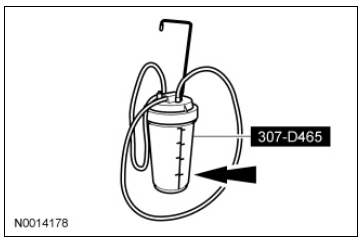


3. Install the Fluid Level and Fill Plug Adapter into the transmission fluid pan.

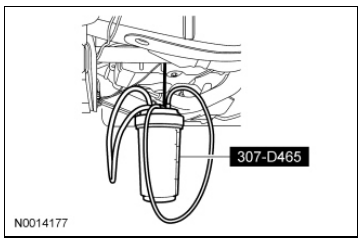


4. **NOTE:** Prior to filling the Fluid Transporter/Evacuator/Injector with transmission fluid, make sure that the canister is clean.

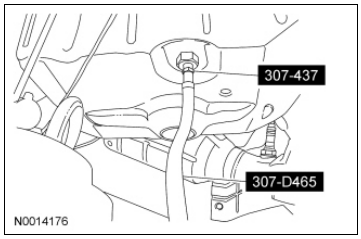
Fill the Fluid Transporter/Evacuator/Injector with transmission fluid.



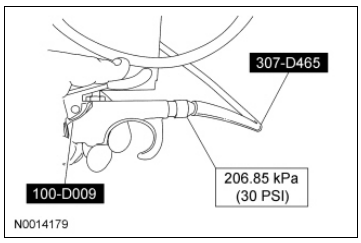
5. Hang the Fluid Transporter/Evacuator/Injector under the vehicle, upright and close to the transmission.



6. Connect the Fluid Transporter/Evacuator/Injector.
   - Connect the open end of the fluid hose from the Fluid Transporter/Evacuator/Injector to the Fluid Level and Fill Plug Adapter at the bottom of the transmission fluid pan.



7. Apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the Rubber Tip Air Nozzle. Transmission fluid will immediately start flowing out of the Fluid Transporter/Evacuator/Injector into the transmission fluid pan.



8. Add 1.89L or 2.83L (2 qt or 3 qt) of transmission fluid into the transmission fluid pan. Stop the process by releasing the air pressure and removing the Rubber Tip Air Nozzle from the end of the hose.

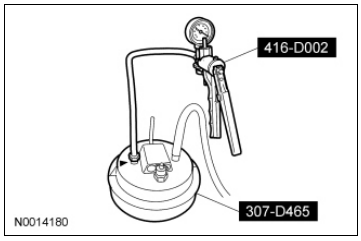
9. **NOTE:** Engine idle speed is approximately 650 rpm.

   Using the scan tool, start and run the engine until the Transmission Fluid Temperature (TFT) is between 27°C-49°C (80°F-120°F).

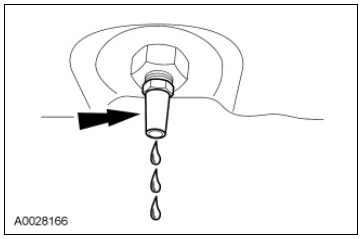
10. Inspect the transmission fluid level in the Fluid Transporter/Evacuator/Injector. If the fluid drains back into the canister, the transmission is full. If no transmission fluid drains back, more transmission

fluid will need to be added. Repeat Steps 9 and 10.

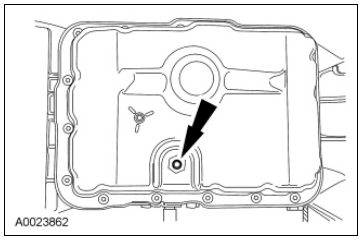
11. Once the transmission is full, place a hand Vacuum Pump Kit on the open end of the vacuum/pressure hose on the Fluid Transporter/Evacuator/Injector and apply vacuum to the system. This will pull out any extra fluid trapped in the system and direct it into the container.



12. Allow the transmission fluid to drain. When the transmission fluid comes out as a thin stream or drip, the transmission fluid is at the correct level.

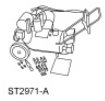


13. Reinstall the small (center) transmission fluid level indicating plug.
    - Tighten to 10 Nm (89 lb-in).



Transmission Fluid Cooler Backflushing and Cleaning

Special Tool(s)

 ST2971-A	Transmission Heated Cooler Line Flusher 222-00007, 222-00004 or equivalent

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

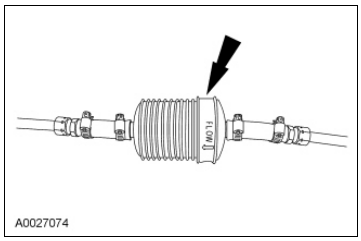
NOTICE: **Use transmission fluid specified for this transmission. Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products could cause internal transmission components to fail, which will affect the operation of the transmission.**

NOTE: Transmission fluid cooler backflushing and cleaning will be performed using the Transmission Heated Cooler Line Flusher or equivalent. Follow the manufacturer's instructions included with the machine. Test the equipment to make sure that a vigorous fluid flow is present before proceeding.

NOTE: If the Transmission Heated Cooler Line Flusher or equivalent is not available, install a new transmission fluid cooler and/or an auxiliary transmission fluid cooler.

NOTE: If the vehicle is equipped with an in-line transmission fluid filter, remove and discard the in-line filter.

1. Check and top off fluid level of the cooler line flusher with transmission fluid.
2. Allow the transmission fluid in the cooler line flusher 15-30 minutes to heat up to 60°C (140°F) before using.
3. If equipped, remove and discard the in-line transmission fluid filter.



4. Install the line adapters into the transmission cooler tubes.
5. Attach the cooler line flusher red line to the transmission fluid cooler pressure tube quick disconnect fitting.

6. Attach the cooler line flusher blue line to the transmission fluid cooler return tube quick disconnect fitting.

7. Follow the equipment instructions to purge the transmission fluid cooler tubes and transmission fluid cooler prior to starting the flushing procedure.

8. Allow the cooling system to backflush for 10-15 minutes, then flush the transmission fluid cooler in a normal flow direction for an additional 10-15 minutes.

Transmission Range (TR) Sensor Adjustment

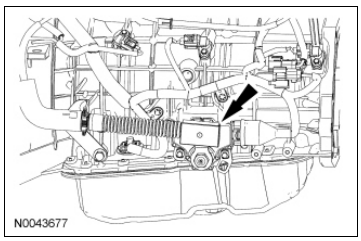
Special Tool(s)

 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

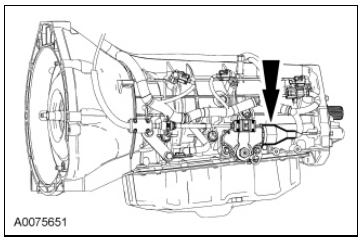
Adjust

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

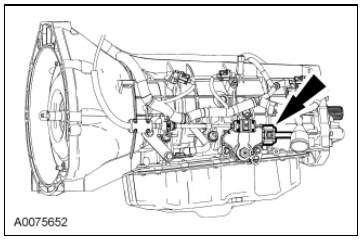
2. Remove the selector lever cable shield by prying on the side of the shield closest to the boot, then sliding the shield away from the boot.


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3. Move the rubber boot back to gain access to the Transmission Range (TR) sensor connector.

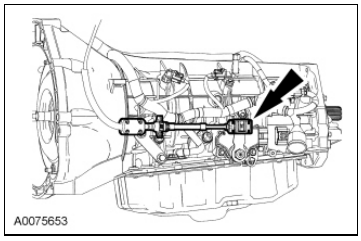

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4. Disconnect the TR sensor connector.

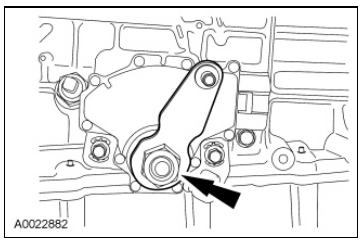

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5. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

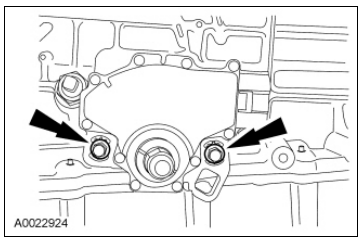
   Remove the selector lever cable end from the manual control lever.



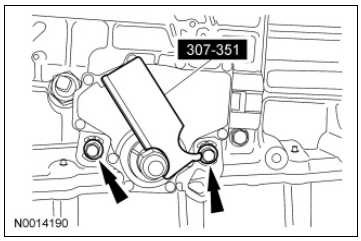
6. Remove the manual control lever nut and the manual control lever.



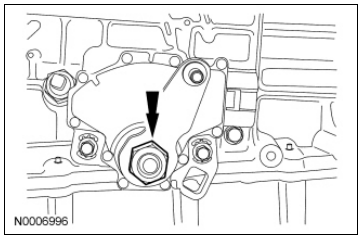
7. Loosen but do not remove the TR sensor screws.



8. Using the TR Sensor Alignment Gauge, align the TR sensor and tighten the screws in an alternating sequence.
    - Tighten to 8 Nm (71 lb-in).



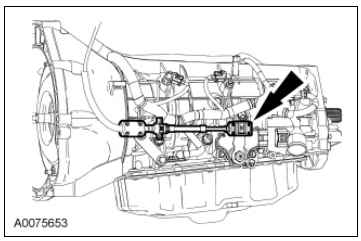
9. Install the manual control lever and manual control lever nut.
    - Tighten to 48 Nm (35 lb-ft).



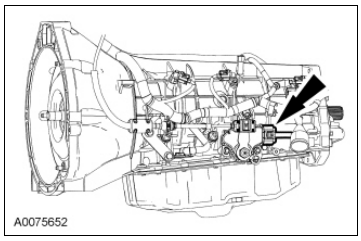
10. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

    NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable to make sure that the selector cable end is correctly installed onto the manual control lever.

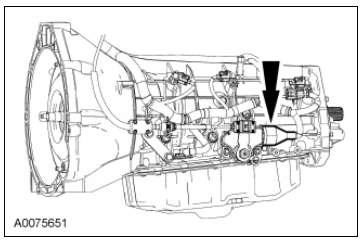
Install the selector lever cable end onto the manual control lever.



11. Connect the TR sensor connector.

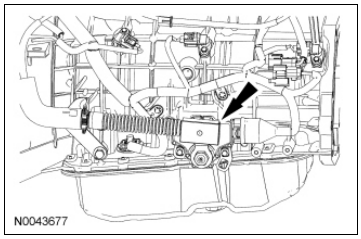


12. Install the rubber boot over the TR connector.



13. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, replace the selector lever cable shield.

    Install the selector lever cable shield.



14. Verify that the selector lever cable is adjusted correctly.

15. Verify that the vehicle will start in PARK and NEUTRAL and that the reverse lamps illuminate in REVERSE.

Torque Converter Contamination Inspection

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - The torque converter stud or studs, impeller hub or bushing are damaged.
    - The torque converter exhibits external discoloration (due to overheating).
    - There is evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes.
        - Major metallic failure
        - Multiple clutch plates or band failures
        - Sufficient component wear which results in metallic contamination
        - Water or antifreeze contamination

2. If none of the above conditions are present, continue with the following fluid inspection.

3. Pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter.

4. Examine the fluid for contaminants, color and smell. The fluid must be free of contaminants, red in color and not have a burnt smell.

5. ***NOTICE:*** **Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur.**

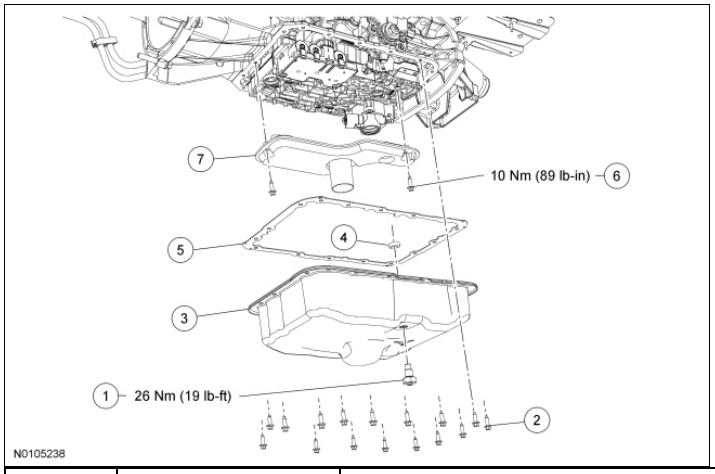
   If the fluid passed inspection:

    - drain the remaining fluid from the torque converter.
    - using only the recommended transmission fluid, add 1.9L (2 qt) of clean fluid into the converter and agitate by hand.
    - thoroughly drain the fluid.

Fluid Pan, Gasket and Filter

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

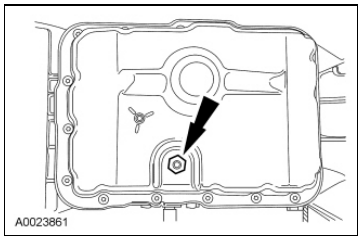


Item	Part Number	Description
1	7A010	Transmission fluid pan drain plug
2	W500213	Transmission fluid pan screw (16 required)
3	7A194	Transmission fluid pan
4	7L027	Transmission fluid pan magnet
5	7A191	Transmission fluid pan gasket
6	W500106	Transmission fluid filter screw (2 required)
7	7A098	Transmission fluid filter

Removal

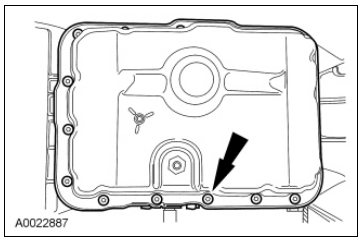
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid pan drain plug and drain the transmission fluid.

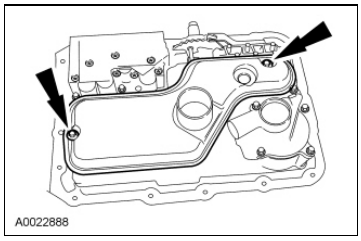


3. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage. If not damaged, the transmission fluid gasket should be reused.

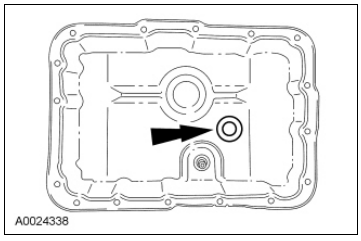
   Remove the 16 transmission fluid pan screws, transmission fluid pan and transmission fluid gasket.



4. Remove and discard the transmission fluid filter.



5. Clean and inspect the transmission fluid pan and magnet.



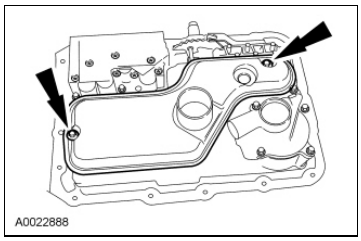
Installation

1. ***NOTICE:*** **Damage may occur to transmission fluid filter seals if they are not lubricated with transmission fluid.**

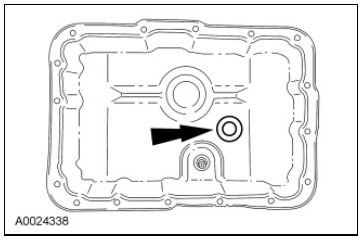
   NOTE: Make sure that the transmission fluid filter seals are correctly seated on the transmission fluid filter.

   Lubricate the transmission fluid filter seals and install the transmission fluid filter.

   - Tighten to 10 Nm (89 lb-in).

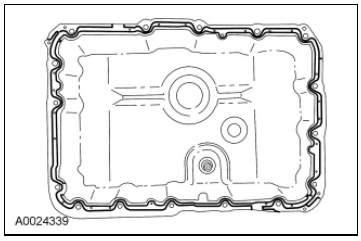


2. Install the transmission fluid pan magnet in the transmission fluid pan.

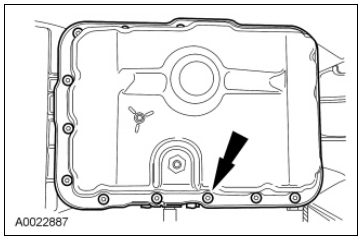


3. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage. If not damaged, the transmission fluid pan gasket should be reused.

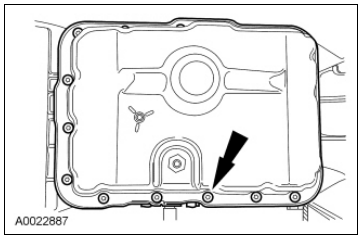
   Install the transmission fluid pan gasket on the transmission fluid pan.



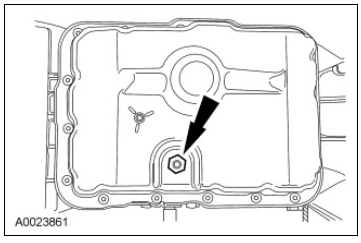
4. Install the transmission fluid pan and transmission fluid pan gasket and loosely install the transmission fluid pan screws.



5. Tighten the transmission fluid pan screws in a crisscross sequence.
   - Tighten to 11 Nm (97 lb-in).



6. Install the transmission fluid pan drain plug.
   - Tighten to 26 Nm (19 lb-ft).



7. Fill the transmission. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Transmission Filter - In Line

Special Tool(s)

 ST2935A	Disconnect Tool, Transmission Cooler Line 307-569

Material

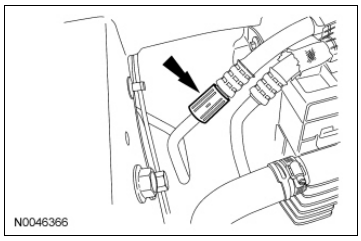
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: Use the following guidelines for installing the transmission fluid in-line filter:

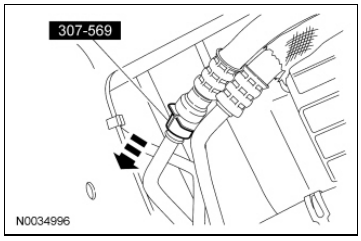
- If the transmission was overhauled and the vehicle was equipped with an in-line transmission fluid filter, install a new in-line transmission fluid filter.
- If the transmission was overhauled and the vehicle was not equipped with an in-line transmission fluid filter, install a new in-line transmission fluid filter kit.
- If the transmission is being installed for a non-internal repair, do not install an in-line transmission fluid filter or in-line transmission fluid filter kit.
- If installing a Ford-authorized remanufactured transmission, install a new in-line transmission fluid filter.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler connector.



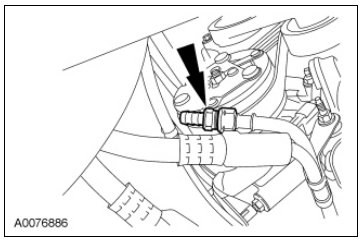
3. Using the Transmission Cooler Line Disconnect Tool, disconnect the transmission fluid cooler connector.



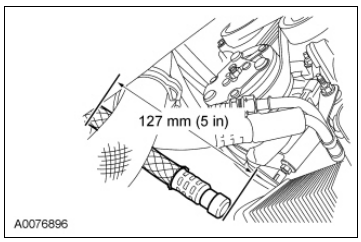
4. Remove the section of the transmission fluid cooler tube at the second flare.
    - Clean and de-burr the cut end of the transmission fluid cooler tube.

5. **NOTE:** Be sure the transmission fluid cooler tube is fully seated in the body of the fitting before final tightening of the ferrule nut.

   Install the tubing ferrule hose assembly connector onto the end of the transmission fluid cooler tube. Finger-tighten the ferrule nut, then tighten the nut an additional one and one-half turns to seat the ferrule in the connector.



6. Remove the section of the transmission fluid cooler hose as illustrated.

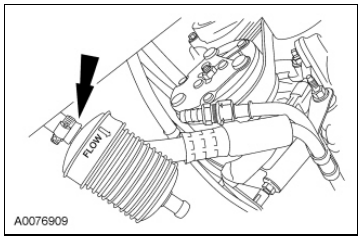


7. ***NOTICE:*** **The transmission fluid cooler filter has a bypass valve in it. The red arrow on the transmission fluid filter indicates the direction of transmission fluid flow through the filter. The transmission fluid filter must be installed in the transmission fluid cooler return tube with the red arrow on the transmission fluid filter pointing away from the transmission fluid cooler and toward the transmission (the transmission fluid return tube has transmission fluid coming out of the transmission fluid cooler going to the transmission). If the transmission fluid filter is not installed correctly, it will cause internal transmission damage.**

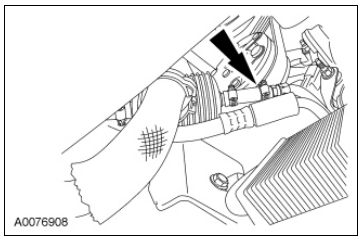
   NOTICE: **Do not install any transmission fluid cooler hoses or transmission fluid cooler tubes with a bend entering the transmission fluid filter greater than 60 degrees. Doing so can block transmission fluid flow and cause internal transmission damage.**

   Install the one end of the transmission fluid filter into the transmission fluid cooler hose with a clamp.

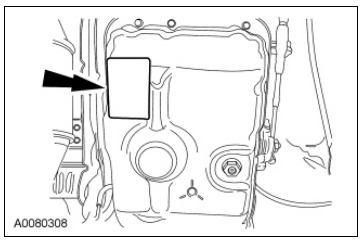
    - Tighten the transmission fluid cooler hose clamp.



8. Using a suitable length of hose, install the other end of the transmission fluid filter into the tubing ferrule hose assembly with 2 clamps.
    - Tighten the hose clamps.



9. Clean a section of the transmission fluid pan, then install the sticker.



10. Fill the transmission with transmission fluid.
    - Verify for correct operation.
    - Check the filter for leaks.

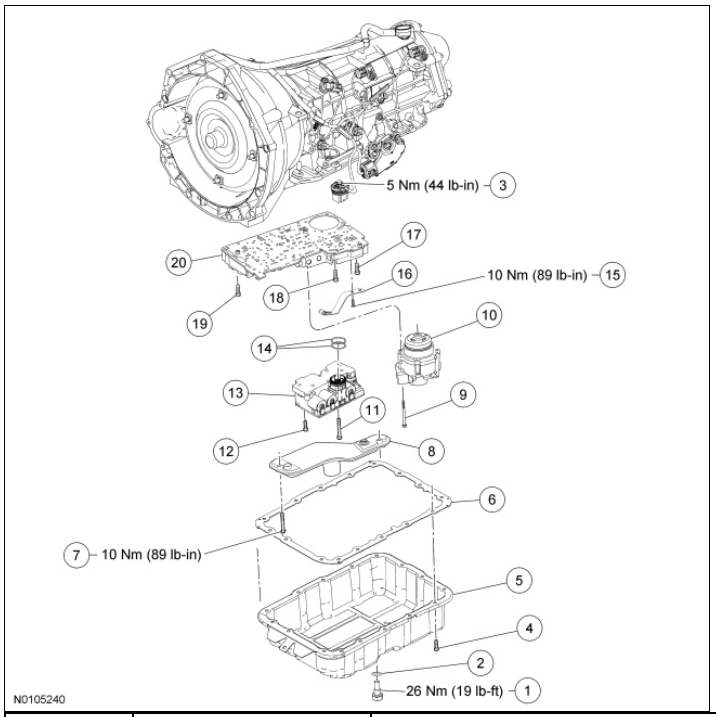
Main Control Valve Body

Special Tool(s)

 ST1639-A	Aligner, Valve Body (2 required) 307-334 (T95L-70010-C)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



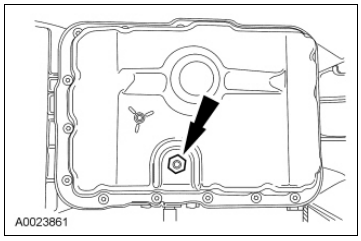
Item	Part Number	Description
1	7A010	Transmission fluid pan drain plug
2	6734	Transmission fluid pan drain plug gasket
3	-	Transmission vehicle harness connector screw
4	W500213	Transmission fluid pan screw (16 required)
5	7A194	Transmission fluid pan
6	7A191	Transmission fluid pan gasket
7	W705559	Transmission fluid filter screw (2 required)

8	7A098	Transmission fluid filter
9	W702359	Reverse servo piston-to-case screw (4 required)
10	7B193	Reverse servo assembly
11	W703189	Transmission control solenoid body screw (7 required)
12	W702921	Transmission control solenoid body screw
13	7G391	Transmission control solenoid body
14	W705928	Solenoid body connector O-ring seals
15	W500100	Manual valve detent spring screw
16	7E332	Manual valve detent spring
17	W500102	Main control valve body screw (18 required)
18	W702791	Main control valve body screw
19	W706672	Main control valve body screw
20	7A100	Lower main control valve body assembly

Removal

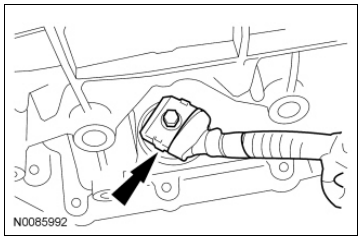
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid pan drain plug and drain the transmission fluid.



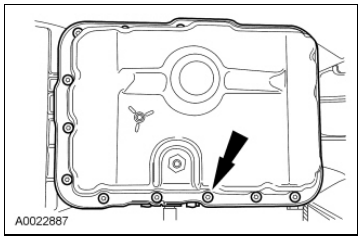
3. **NOTE:** Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission control solenoid vehicle harness connector.

   Disconnect the transmission vehicle harness connector.

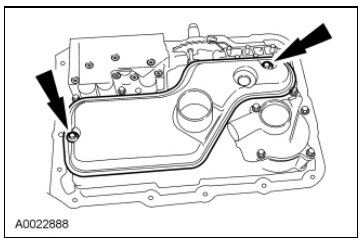


4. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the transmission fluid pan gasket should be reused.

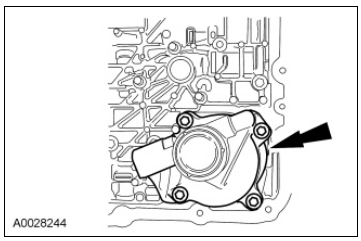
   Remove the 16 transmission fluid pan screws, transmission fluid pan and transmission fluid pan gasket.



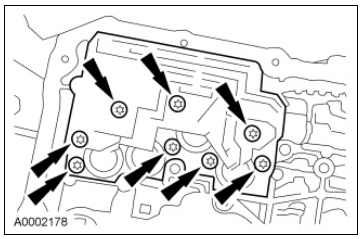
5. Remove the transmission fluid filter.



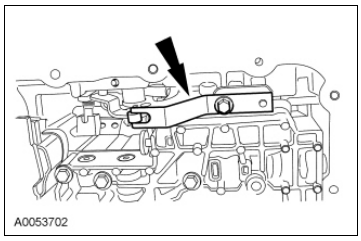
6. Remove the reverse servo assembly screws and the reverse servo assembly.



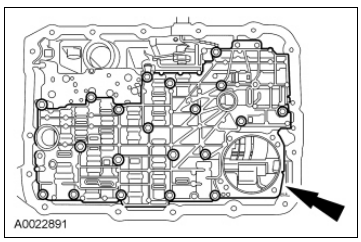
7. Remove the transmission control solenoid body screws and the transmission control solenoid body.



8. Remove the manual control valve detent spring.

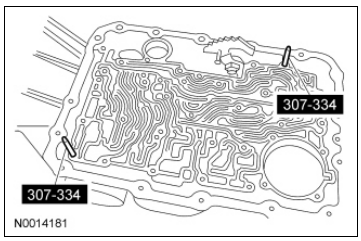


9. Remove the main control valve body screws and the main control valve body.

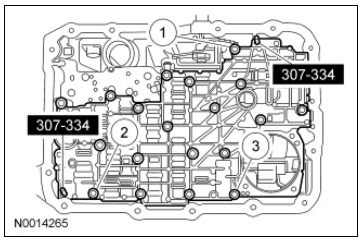


Installation

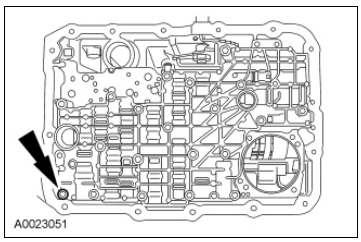
1. Install the Valve Body Aligners into the transmission case.



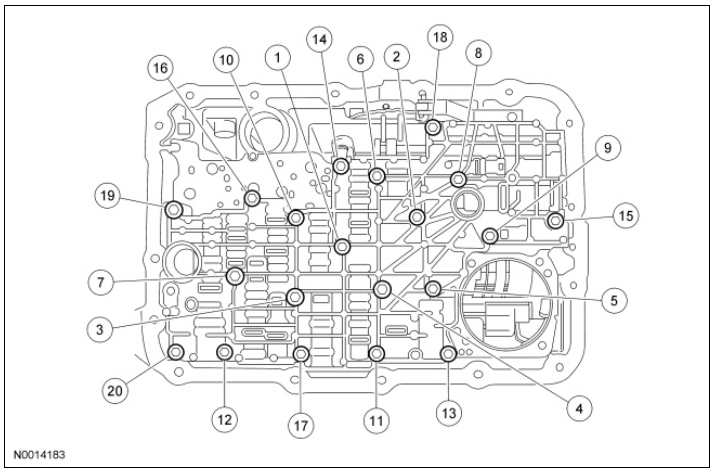
2. Using the Valve Body Aligners, install the main control valve body and loosely install the main control valve body-to-case screws.
    1. Install the short main control valve body-to-case screw.
    2. Install the main control valve body-to-case screw with the larger head.
    3. Install the remaining main control valve body-to-case screws.



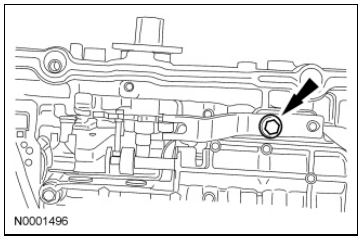
3. Remove the Valve Body Aligners and loosely install the main control valve body screw.



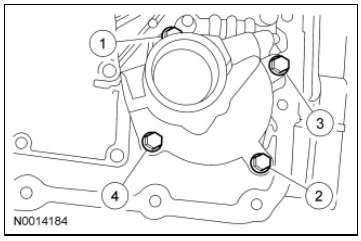
4. Tighten the main control valve body screws in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).



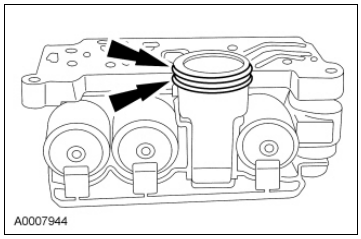
5. Install the manual control valve detent spring screw.
    - Tighten to 10 Nm (89 lb-in).



6. Install the reverse servo assembly. Tighten the reverse servo assembly screws in 2 stages, in the sequence shown.
    - Stage 1: Tighten to 5 Nm (44 lb-in).
    - Stage 2: Tighten to 11 Nm (97 lb-in).



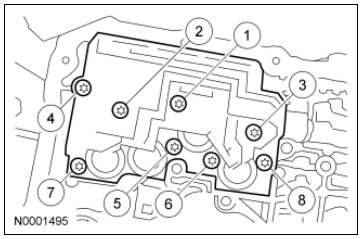
7. Install new O-ring seals on the transmission control solenoid body connector. Lubricate the O-ring seals with transmission fluid.



8. ***NOTICE:*** **Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If damaged, a transmission leak may occur.**

    Install the transmission control solenoid body. Tighten the transmission control solenoid body screws in the sequence shown.

    - Tighten to 8 Nm (71 lb-in).

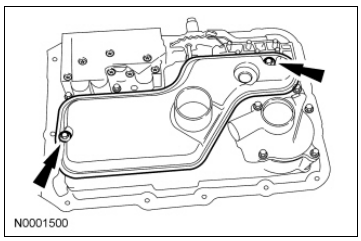


9. ***NOTICE:*** **Damage may occur to transmission fluid filter seals if they are not lubricated with transmission fluid.**

    NOTE: Make sure that the transmission fluid filter seals are correctly seated on the transmission fluid filter.

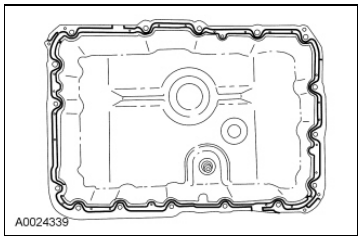
    Lubricate the transmission fluid filter seals and install the transmission fluid filter. Tighten the transmission fluid filter screws.

- Tighten to 10 Nm (89 lb-in).

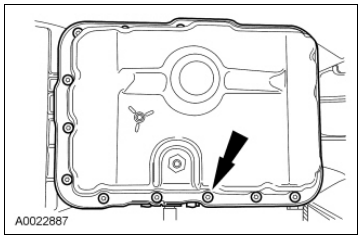


10. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the transmission fluid pan gasket should be reused.

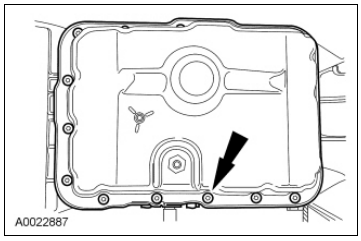
    Install the transmission fluid pan gasket on the transmission fluid pan.



11. Install the transmission fluid pan and transmission fluid pan gasket and loosely install the transmission fluid pan-to-case screws.



12. Tighten the transmission fluid pan-to-case screws in a crisscross sequence.
    - Tighten to 11 Nm (97 lb-in).



13. ***NOTICE:*** **Damage will occur to the transmission vehicle harness connector if the screw is tightened above specification.**

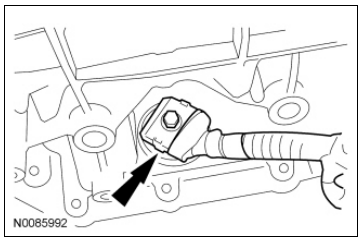
    NOTE: Always install new O-ring seals on the transmission control solenoid body connector.

    NOTE: Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission control solenoid body connector.

    NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

Install and lubricate new O-ring seals on the transmission control solenoid body harness connector and connect the connector.

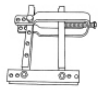
- Tighten to 5 Nm (44 lb-in).

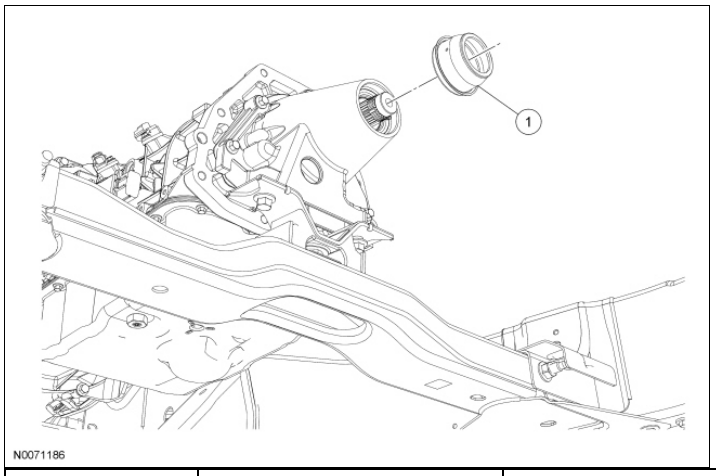


14. Fill the transmission. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Extension Housing Seal - Rear Wheel Drive (RWD)

Special Tool(s)

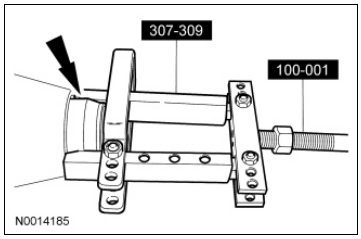
 ST1188-A	Installer, Transmission Extension Housing Oil Seal 308-002 (T61L-7657-A)
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)



Item	Part Number	Description
1	7052	Extension housing seal

Removal

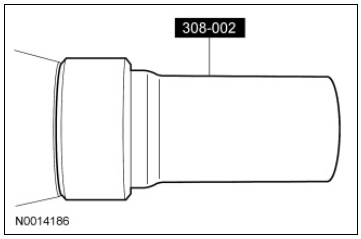
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the driveshaft. For additional information, refer to Section 205-01 .
3. Using the Torque Converter Fluid Seal Remover and Slide Hammer, remove the extension housing seal.



Installation

1. **NOTE:** Make sure the extension housing seal is correctly installed onto the Transmission Extension Housing Oil Seal Installer and the garter spring is in the correct position.

   Using the Transmission Extension Housing Oil Seal Installer, install the extension housing seal.

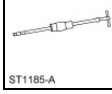


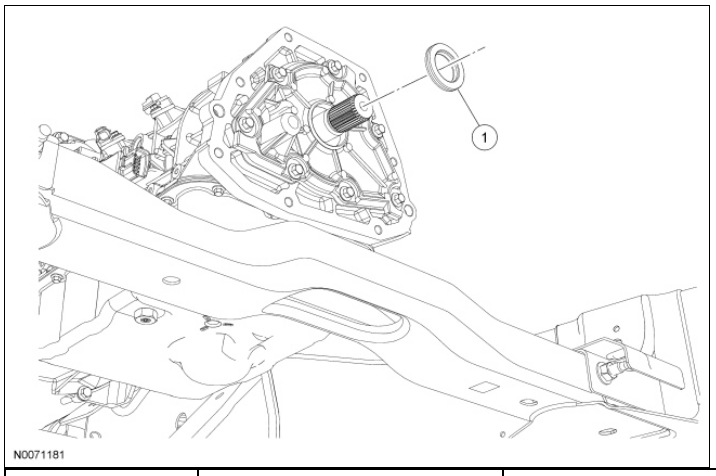
2. Install the driveshaft. For additional information, refer to Section 205-01 .

3. Carry out the transmission fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

Extension Housing Seal - Four Wheel Drive (4WD)

Special Tool(s)

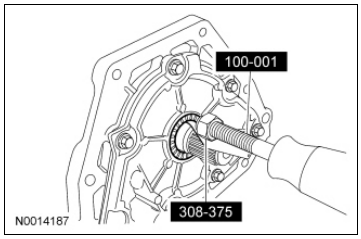
 ST3003-A	Installer, Extension Housing Seal 307-435
 ST2417-A	Remover, Input Shaft Oil Seal 308-375
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)



Item	Part Number	Description
1	7052	Extension housing seal

Removal

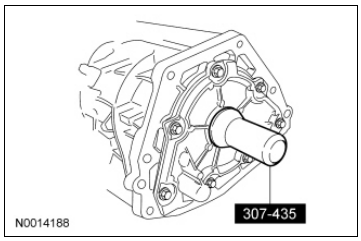
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the transfer case assembly. For additional information, refer to Section 308-07B .
3. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the extension housing seal.



Installation

1. **NOTE:** Make sure the extension housing seal is correctly installed onto the Extension Housing Seal Installer and the garter spring is in the correct position.

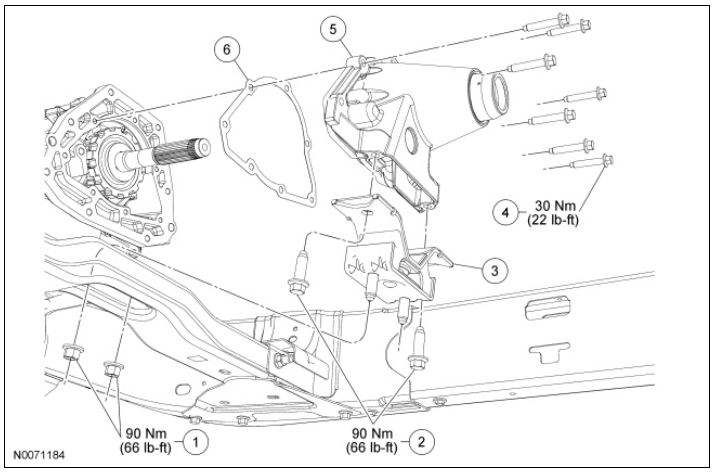
   Using the Extension Housing Seal Installer, install the extension housing seal.



2. Install the transfer case assembly. For additional information, refer to Section 308-07B .

3. Carry out the transmission fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

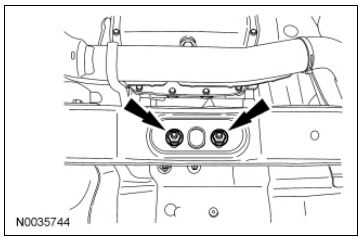
Extension Housing Gasket - Rear Wheel Drive (RWD)



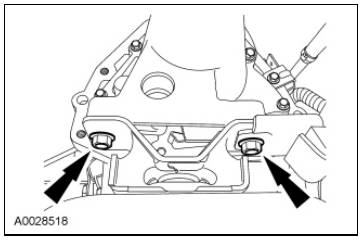
Item	Part Number	Description
1	W10660	Transmission support insulator-to-crossmember nuts
2	W708138	Transmission support insulator-to-extension housing screws
3	6D091	Transmission support insulator
4	W500311	Extension housing screw (7 required)
5	7A039	Extension housing
6	7086	Extension housing gasket

Removal

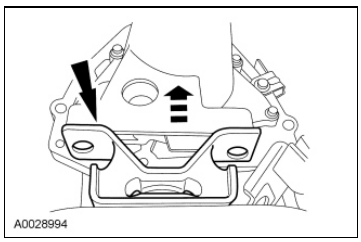
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the driveshaft. For additional information, refer to Section 205-01 .
3. Support the transmission with a suitable jack.
4. Remove the transmission support insulator-to-crossmember nuts.



5. Remove the transmission support insulator-to-extension housing screws.

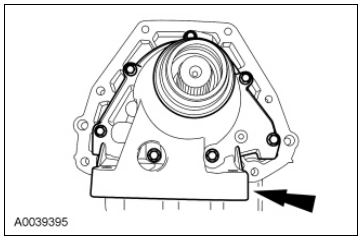


6. Raise the transmission and remove the transmission support insulator.

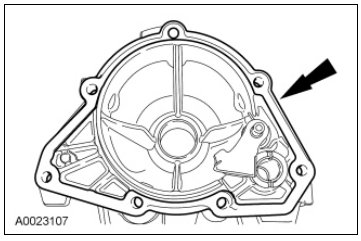


7. **NOTE:** The park pawl, park pawl return spring and park pawl shaft may fall out during removal of the extension housing.

   Remove the extension housing screws and the extension housing.

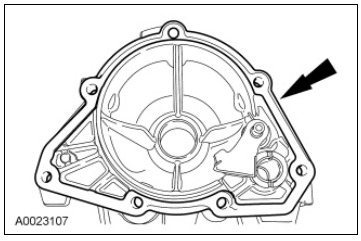


8. Remove and discard the extension housing gasket.



Installation

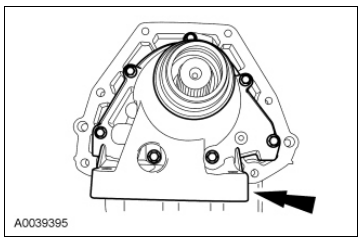
1. Clean the extension housing and install a new extension housing gasket. Verify that the park pawl is installed correctly.



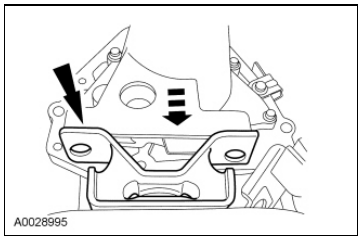
2. **NOTE:** Verify the park lever actuating rod is correctly seated into the case parking rod guide cup.

Install the extension housing and the extension housing screws.

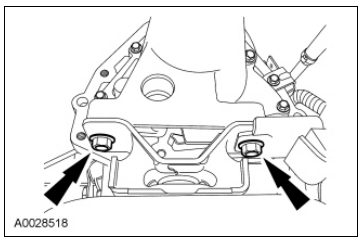
- Tighten to 30 Nm (22 lb-ft).



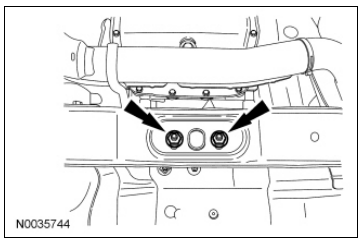
3. Install the transmission support insulator and lower the transmission onto the transmission support insulator.



4. Install the transmission support insulator-to-extension housing screws.
   - Tighten to 90 Nm (66 lb-ft).



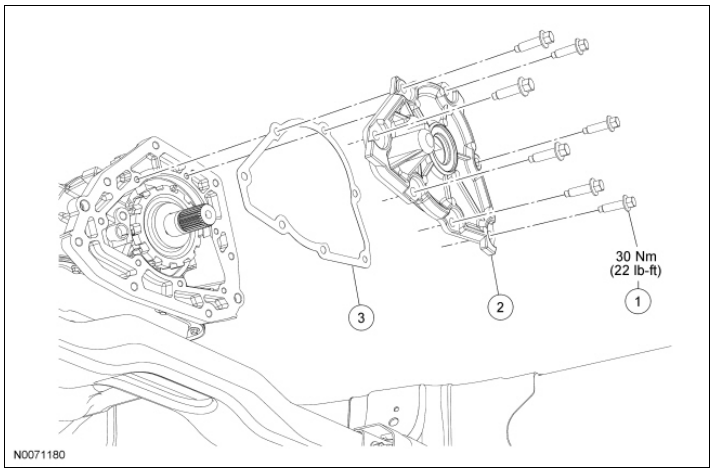
5. Install the transmission support insulator-to-crossmember nuts.
   - Tighten to 90 Nm (66 lb-ft).



6. Install the driveshaft. For additional information, refer to Section 205-01 .

7. Carry out the transmission fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

Extension Housing Gasket - Four Wheel Drive (4WD)



Item	Part Number	Description
1	W500224	Extension housing screw (7 required)
2	7A039	Extension housing
3	7086	Extension housing gasket

Removal

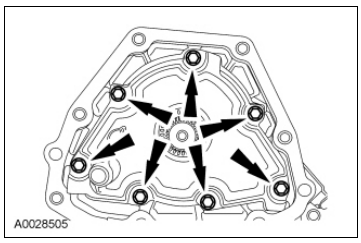
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Support the transmission with a suitable jack.

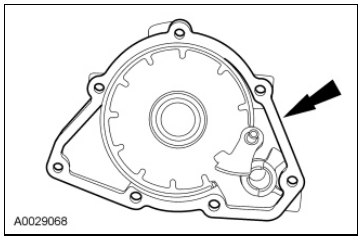
3. Remove the transfer case. For additional information, refer to Section 308-07B .

4. **NOTE:** The park pawl, park pawl return spring and park pawl shaft may fall out during removal of the extension housing.

   Remove the extension housing.

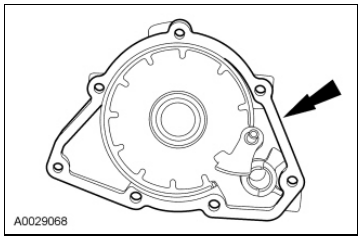


5. Remove and discard the extension housing gasket.



Installation

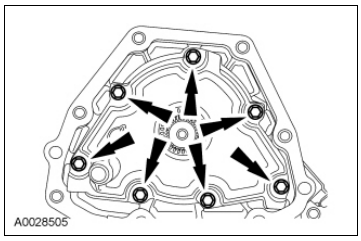
1. Clean the extension housing and install new extension housing gasket. Make sure that the park pawl is installed correctly.



2. **NOTE:** Verify the park lever actuating rod is correctly seated into the case park rod guide cup.

   Install the extension housing and the extension housing screws.

   - Tighten to 30 Nm (22 lb-ft).



3. Install the transfer case. For additional information, refer to Section 308-07B .

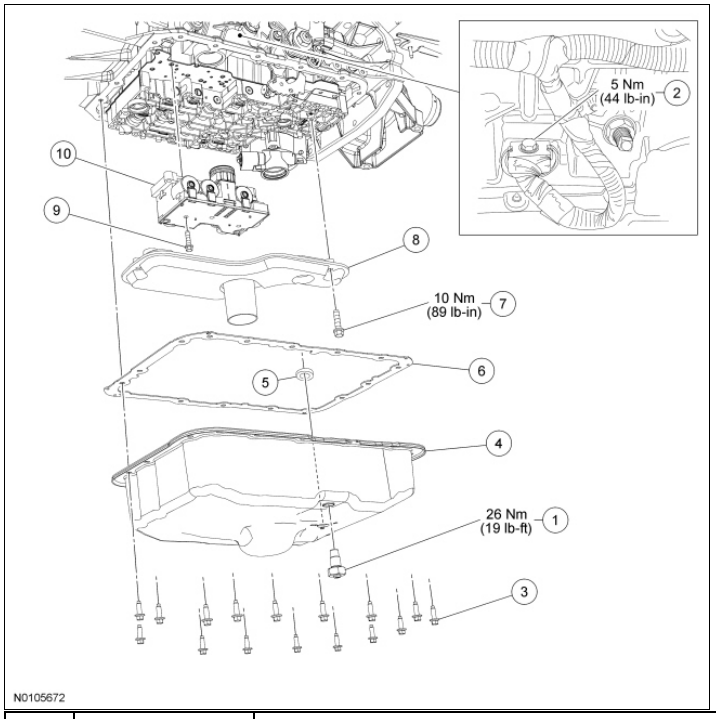
4. Remove the transmission support jack.

5. Carry out the transmission fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

Solenoid Body Assembly

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

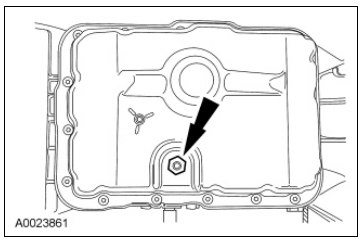


Item	Part Number	Description
1	7A010	Transmission fluid pan drain plug
2	-	Transmission vehicle harness connector screw
3	W500213	Transmission fluid pan-to-case screw (16 required)
4	7A194	Transmission fluid pan
5	7L027	Transmission fluid pan magnet
6	7A191	Transmission fluid pan gasket
7	W500106	Transmission fluid filter screw (2 required)
8	7A098	Transmission fluid filter
9	-	Transmission control solenoid body screw (8 required)
10	7G391	Transmission control solenoid body

Removal

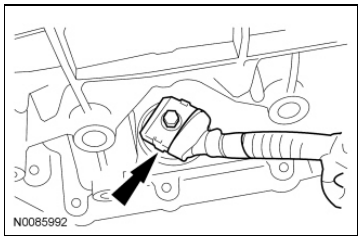
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid pan drain plug and drain the transmission fluid.



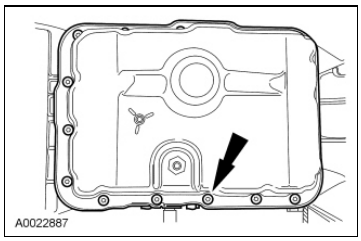
3. **NOTE:** Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission control solenoid vehicle harness connector.

   Disconnect the transmission vehicle harness connector.

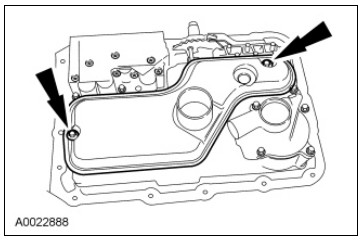


4. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage. If not damaged, the transmission fluid pan gasket should be reused.

   Remove the 16 transmission fluid pan-to-case screws, transmission fluid pan and transmission fluid pan gasket.

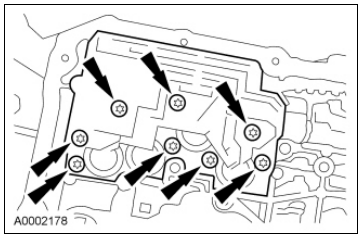


5. Remove the transmission fluid filter.



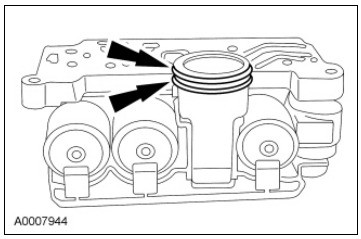
6. ***NOTICE:*** **Do not damage the solenoid body connector pins.**

   Remove the transmission control solenoid body screws and remove the transmission control solenoid body by pulling down on the transmission control solenoid body and pushing down on the transmission solenoid body connector from the other side of the case.



Installation

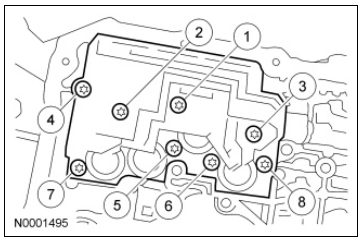
1. Install new O-ring seals on the transmission control solenoid body connector. Lubricate the O-ring seals with transmission fluid.



2. ***NOTICE:*** **Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If damaged, a transmission leak may occur.**

   Install the transmission control solenoid body. Tighten the transmission control solenoid body screws in sequence shown.

   - Tighten to 8 Nm (71 lb-in).

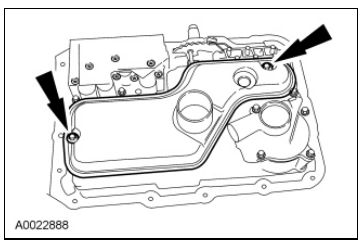


3. ***NOTICE:*** **Damage may occur to transmission fluid filter seals if they are not lubricated with transmission fluid.**

   NOTE: Make sure that the transmission fluid filter seals are correctly seated on the transmission fluid filter.

   Lubricate the transmission fluid seals and install the transmission fluid filter.

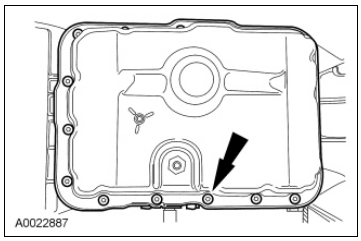
   - Tighten to 10 Nm (89 lb-in).



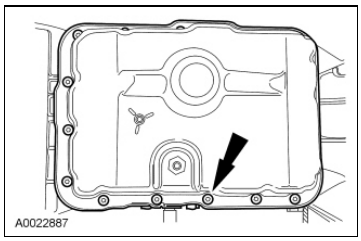
4. **NOTE:** The transmission fluid pan gasket is reusable, clean and inspect for damage. If not damaged,

the transmission fluid pan gasket should be reused.

Install the transmission fluid pan and transmission fluid pan gasket and loosely install the transmission fluid pan-to-case screws.



5. Tighten the transmission fluid pan-to-case screws in a crisscross sequence.
   - Tighten to 11 Nm (97 lb-in).



6. ***NOTICE:*** **Damage will occur to the transmission vehicle harness connector if the screw is tightened above specification.**

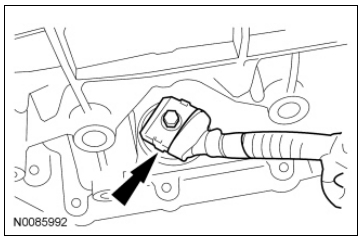
   NOTE: Always install new O-ring seals on transmission control solenoid body harness connector.

   NOTE: Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission control solenoid body connector.

   NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

   Install and lubricate new O-ring seals on the transmission control solenoid body harness connector and connect the connector.

   - Tighten to 5 Nm (44 lb-in).

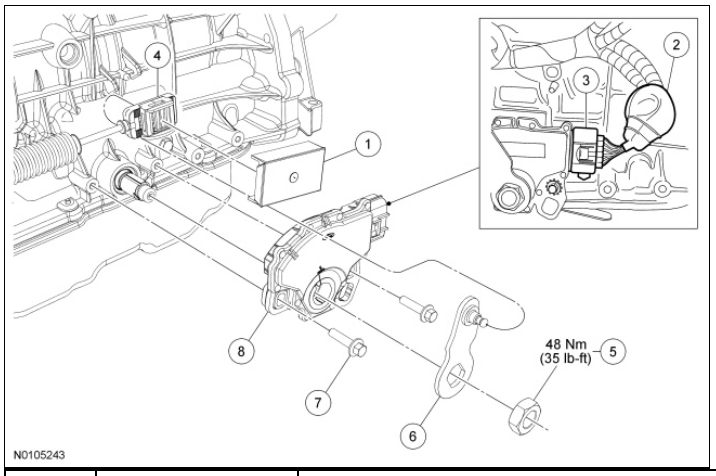


7. Fill the transmission. For additional information, refer to Transmission Fluid Level Check in this section.

Digital Transmission Range (TR) Sensor

Special Tool(s)

 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

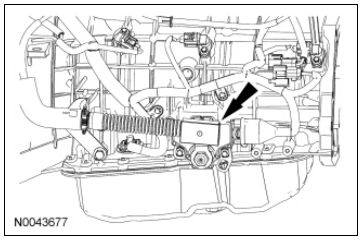


Item	Part Number	Description
1	-	Selector lever cable shield (part of 7E395)
2	-	Transmission Range (TR) sensor connector boot
3	-	TR sensor connector
4	7E395	Selector lever cable
5	W703001	Manual control lever nut
6	7A256	Manual control lever
7	W500106	TR sensor screw and washer (2 required)
8	7F293	TR sensor

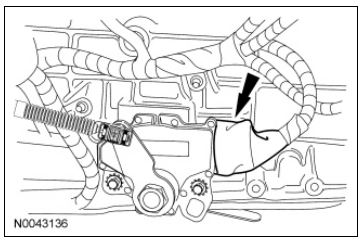
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

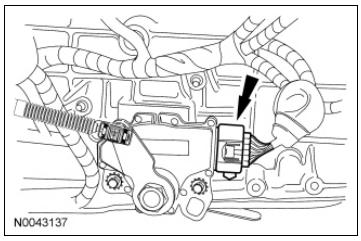
2. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the Transmission Range (TR) sensor connector boot, then sliding the selector lever cable shield away from the TR sensor connector boot.



3. Move the TR sensor connector boot back to gain access to the TR sensor connector.

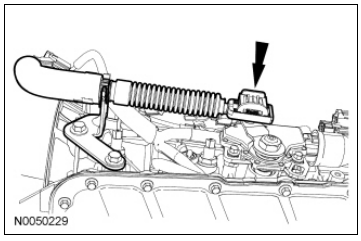


4. Disconnect the TR sensor connector.

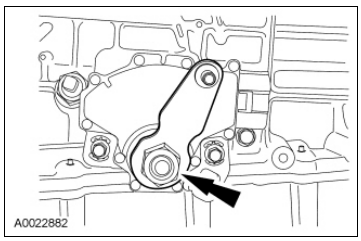


5. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

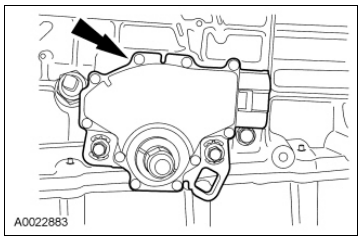
   Remove the selector lever cable from the manual control lever.



6. Remove the manual control lever nut.



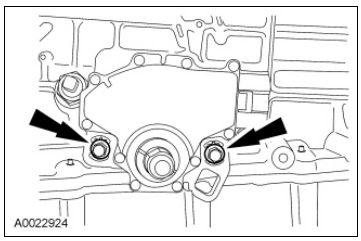
7. Remove the TR sensor.



Installation

1. ***NOTICE:*** **The Transmission Range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.**

Install the TR sensor and loosely install the TR sensor screw and washer (2 required).

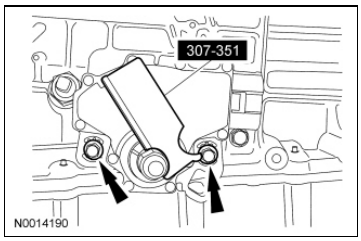


2. ***NOTICE:*** **Tightening one screw before tightening the other may cause the sensor to bind or become damaged.**

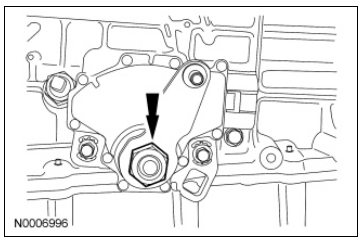
   NOTE: The manual control lever must be in the NEUTRAL position.

   Using the TR Sensor Alignment Gauge, align the TR sensor and tighten the screws in an alternating sequence.

   - Tighten to 8 Nm (71 lb-in).



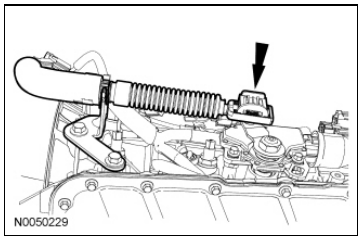
3. Install the manual control lever and the manual control lever nut.
   - Tighten to 48 Nm (35 lb-ft).



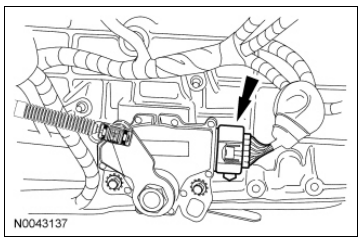
4. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable to make sure that the selector cable end is correctly installed onto the manual control lever.

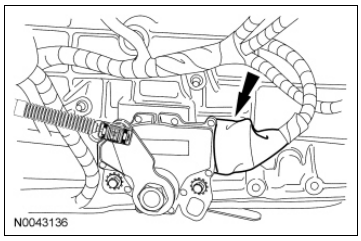
   Install the selector lever cable end onto the manual control lever.



5. Connect the TR sensor connector.

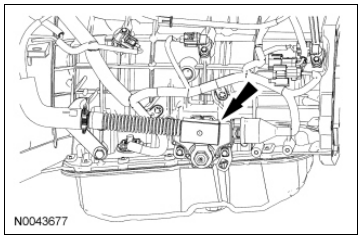


6. Move the TR sensor connector boot back over the TR sensor connector.



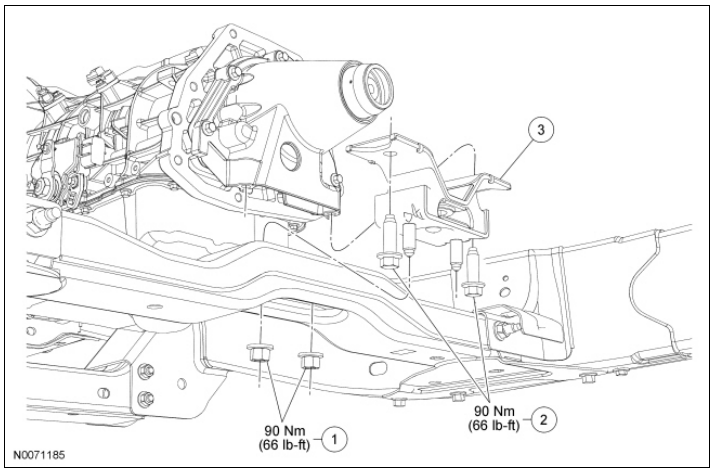
7. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install the selector lever cable shield.



8. Verify that the selector lever cable is adjusted correctly. For additional information, refer to Section 307-05 .

Transmission Support Insulator - Rear Wheel Drive (RWD)



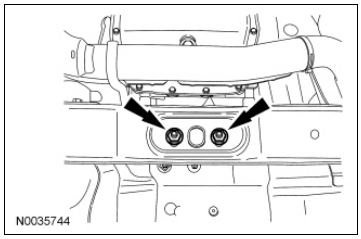
Item	Part Number	Description
1	W710660	Transmission support insulator-to-crossmember nuts
2	W708138	Transmission support insulator-to-extension housing screws
3	6D091	Transmission support insulator

Removal

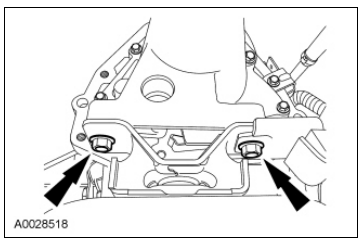
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Support the transmission with a transmission jack.

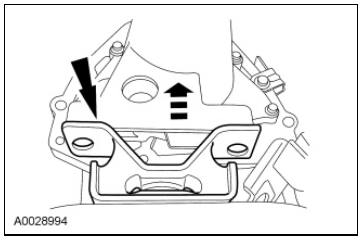
3. Remove the 2 transmission support insulator-to-crossmember nuts.



4. Remove the 2 transmission support insulator-to-extension housing screws.

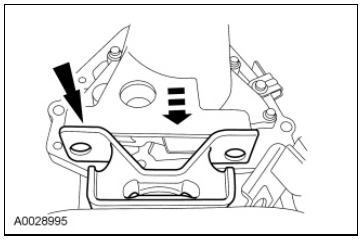


5. Raise the transmission and remove the transmission support insulator.

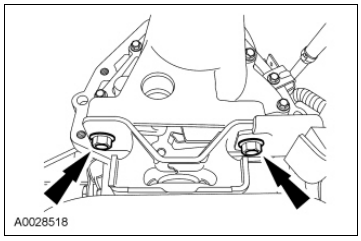


Installation

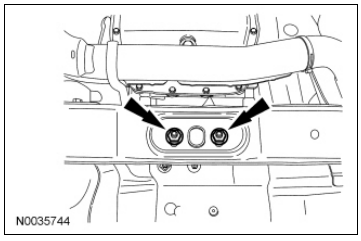
1. Install the transmission support insulator and lower the transmission onto the transmission support insulator.



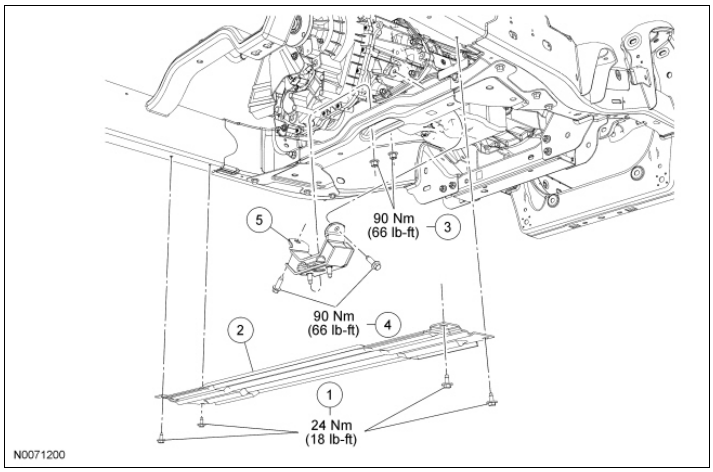
2. Install the 2 transmission support insulator-to-extension housing screws.
   - Tighten to 90 Nm (66 lb-ft).



3. Install the 2 transmission support insulator-to-crossmember nuts.
   - Tighten to 90 Nm (66 lb-ft).



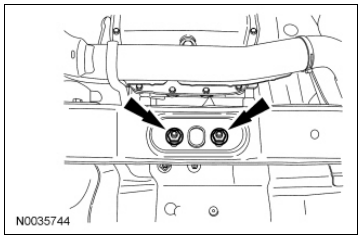
Transmission Support Insulator - Four Wheel Drive (4WD)



Item	Part Number	Description
1	W707079	Skid plate bolts
2	7E063	Skid plate
3	W710660	Transmission support insulator-to-crossmember nuts
4	W708138	Transmission support insulator-to-extension housing screws
5	6D091	Transmission support insulator

Removal

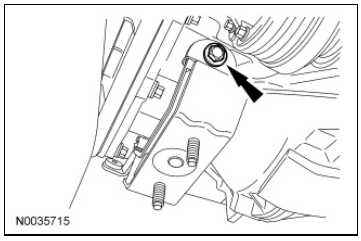
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. If equipped, remove the skid plate bolts and the skid plate.
3. Support the transmission with a transmission jack.
4. Remove the 2 transmission support insulator-to-crossmember nuts.



5. **NOTE:** Crossmember and exhaust system removed for clarity.

   NOTE: LH shown, RH similar.

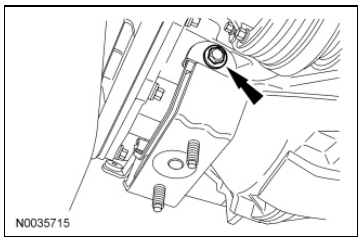
   Remove the 2 transmission support insulator-to-extension housing screws.



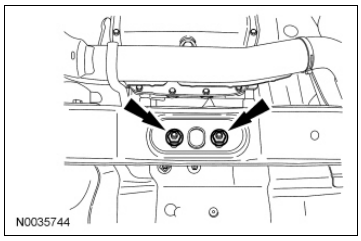
6. Raise the transmission and remove the transmission support insulator.

Installation

1. Install the transmission support insulator and the 2 transmission support insulator-to-extension housing screws.
    - Tighten to 90 Nm (66 lb-ft).

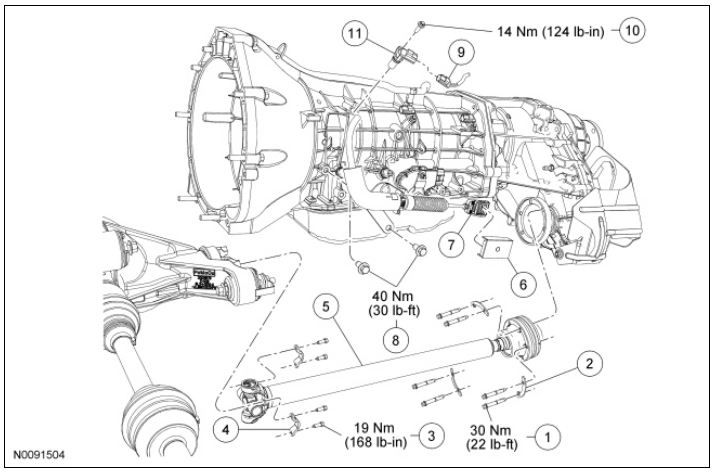


2. Lower the transmission and install the 2 transmission support insulator-to-crossmember nuts.
    - Tighten to 90 Nm (66 lb-ft).



3. If equipped, install the skid plate and skid plate bolts.
    - Tighten to 24 Nm (18 lb-ft).

Turbine Shaft Speed (TSS) Sensor



Item	Part Number	Description
1	-	CV joint bolt (part of 4A376)
2	-	CV joint washer (part of 4A376)
3	389668	U-joint strap bolt
4	4639	U-joint strap
5	4A376	Front driveshaft
6	-	Selector lever cable cover (part of 7E395)
7	7E395	Selector lever cable
8	N605918	Selector lever cable bracket screws
9	-	Turbine Shaft Speed (TSS) sensor connector
10	W708389	TSS sensor screw
11	7H103	TSS sensor

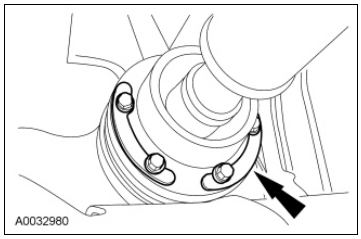
Removal

All vehicles

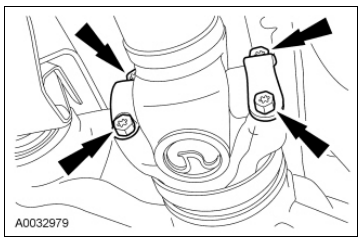
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to the Section 100-02 .

Four-Wheel Drive (4WD) vehicles

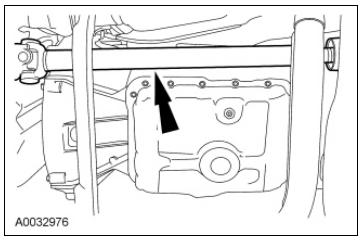
2. Disconnect the front driveshaft from the transfer case.



3. Disconnect the front driveshaft from the front differential.

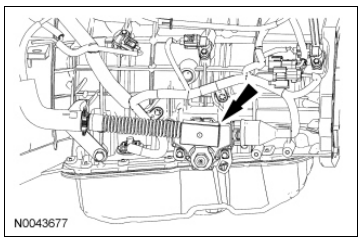


4. Remove the front driveshaft from the vehicle.



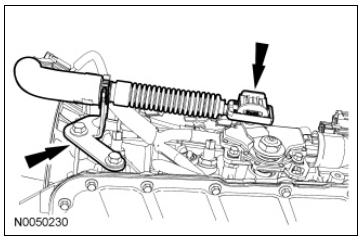
All vehicles

5. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the Transmission Range (TR) sensor connector boot, then sliding the selector lever cable shield away from the TR sensor connector boot.

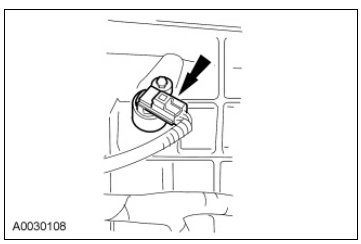


6. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

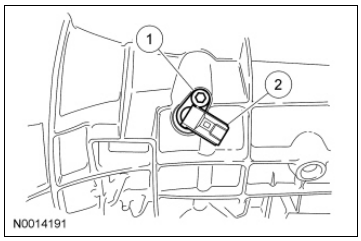
   Remove the selector lever cable and selector lever cable bracket.



7. Disconnect the Turbine Shaft Speed (TSS) sensor connector.



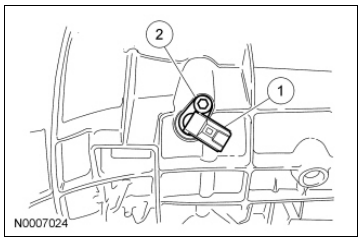
8. Remove the TSS sensor.
    1. Remove the TSS sensor screw.
    2. Remove the TSS sensor from the transmission.
    - Inspect the TSS sensor O-ring for damage. If damaged, install a new O-ring.



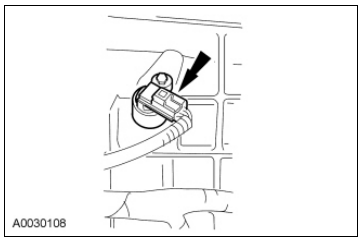
Installation

All vehicles

1. Inspect the TSS O-ring seal for damage. Install a new O-ring seal if damaged. Lubricate the O-ring seal with petroleum jelly to prevent damage to the O-ring seal.
    1. Install the TSS sensor into the transmission.
    2. Tighten the TSS sensor screw.
    - Tighten to 14 Nm (124 lb-in).



2. Connect the TSS sensor connector.

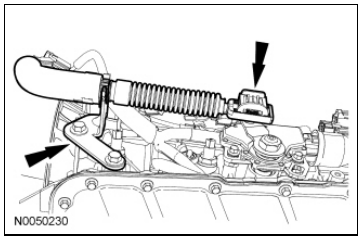


3. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable to make sure that the selector cable end is correctly installed onto the manual control lever.

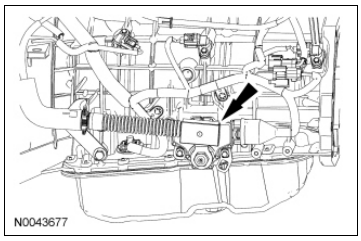
   Install the selector lever cable end onto the manual control lever, selector lever bracket and selector lever bracket screws.

   - Tighten to 40 Nm (30 lb-ft).



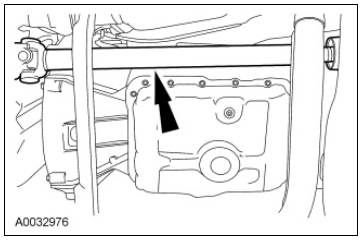
4. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new shield.

   Install the selector lever cable shield.

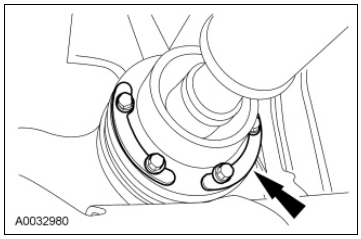


4WD vehicles

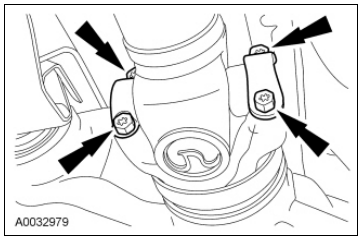
5. Install the front driveshaft in the vehicle.



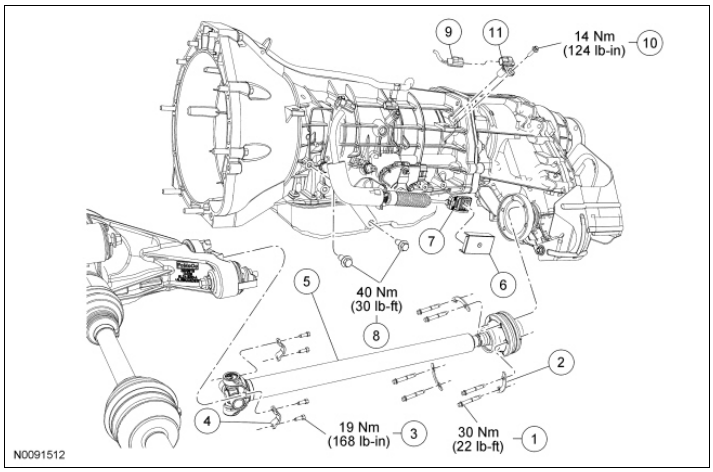
6. Connect the front driveshaft to the transfer case. Install the CV joint washers and CV joint bolts.
   - Tighten to 30 Nm (22 lb-ft).



7. Connect the front driveshaft to the front differential. Install the U-joint straps and U-joint strap bolts.
   - Tighten to 19 Nm (168 lb-in).



Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	-	CV joint bolt (part of 4A376)
2	-	CV joint washer (part of 4A376)
3	389668	U-joint strap bolt
4	4639	U-joint strap
5	4A376	Front driveshaft
6	-	Selector lever cable cover (part of 7E395)
7	7E395	Selector lever cable
8	N605918	Selector lever cable bracket screws
9	-	Output Shaft Speed (OSS) sensor connector
10	W708389	OSS sensor screw
11	7H103	OSS sensor

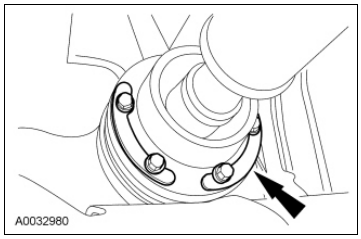
Removal

All vehicles

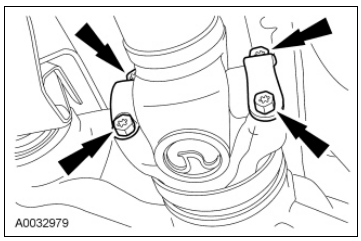
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to the Section 100-02 .

Four-Wheel Drive (4WD) vehicles

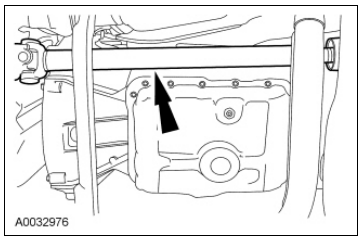
2. Disconnect the front driveshaft from the transfer case.



3. Disconnect the front driveshaft from the front differential.

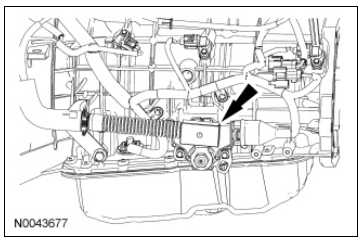


4. Remove the front driveshaft from the vehicle.



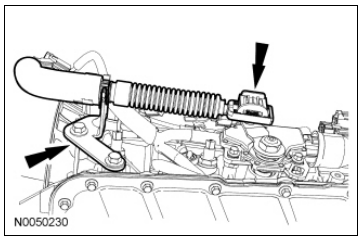
All vehicles

5. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the Transmission Range (TR) sensor connector boot, then sliding the selector lever cable shield away from the TR sensor connector boot.

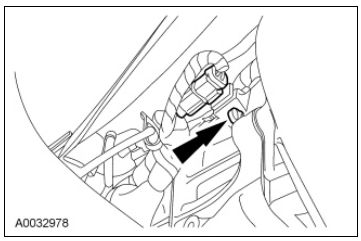


6. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

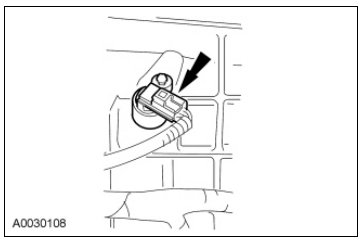
   Remove the selector lever cable and selector lever cable bracket.



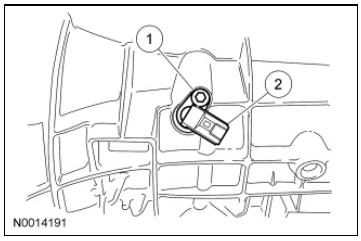
7. Disconnect the Heated Oxygen Sensor (HO2S) connector from the transmission case.



8. Disconnect the Output Shaft Speed (OSS) sensor connector.



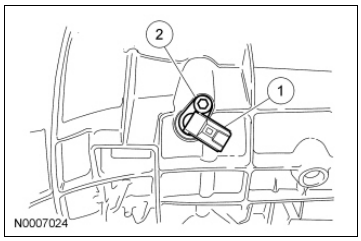
9. Remove the OSS sensor.
    1. Remove the OSS sensor screw.
    2. Remove the OSS sensor from the transmission.
    - Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring.



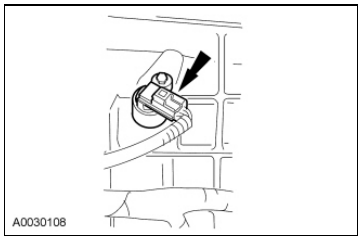
Installation

All vehicles

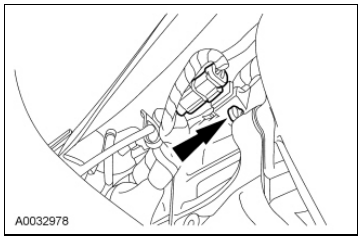
1. Inspect the OSS O-ring seal for damage. Install a new O-ring seal if damaged. Lubricate the O-ring seal with petroleum jelly to prevent damage to the O-ring seal.
    1. Install the OSS sensor into the transmission.
    2. Tighten the OSS sensor screw.
    - Tighten to 14 Nm (124 lb-in).



2. Connect the OSS sensor connector.



3. Connect the HO2S connector to the transmission case.

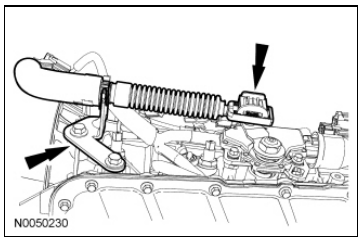


4. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable to make sure that the selector cable end is correctly installed onto the manual control lever.

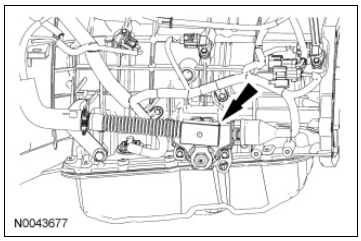
   Install the selector lever cable end onto the manual control lever, selector lever cable bracket and selector lever cable bracket screws.

   - Tighten to 40 Nm (30 lb-ft).



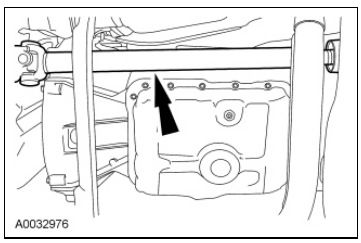
5. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install the selector lever cable shield.

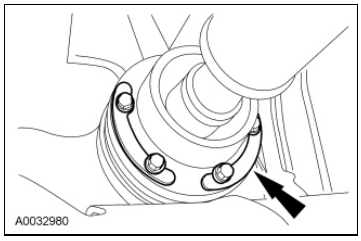


4WD vehicles

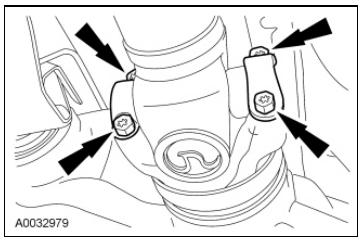
6. Install the front driveshaft in the vehicle.



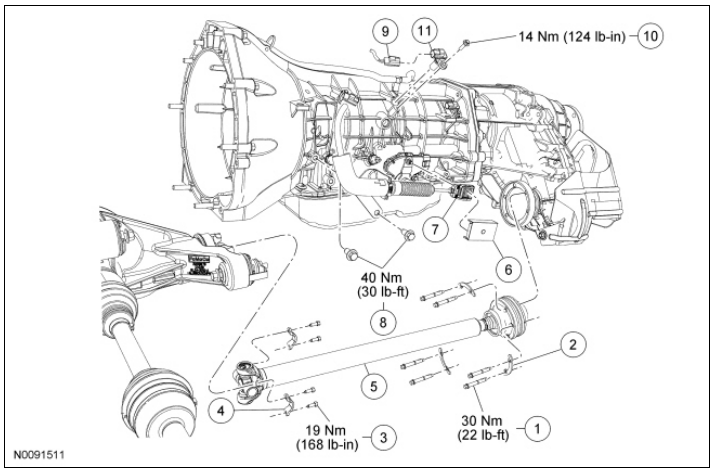
7. Connect the front driveshaft to the transfer case. Install the CV joint washers and CV joint bolts.
   - Tighten to 30 Nm (22 lb-ft).



8. Connect the front driveshaft to the front differential. Install the U-joint straps and U-joint strap bolts.
    - Tighten to 19 Nm (168 lb-in).



Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	-	CV joint bolt (part of 4A376)
2	-	CV joint washer (part of 4A376)
3	389668	U-joint strap bolt
4	4639	U-joint strap
5	4A376	Front driveshaft
6	-	Selector lever cable cover (part of 7E395)
7	7E395	Selector lever cable
8	N605918	Selector lever cable bracket screws
9	-	Intermediate shaft speed sensor connector
10	W708389	Intermediate shaft speed sensor screw
11	7H103	Intermediate shaft speed sensor

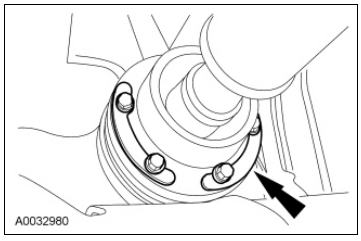
Removal

All vehicles

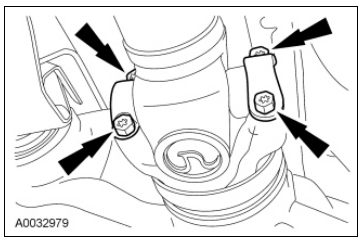
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to the Section 100-02 .

Four-Wheel Drive (4WD) vehicles

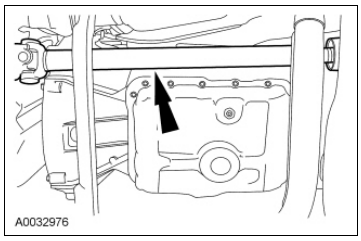
2. Disconnect the front driveshaft from the transfer case.



3. Disconnect the front driveshaft from the front differential.

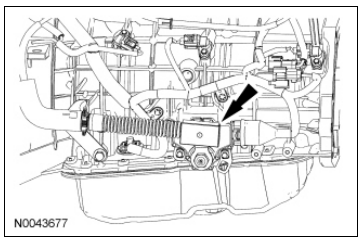


4. Remove the front driveshaft from the vehicle.



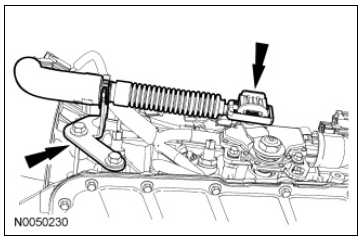
All vehicles

5. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the Transmission Range (TR) sensor connector boot, then sliding the selector lever cable shield away from the TR sensor connector boot.

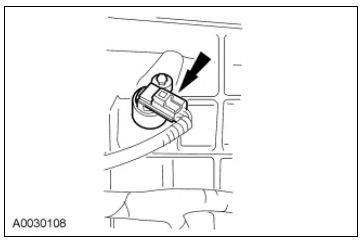


6. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

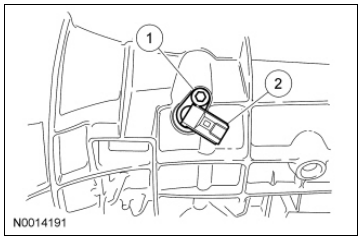
   Remove the selector lever cable and selector lever cable bracket.



7. Disconnect the intermediate shaft speed sensor connector.



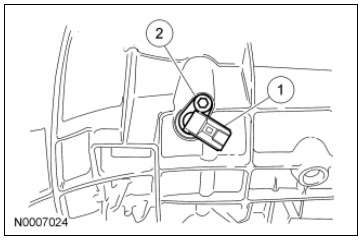
8. Remove the intermediate shaft speed sensor.
    1. Remove the intermediate shaft speed sensor screw.
    2. Remove the intermediate shaft speed sensor from the transmission.
    - Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring.



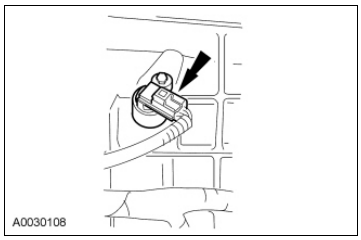
Installation

All vehicles

1. Inspect the O-ring seal for damage. Install a new O-ring seal if damaged. Lubricate the O-ring seal with petroleum jelly to prevent damage to the O-ring seal.
    1. Install the intermediate shaft speed sensor into the transmission.
    2. Tighten the intermediate shaft speed sensor screw.
    - Tighten to 14 Nm (124 lb-in).



2. Connect the intermediate shaft speed sensor connector.

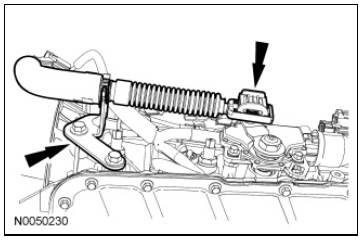


3. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable to make sure that the selector cable end is correctly installed onto the manual control lever.

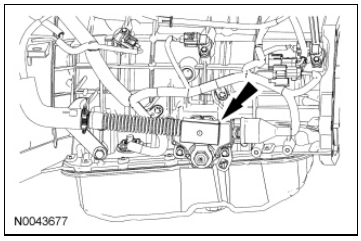
   Install the selector lever cable end onto the manual control lever, selector lever cable bracket and selector lever cable bracket screws.

   - Tighten to 40 Nm (30 lb-ft).



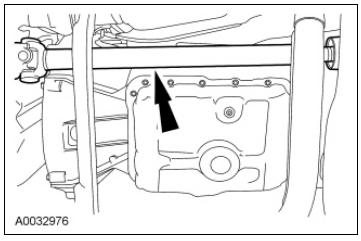
4. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install the selector lever cable shield.

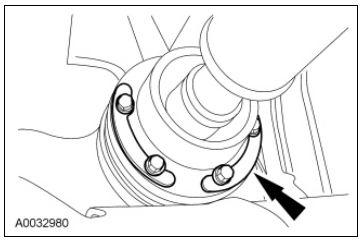


4WD vehicles

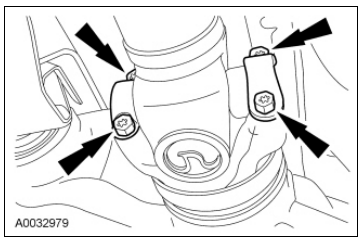
5. Install the front driveshaft in the vehicle.



6. Connect the front driveshaft to the transfer case. Install the CV joint washers and CV joint bolts.
   - Tighten to 30 Nm (22 lb-ft).



7. Connect the front driveshaft to the front differential. Install the U-joint straps and U-joint strap bolts.
   - Tighten to 19 Nm (168 lb-in).



Transmission - Rear Wheel Drive (RWD)

Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

NOTE: Refer to the Transmission Cooler Flushing Job Aid on the FMCDealer website.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** When the battery has been disconnected and reconnected, some abnormal drive symptoms can occur while the vehicle relearns its adaptive strategy. Notify the customer that they can experience slightly different upshifts (either soft or firm) and that this is a temporary condition and will eventually return to normal operating condition.

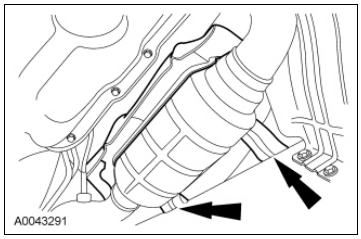
   Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the coolant expansion tank bolts and position the tank aside.

4. Remove the fan shroud bolts. Do not remove the fan shroud.

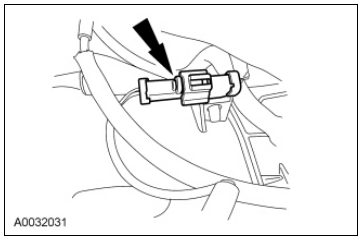
5. If transmission disassembly or installation of a new transmission is necessary, drain the transmission fluid.
   - Install the transmission fluid drain plug when finished.

6. Remove the 2 RH heat shield bolts and position the RH heat shield aside.


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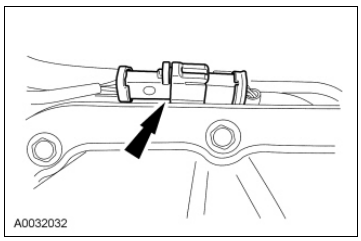
7. **NOTE:** LH side shown, RH side similar.

   Disconnect the 2 Heated Oxygen Sensor (HO2S) connectors.

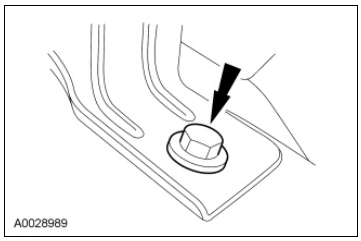

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8. **NOTE:** LH side shown, RH side similar.

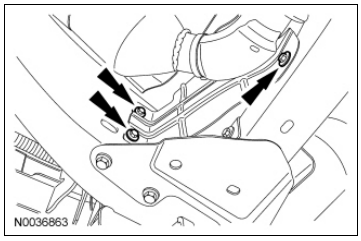
   Disconnect the 2 Catalyst Monitor Sensor (CMS) connectors.



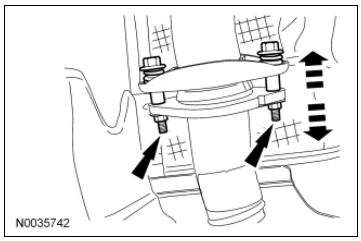
9. Remove the LH exhaust heat shield bolt.



10. If equipped, remove the RH exhaust heat shield.

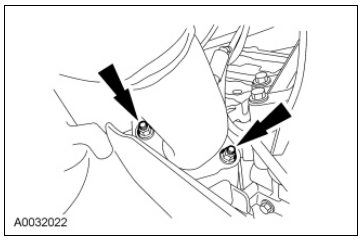


11. Remove the catalytic converter-to-muffler nuts and bolts. Separate the muffler from the converter.
    - Discard the gasket.
    - Discard the nuts.



12. **NOTE:** RH shown, LH similar.

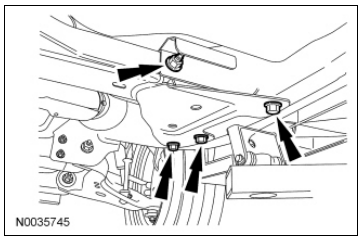
    Remove the 4 catalytic converter-to-manifold nuts.



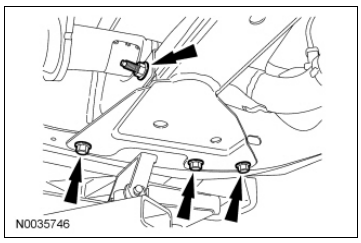
13. ⚠ **WARNING: Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal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

    Support the transmission with a suitable transmission jack.

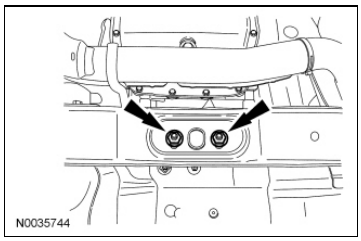
14. Remove the 4 RH side crossmember bolts and the crossmember nut.



15. Remove the 4 LH side crossmember bolts and the crossmember nut.



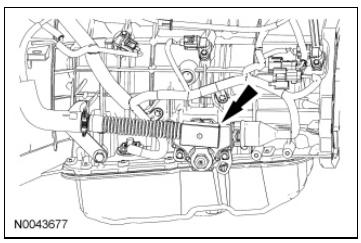
16. Remove the transmission support insulator-to-crossmember nuts and remove the crossmember.



17. **NOTE:** This step may require an assistant.

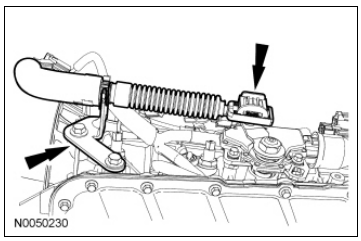
    Remove the 3-way catalytic converter system.

18. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the Transmission Range (TR) sensor connector boot, then sliding the selector lever cable shield away from the TR sensor connector boot.



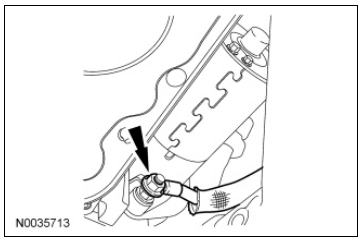
19. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

Remove the selector lever cable and selector lever cable bracket.

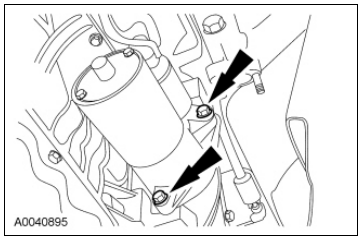


20. Remove the driveshaft. For additional information, refer to Section 205-01 .

21. Remove the ground cable nut and position the cable to the side.



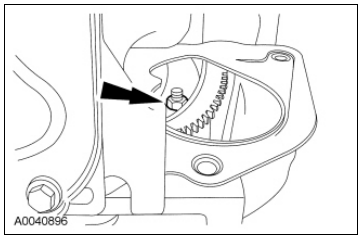
22. Remove the starter and position aside.



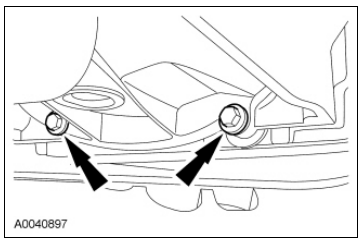
23. ***NOTICE:*** **Rotating the crankshaft pulley bolt counterclockwise could cause a reduction in clamp load on the crankshaft pulley and timing sprocket, which could cause severe engine damage.**

    NOTE: Make an identifying mark on the nut, stud and flexplate to allow for correct installation.

    Remove and discard the 4 torque converter-to-flexplate nuts.

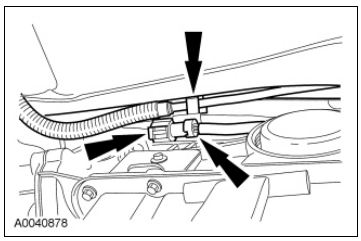


24. Remove the lower transmission-to-engine bolts.

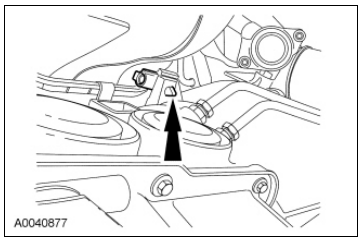


25. Lower the transmission to gain access to the sensor connectors and the transmission-to-engine bolts.

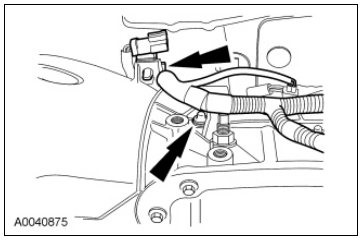
26. Remove the RH CMS connector and the fuel lines from the bracket.



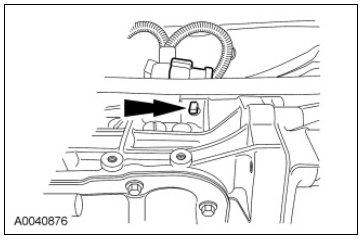
27. Remove the RH HO2S from the transmission.



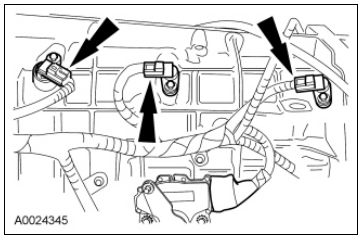
28. Remove the LH HO2S and the harness clip from the transmission.



29. Remove the LH CMS connector from the transmission.

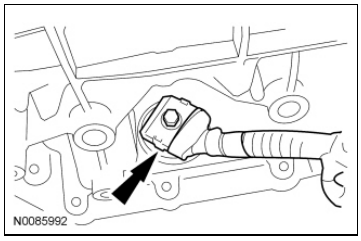


30. Disconnect the Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor and intermediate shaft speed sensor connectors.

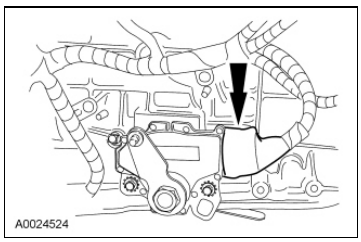


31. **NOTE:** Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission control solenoid vehicle harness connector.

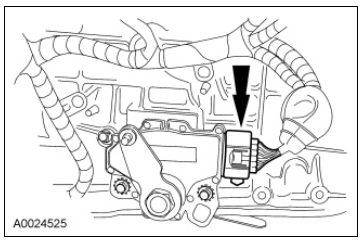
    Disconnect the transmission vehicle harness connector.



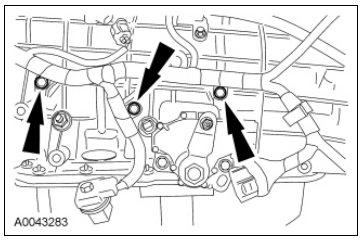
32. Move the TR sensor connector boot back to gain access to the TR sensor connector.



33. Disconnect the TR sensor connector.

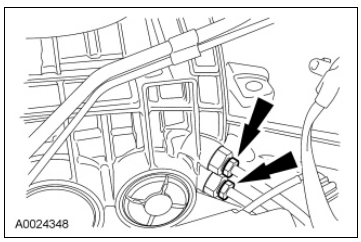


34. Remove the transmission vehicle harness retainers from the transmission.

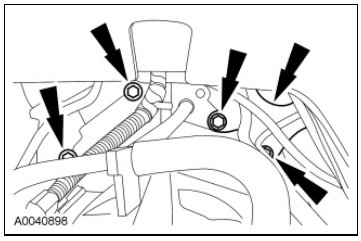


35. ***NOTICE:*** **Do not damage the transmission fluid cooler tubes. Hold the transmission case fittings with a backup wrench.**

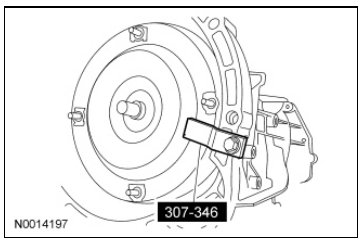
    Disconnect the 2 transmission fluid cooler tube nut-to-case fitting.



36. Remove the 6 transmission-to-engine bolts and position the fuel line bracket aside.

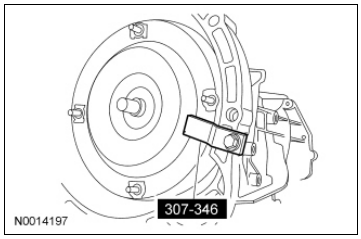


37. Move the transmission back enough to install the Torque Converter Retainer.



38. Lower the transmission from the vehicle.

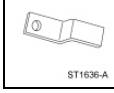
39. Remove the Torque Converter Retainer.



40. If the transmission is being disassembled to install new parts, or if a new or remanufactured transmission is being installed, the transmission fluid cooler, the auxiliary transmission fluid cooler (if equipped) and the transmission fluid cooler tubes must be cleaned and backflushed to keep contaminants from entering the transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

Transmission - Four Wheel Drive (4WD)

Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

NOTE: Refer to the Transmission Cooler Flushing Job Aid on the FMCDealer website.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. **NOTE:** When the battery has been disconnected and reconnected, some abnormal drive symptoms can occur while the vehicle relearns its adaptive strategy. Notify the customer that they can experience slightly different upshifts either (soft or firm) and that this is a temporary condition and will eventually return to normal operating condition.

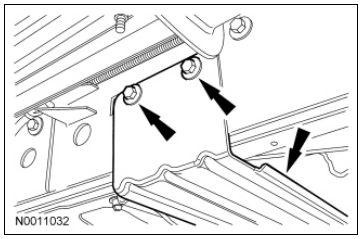
   Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Remove the coolant expansion tank bolts and position the tank aside.

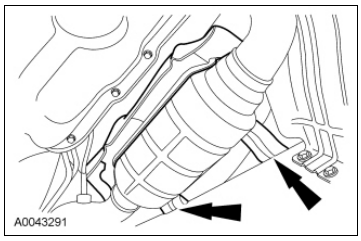
4. Remove the fan shroud bolts. Do not remove the fan shroud.

5. If transmission disassembly or installation of a new transmission is necessary, drain the transmission fluid.
   - Install the drain plug when finished.

6. If equipped, remove the 4 skid plate bolts and the skid plate.

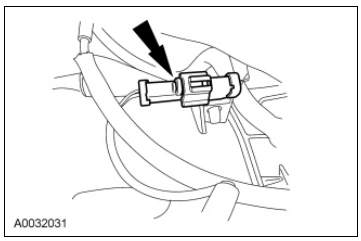

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7. Remove the 2 RH heat shield bolts and position the RH heat shield aside.


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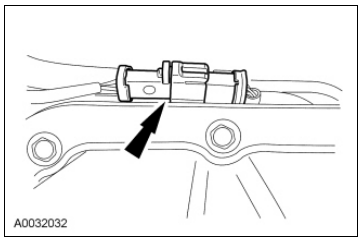
8. **NOTE:** LH side shown, RH side similar.

Disconnect the 2 Heated Oxygen Sensor (HO2S) connectors.

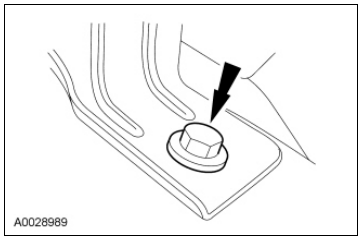


9. **NOTE:** LH side shown, RH side similar.

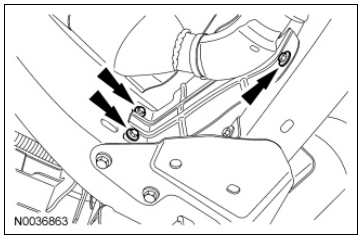
   Disconnect the 2 Catalyst Monitor Sensor (CMS) connectors.



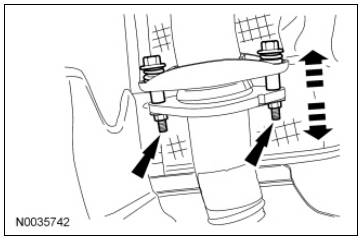
10. Remove the LH exhaust heat shield bolt.



11. If equipped, remove the RH exhaust heat shield.

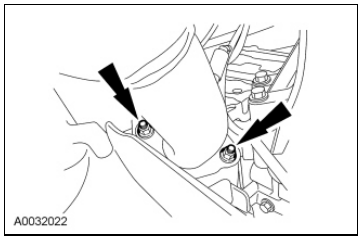


12. Remove the catalytic converter-to-muffler nuts and bolts. Separate the muffler from the converter.
    - Discard the gasket.
    - Discard the nuts.

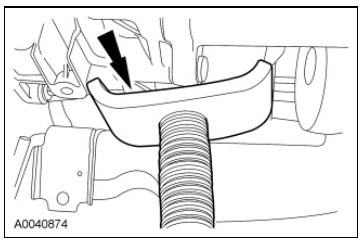


13. **NOTE:** RH side shown, LH similar.

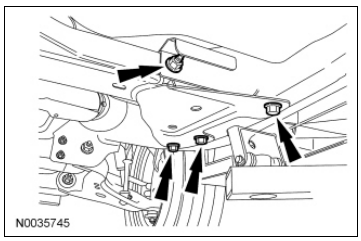
    Remove the 4 catalytic converter-to-manifold nuts.



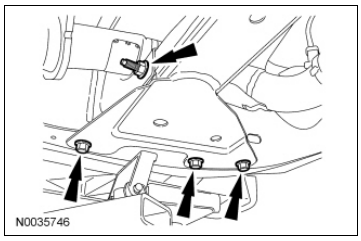
14. Install a suitable jackstand under the transfer case.



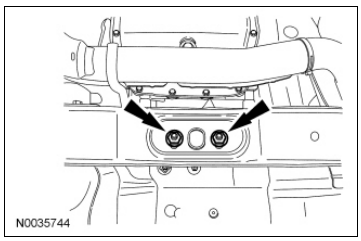
15. Remove the 4 RH side crossmember bolts and the crossmember nut.



16. Remove the 4 LH side crossmember bolts and the crossmember nut.



17. Remove the transmission support insulator-to-crossmember nuts and remove the crossmember.

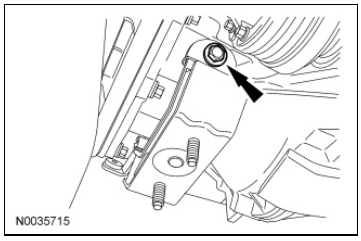


18. **NOTE:** This step may require an assistant.

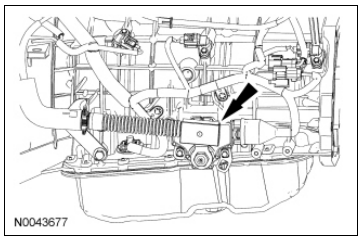
    Remove the 3-way catalytic converter system.

19. **NOTE:** LH side shown, RH similar.

    If required, remove the transmission support insulator.

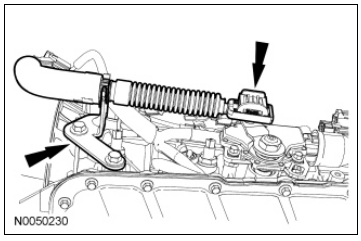


20. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the Transmission Range (TR) sensor connector boot, then sliding the selector lever cable shield away from the TR sensor connector boot.



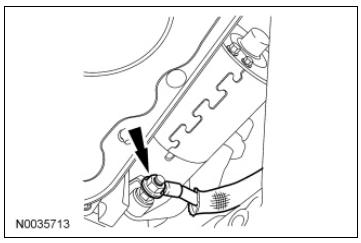
21. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

    Remove the selector lever cable and selector lever cable bracket.

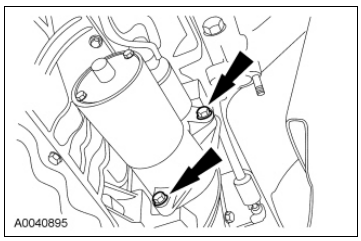


22. Remove the driveshafts. For additional information, refer to Section 205-01 .

23. Remove the ground cable nut and position the cable aside.



24. Remove the starter and position to the side.

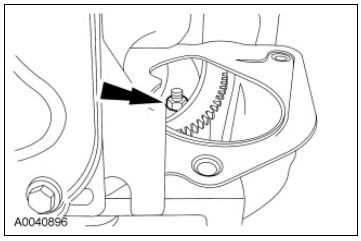


25. ***NOTICE:*** **Rotating the crankshaft pulley bolt counterclockwise could cause a reduction in clamp load on the crankshaft pulley and timing sprocket, which could cause severe engine**

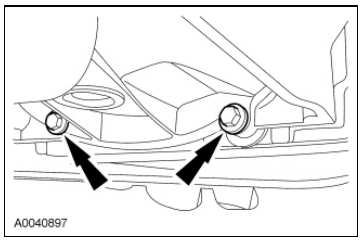
damage.

NOTE: Make an identifying mark on the nut, stud and flexplate to allow for correct installation.

Remove and discard the 4 torque converter-to-flexplate nuts.

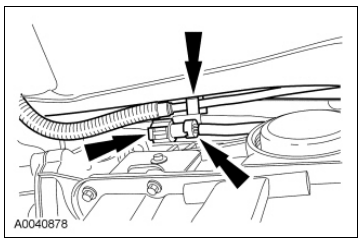


26. Remove the lower transmission-to-engine bolts.

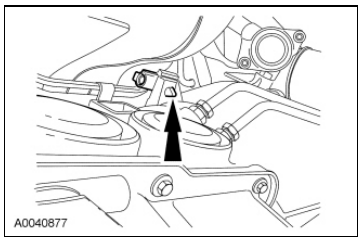


27. Lower the transmission to gain access to the sensor connectors and the transmission-to-engine bolts.

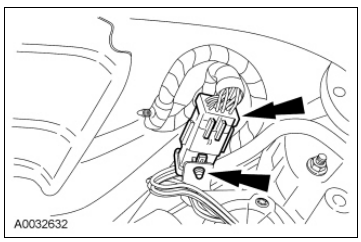
28. Remove the RH CMS connector and the fuel lines from the bracket.



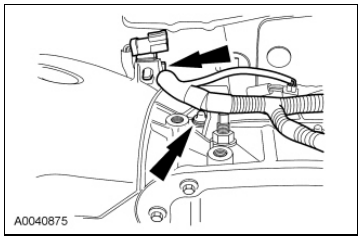
29. Remove the RH HO2S from the transmission.



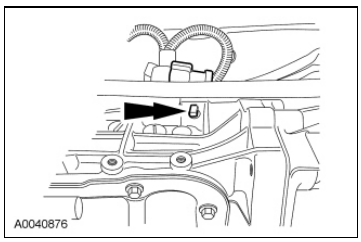
30. If equipped, disconnect the transfer case shift motor connector.



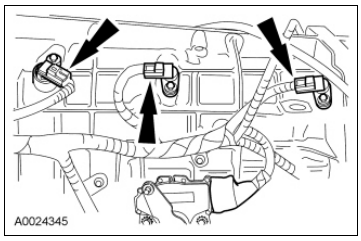
31. Remove the LH HO2S and the harness clip from the transmission.



32. Remove the LH CMS connector from the transmission.

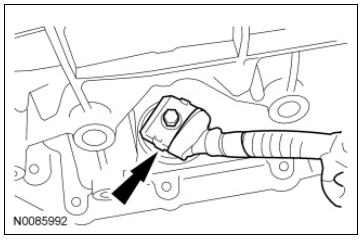


33. Disconnect the Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor and intermediate shaft speed sensor connectors.

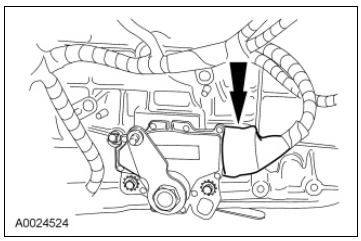


34. **NOTE:** Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission control solenoid vehicle harness connector.

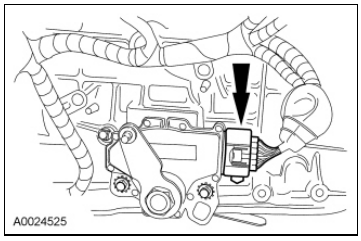
    Disconnect the transmission vehicle harness connector.



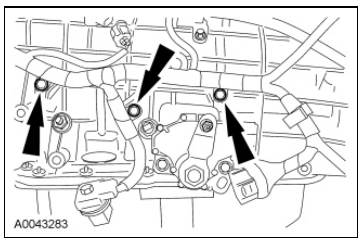
35. Move the TR sensor connector boot back to gain access to the TR sensor connector.



36. Disconnect the TR sensor connector.

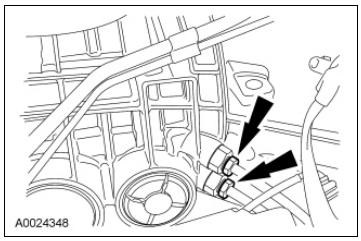


37. Remove the transmission vehicle harness retainers from the transmission.



38. ***NOTICE:*** **Do not damage the transmission fluid cooler tubes. Hold the transmission case fittings with a backup wrench.**

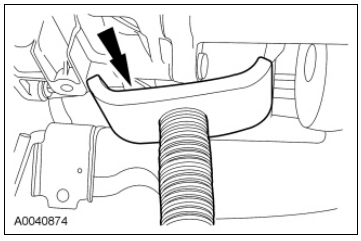
    Disconnect the 2 transmission fluid cooler tube nut-to-case fitting.



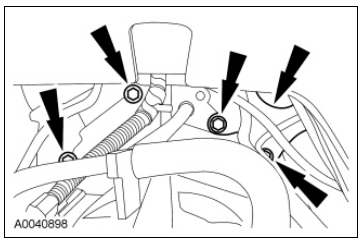
39. ⚠ **WARNING: Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal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

    Support the transmission with a transmission jack.

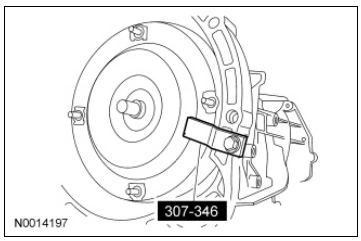
40. Remove the jackstand from under the transfer case.



41. Remove the 6 transmission-to-engine bolts and position the fuel line bracket aside.

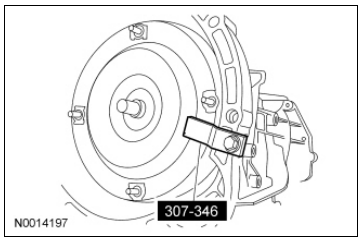


42. Move the transmission back enough to install the Torque Converter Retainer.



43. Lower the transmission and transfer case (as an assembly) from the vehicle.

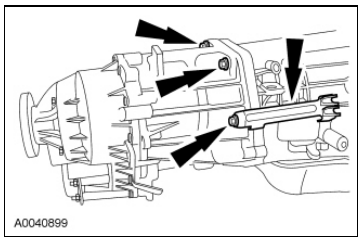
44. Remove the Torque Converter Retainer.



45. **NOTE:** If the transmission is being serviced, the transfer case will need to be removed.

    Remove the transfer case from the back of the transmission.

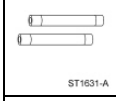
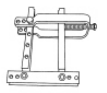
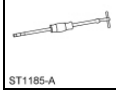
    - Remove the transfer case bolts and the bracket.
    - Disconnect the vent hose.



46. If the transmission is being disassembled to install new parts, or if a new or remanufactured transmission is being installed, the transmission fluid cooler, the auxiliary transmission fluid cooler (if equipped) and the transmission fluid cooler tubes must be cleaned and backflushed to keep contaminants from entering the transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

Transmission

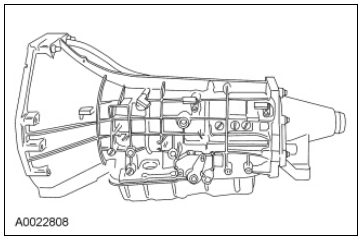
Special Tool(s)

 ST2393-A	Compressor, Servo Cover 307-402
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST2417-A	Remover, Input Shaft Oil Seal 308-375
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)
 ST2418-A	Remover, Transmission Fluid Pump 307-397
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

All vehicles

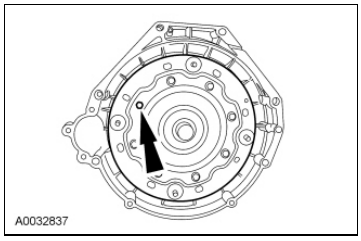
NOTE: Tag and identify all parts during disassembly.

1. Place the transmission on a workbench.


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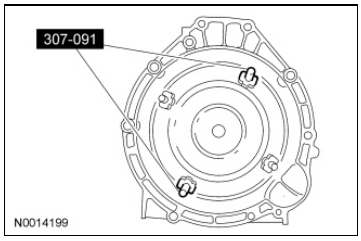
2. **NOTE:** If the adapter plate is removed, remove and discard the torque converter adapter plate-to-converter nuts.

   If vehicle is equipped, and installation of a new or remanufactured torque converter is necessary, remove and discard the torque converter adapter plate-to-converter nuts. Remove the adapter plate.



3. ⚠ **WARNING: Secure the torque converter in the transmission during removal or installation. The torque converter is heavy and may result in injury if it falls out of the transmission. Failure to follow this instruction may result in serious personal injury.**

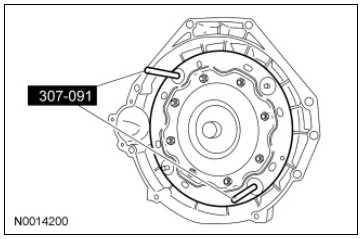
   If the adapter plate has been removed, use the Torque Converter Handle to remove the torque converter.



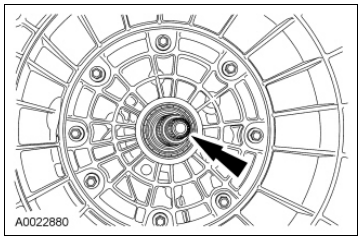
4. ⚠ **WARNING: Secure the torque converter in the transmission during removal or installation. The torque converter is heavy and may result in injury if it falls out of the transmission. Failure to follow this instruction may result in serious personal injury.**

   NOTE: If not installing a new torque converter, leave the adapter plate bolted to the torque converter.

   Using the Torque Converter Handle, remove the torque converter and adapter plate as an assembly.

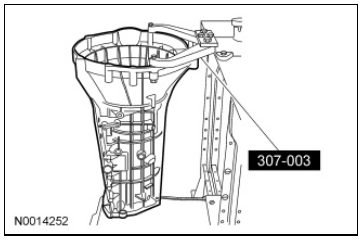


5. Remove the input shaft.

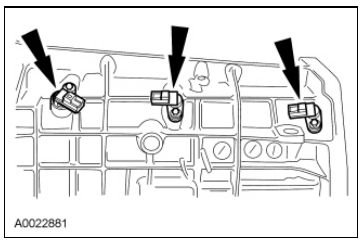


6. ⚠ **WARNING: Always verify that the lockpin on a bench-mounted holding fixture is correctly secured to help prevent unexpected component rotation. Failure to follow this instruction may result in serious personal injury.**

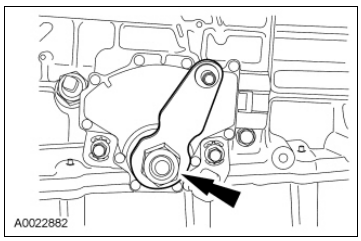
   Using the Transmission Holding Fixture, install the transmission into the bench with the torque converter housing facing up.



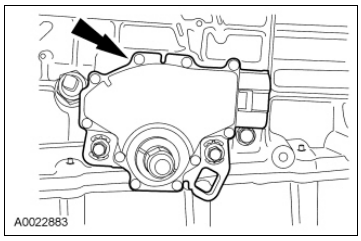
7. Remove the 3 speed sensors.



8. Remove the manual control lever nut and manual control lever.

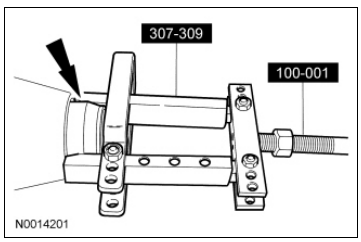


9. Remove the Transmission Range (TR) sensor.



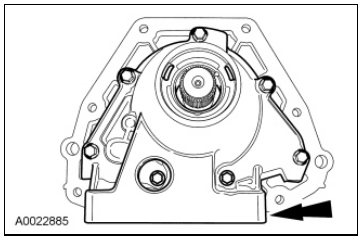
Rear Wheel Drive (RWD) applications

10. Using the Torque Converter Fluid Seal Remover and Slide Hammer, remove the extension housing seal.



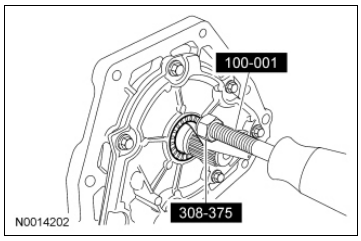
11. ***NOTICE:*** **The park pawl, park pawl return spring and park pawl shaft may fall out during removal of the extension housing.**

    Remove the extension housing screws and extension housing.



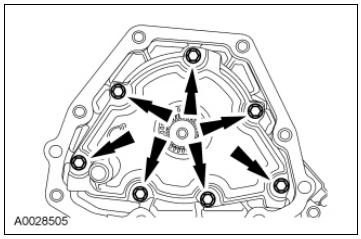
Four-Wheel Drive (4WD) applications

12. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the extension housing seal.



13. *NOTICE:* **The park pawl, park pawl return spring and park pawl shaft may fall out during removal of the extension housing.**

    Remove the extension housing screws and extension housing.

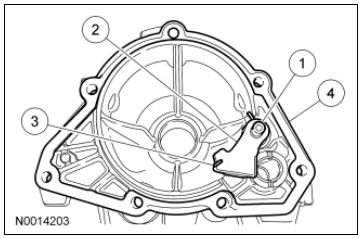


All applications

14. **NOTE:** Rear Wheel Drive (RWD) shown, Four-Wheel Drive (4WD) similar.

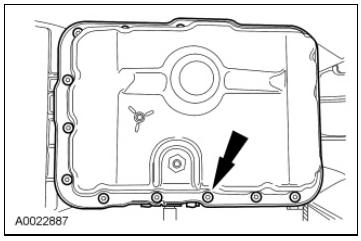
    Remove the park pawl assembly and discard the gasket.

    1. Remove the park pawl shaft.
    2. Remove the park pawl.
    3. Remove the park pawl return spring.
    4. Remove and discard the gasket.

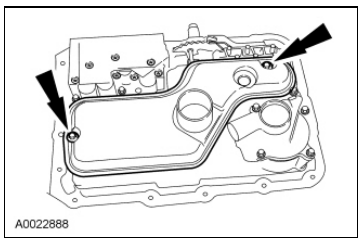


15. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect the transmission fluid pan gasket for damage. If not damaged, the transmission fluid pan gasket should be reused.

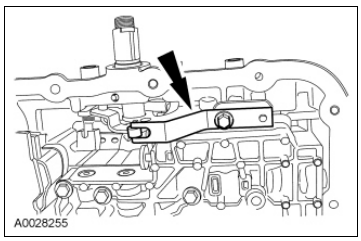
    Remove the 16 transmission fluid pan-to-case screws, transmission fluid pan and gasket.



16. Remove the transmission fluid filter and seal assembly and discard.

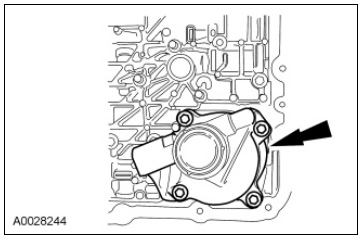


17. Remove the manual control valve detent spring.



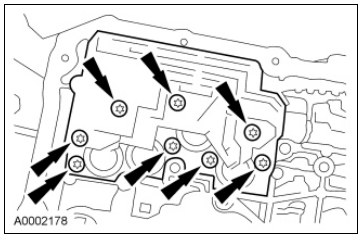
18. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

    Remove the reverse servo assembly.

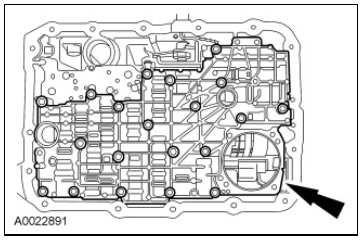


19. ***NOTICE:*** **Do not damage transmission control solenoid body connector pins.**

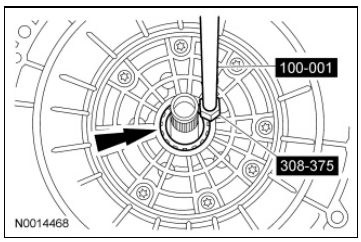
    Remove the transmission control solenoid body assembly by lifting on the body and pushing the transmission control solenoid body connector from the other side of the case.



20. Remove the main control valve body, separator plate and gasket.



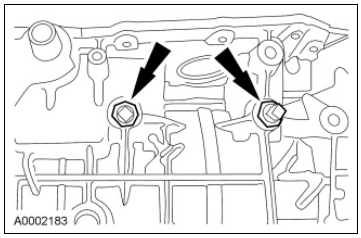
21. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the converter hub seal.



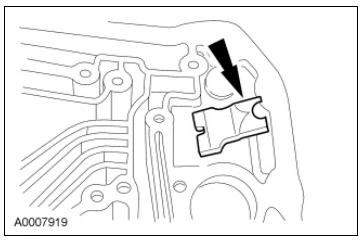
22. ***NOTICE:*** **Failure to loosen the Overdrive (O/D)/intermediate band adjustment screws prior to pump removal may cause damage to the pump and O/D band.**

    NOTE: Throw the locknuts away. The locknuts are not reusable for assembly.

    Remove and discard the locknuts, and loosen the Overdrive (O/D)/intermediate band adjustment screws.

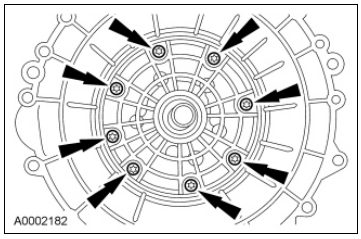


23. Remove and tag the O/D anchor strut for assembly.

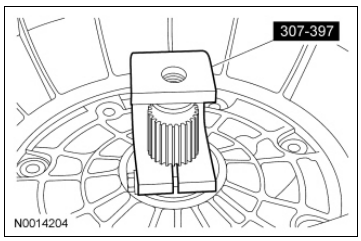


24. ***NOTICE:*** **The transmission fluid pump housing-to-case screws are not reusable for assembly. Discard the screws. If the screws are reused, the housing may become separated from the transmission.**

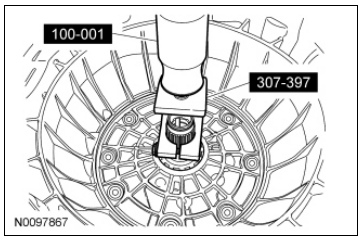
    Remove and discard the transmission fluid pump housing-to-case screws.



25. Install the Transmission Fluid Pump Remover.

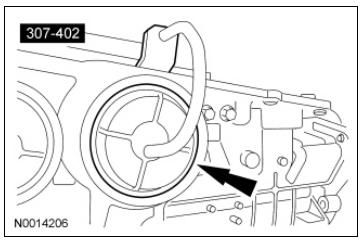


26. Using the Transmission Fluid Pump Remover and Slide Hammer, remove the pump.

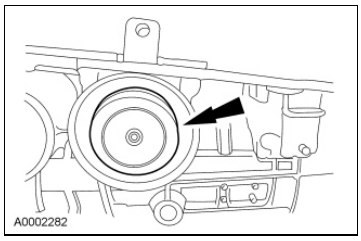


27. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

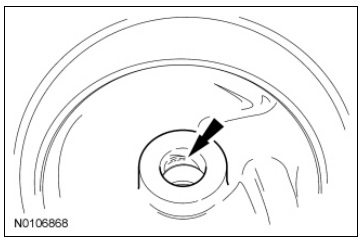
    Using the Servo Cover Compressor, remove the intermediate servo cover retaining ring and cover.



28. Remove the intermediate band servo piston and spring.

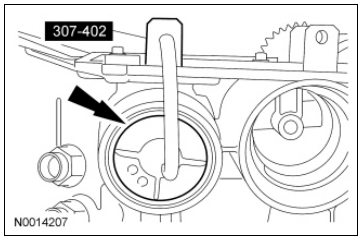


29. After removing the intermediate band servo piston and spring, inspect the transmission case servo bore for excessive wear. If excessive wear or damage to the transmission case is evident, repair the transmission case servo bore using the servo bore repair kit.

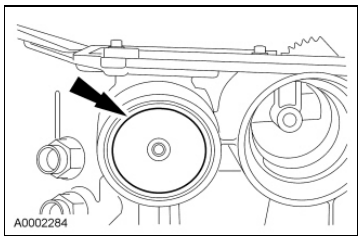


30. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

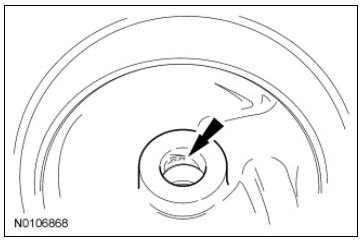
    Using the Servo Cover Compressor, remove the O/D servo cover retaining ring and cover.



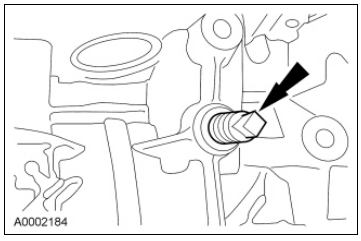
31. Remove the front band servo piston and spring.



32. After removing the O/D band servo piston and spring, inspect the transmission case servo bore for excessive wear. If excessive wear or damage to the transmission case is evident, repair the transmission case servo bore using the servo bore repair kit.

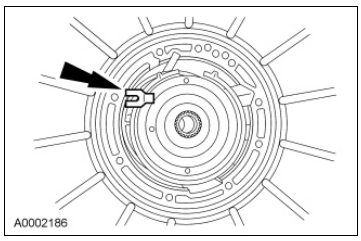


33. Remove the screw.



34. **NOTE:** Tag and identify parts for reassembly.

    Compress the O/D band and remove the apply strut.

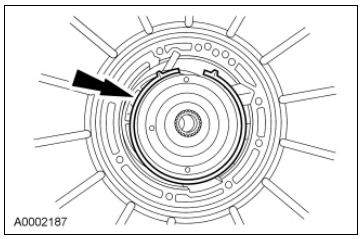


35. **NOTE:** Identify the anchor and apply ends of the O/D band.

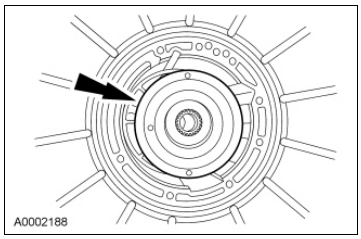
    NOTE: The new O/D band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

    Remove and inspect the O/D band. Check the following conditions for installing a new band:

    - Inspect for glazing.
    - Inspect for missing friction material.
    - Inspect for material flaking.
    - Inspect for damage to the anchor pins.



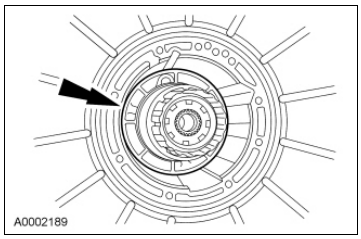
36. Remove the O/D brake and coast clutch drum.



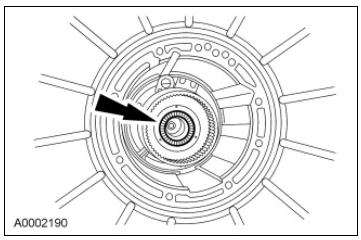
37. **NOTE:** Do not bend the trigger wheel.

    NOTE: The No. 12 thrust bearing is in this assembly.

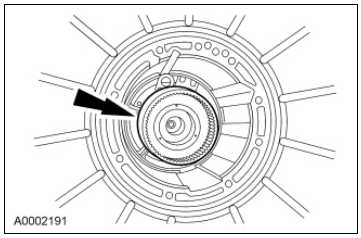
    Remove the planetary gear O/D carrier.



38. Remove the O/D planet thrust bearing (No. 2).

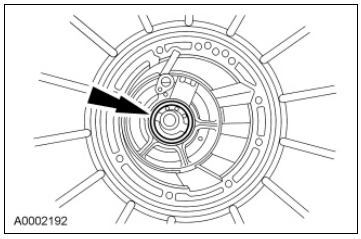


39. Remove the O/D ring gear, O/D One-Way Clutch (OWC) assembly and center shaft as an assembly.



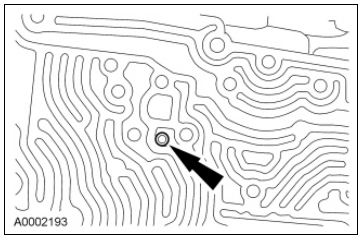
40. **NOTE:** Tag and identify the center shaft thrust bearing (No. 3) for assembly.

    Remove the No. 3 center shaft thrust bearing.

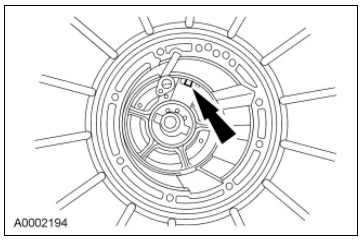


41. **NOTE:** The center support locknut may fall into the remaining assembly if not removed.

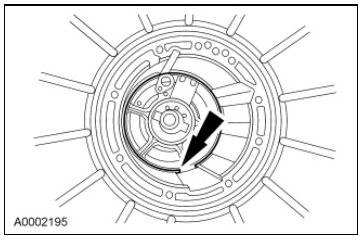
    Remove the screw.



42. Remove the locknut and cage.



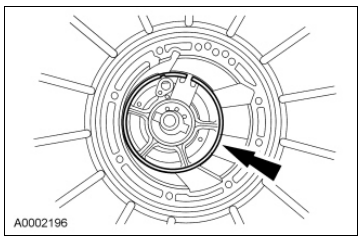
43. Remove the center support retaining ring.



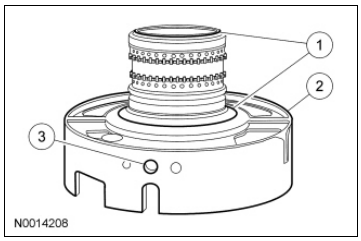
44. **NOTE:** The center support is repaired as an assembly. Any damage requires installing a new component.

    NOTE: When removing the center support, pull evenly around the center support web.

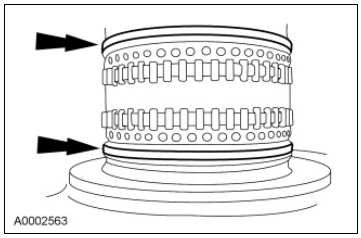
Remove the center support.



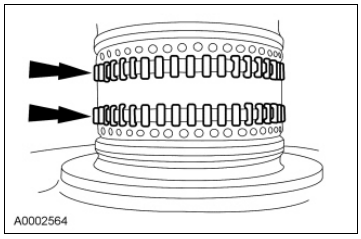
45. Inspect the center support assembly for wear or damage.
    1. Inspect the thrust surfaces for wear or damage.
    2. Inspect the center support sealing surface.
    3. Inspect the fluid passage for blockage or damage.



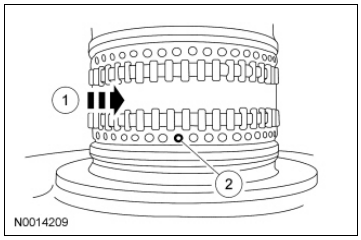
46. Inspect the seal rings for damage.



47. Inspect the bearing for missing rollers or damage.

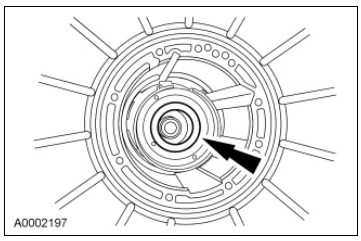


48. Inspect the direct clutch feed hole for blockage or damage.
    1. Rotate the center support bearing to locate the direct clutch feed hole.
    2. Inspect the direct clutch feed hole for blockage or damage.

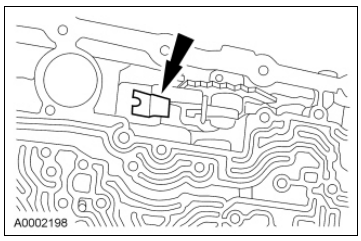


49. **NOTE:** Tag and identify the No. 4 intermediate brake drum thrust bearing.

Remove the intermediate brake drum thrust bearing (No. 4).



50. Remove and tag the intermediate band anchor strut for assembly.

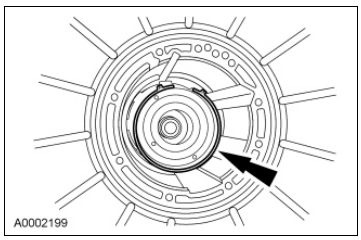


51. **NOTE:** Identify the anchor and apply ends of the intermediate band.

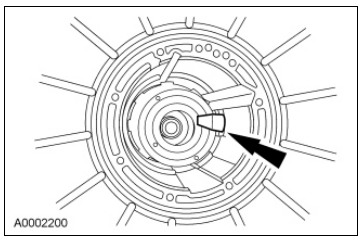
    NOTE: The new intermediate band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

    Remove and inspect the intermediate band. Check the following conditions for installing a new band:

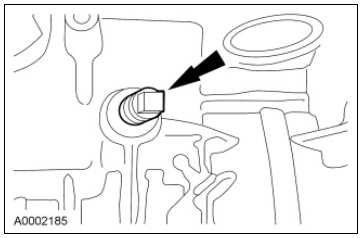
    - Inspect for glazing.
    - Inspect for missing friction material.
    - Inspect for material flaking.
    - Inspect for damage to the anchor pins.



52. Remove and tag the intermediate band apply strut for assembly.

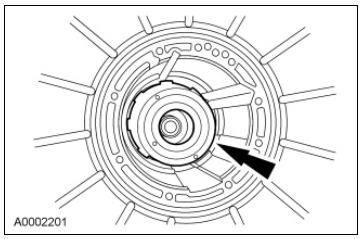


53. Remove the screw.

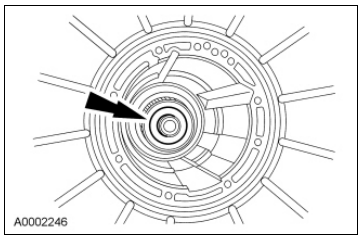


54. **NOTE:** The No. 5 forward clutch cylinder thrust bearing may come out with the intermediate brake and direct clutch drum.

    Remove the direct clutch drum.

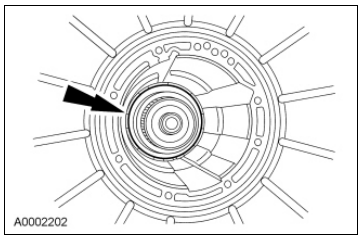


55. Remove the No. 5 forward clutch cylinder thrust bearing, tag and identify.



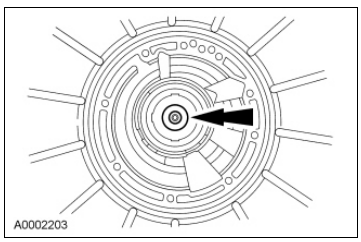
56. **NOTE:** The No. 6A thrust bearing may come out with the cylinder. Tag for reassembly.

    Remove the forward clutch cylinder.



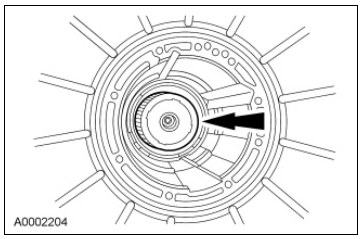
57. **NOTE:** The No. 6A forward ring gear hub thrust bearing may have come out with the forward clutch cylinder.

    Remove the No. 6A forward ring gear hub thrust bearing.

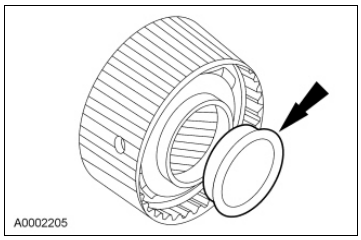


58. **NOTE:** The No. 7 forward planet thrust bearing may come out with the forward ring gear and hub assembly.

    Remove the forward ring gear and hub as an assembly.

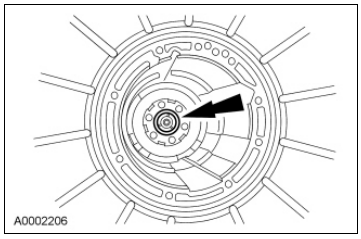


59. Remove the No. 6B forward clutch thrust washer from the forward ring gear hub.

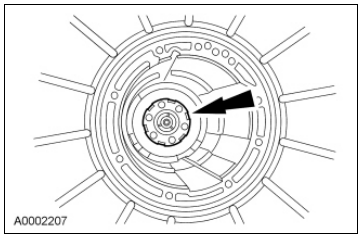


60. **NOTE:** The No. 7 forward planet thrust bearing may come out with the forward ring gear and hub assembly.

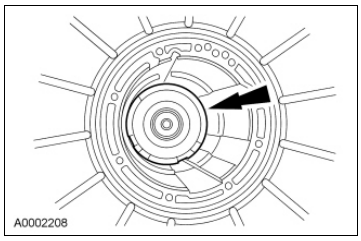
    Remove the No. 7 forward planet thrust bearing.



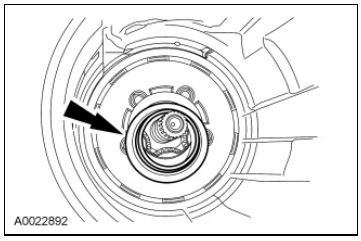
61. Remove the forward planetary assembly.



62. Remove the input shell and sun gear assembly.

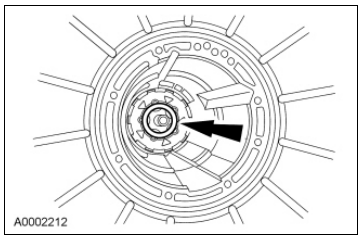


63. Remove the spacer.

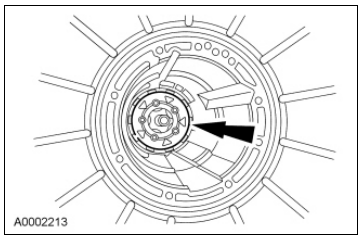


64. **NOTE:** Tag and identify the No. 8 low/reverse planetary carrier thrust bearing.

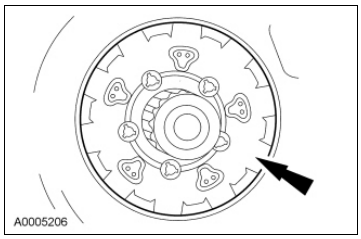
    Remove the thrust bearing.



65. Remove the retaining ring.

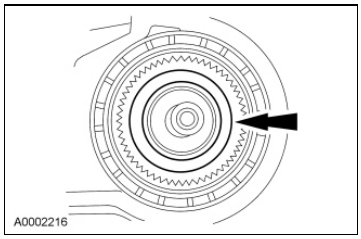


66. Remove low/reverse planetary assembly.



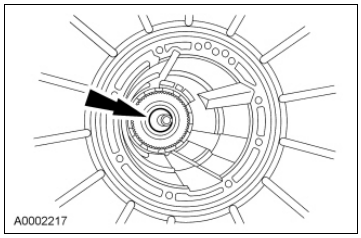
67. **NOTE:** Tag and identify the No. 9 low/reverse planetary carrier thrust bearing.

    Remove the thrust bearing.



68. **NOTE:** Use slots located around the outside of the sleeve.

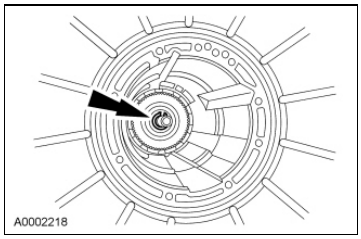
    Using a small pick, remove the output shaft sleeve.



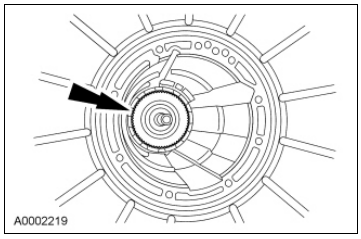
69. ⚠ **WARNING: Hold onto the output shaft so it does not fall out after removing the snap ring. Failure to follow this instruction may result in serious personal injury.**

    NOTICE: **Discard the output shaft retaining ring. A new retaining ring must be used for assembly or damage to the transmission may occur.**

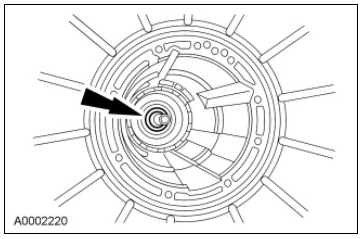
    While holding the output shaft, remove and discard the output shaft retaining ring.



70. Remove the output shaft ring gear and hub.



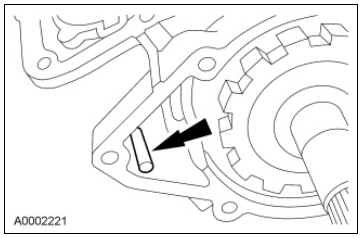
71. Remove the No. 10 low intermediate sun gear bearing.



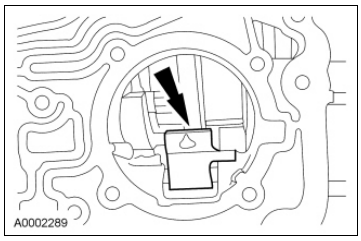
72. ***NOTICE:*** **Do not pry on the outer edge of the case or damage to the gasket sealing surface may occur.**

    NOTE: It may be necessary to grind flat spots on the edges of the reverse band actuating lever shaft in order to remove it.

    Using a pair of vise grips, hold the flat spots on the reverse band actuating lever shaft, wiggle it back and forth and remove the reverse band actuating lever shaft.

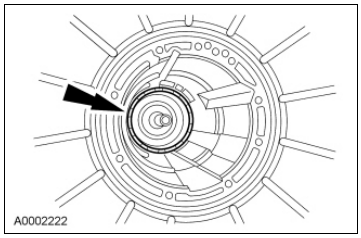


73. Remove the reverse band actuating lever assembly.



74. **NOTE:** The inner race of the rear OWC is not removable. It is repaired in the case.

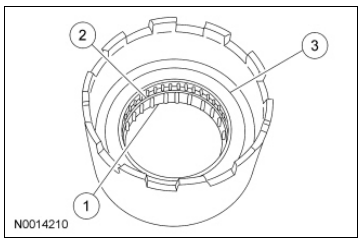
    Remove the low/reverse brake drum and OWC assembly by rotating it clockwise.



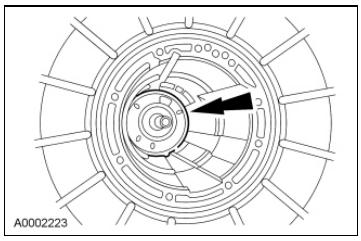
75. **NOTE:** The reverse OWC is part of the reverse brake drum assembly. Install a new reverse brake drum as an assembly only.

    Inspect the reverse brake drum assembly and install a new reverse brake drum assembly if damaged.

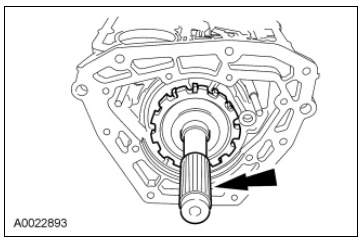
    1. Inspect the reverse brake drum sprags.
    2. Inspect the reverse brake drum rollers.
    3. Inspect the reverse brake drum.



76. Remove the reverse band.

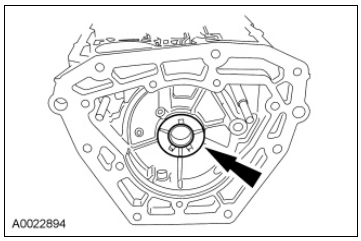


77. Remove the output shaft and park gear.



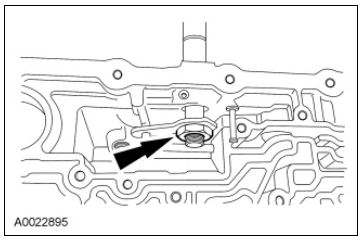
78. **NOTE:** Tag and identify the No. 11 output shaft thrust washer.

    Remove the output shaft thrust washer.

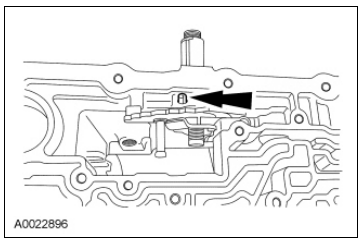


79. ***NOTICE:*** **To avoid damage, make sure the wrench does not strike the manual valve inner lever pin.**

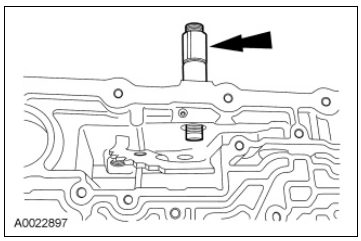
    Remove the nut.



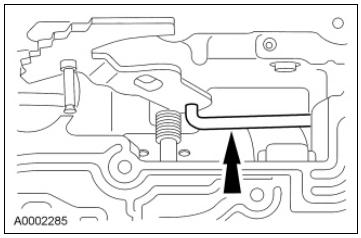
80. Remove the manual control lever shaft retaining pin.



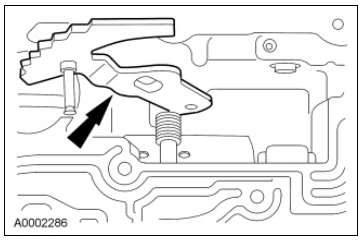
81. Remove the manual control lever shaft.



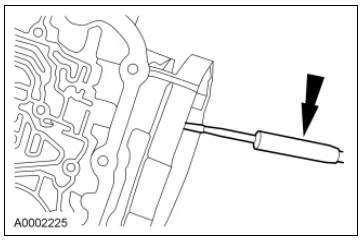
82. Disconnect the manual valve inner lever from the park lever actuating rod.



83. Remove the manual valve inner lever.

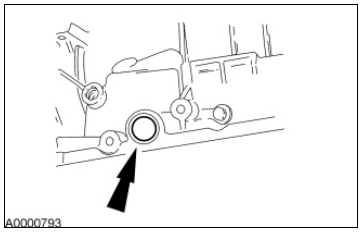


84. Remove the park lever actuating rod.



85. ***NOTICE:*** **Do not damage the bore.**

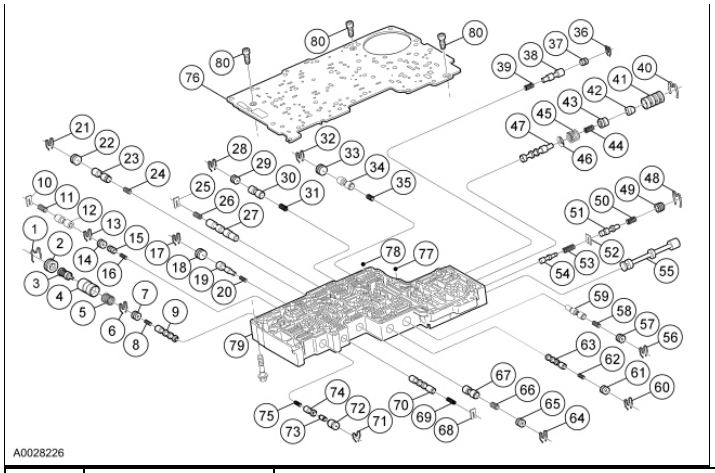
Remove the manual control lever seal.



Main Control Valve Body

Special Tool(s)

 ST1639-A	Aligner, Valve Body (2 required) 307-334 (T95L-70010-C)



Item	Part Number	Description
1	-	Clip - retainer
2	-	Plug - retainer
3	-	Valve assembly - thermo
4	-	Valve - fluid cooler bypass
5	-	Spring - fluid cooler bypass
6	-	Clip - retainer
7	-	Plug - retainer
8	-	Spring - converter clutch control valve
9	-	Valve - converter clutch control
10	-	Plate
11	-	Spring - coast clutch control
12	-	Valve - coast clutch control
13	-	Clip - retainer
14	-	Plug - retainer
15	-	Valve - converter clutch back pressure
16	-	Spring - converter clutch back pressure
17	-	Clip - retainer
18	-	Plug - retainer
19	-	Valve - VFS2 modulator
20	-	Spring - VFS2 modulator valve

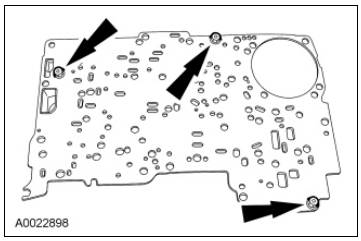
21	-	Clip - retainer
22	-	Plug - retainer
23	-	Valve - intermediate servo release
24	-	Spring - intermediate servo release valve
25	-	Plate
26	-	Spring - high clutch control
27	-	Valve - high clutch control
28	-	Plug - retainer
29	-	Clip - retainer
30	-	Valve - reverse modulator
31	-	Spring - reverse modulator valve
32	-	Clip - retainer
33	-	Plug - retainer
34	-	Valve - reverse engagement
35	-	Spring - reverse engagement valve
36	-	Clip - retainer
37	-	Plug - retainer
38	-	Valve - VFS1 modulator
39	-	Spring -VFS1 modulator valve
40	-	Clip - retainer
41	-	Sleeve
42	-	Valve - booster
43	-	Valve - booster
44	-	Spring - inner
45	-	Spring - outer
46	-	Spring - retainer
47	-	Valve - main regulator
48	-	Clip - retainer
49	-	Plug - retainer
50	-	Spring - converter limit
51	-	Valve - converter limit
52	-	Plate
53	-	Spring - solenoid regulator valve
54	-	Valve - solenoid regulator
55	-	Valve - manual
56	-	Clip - retainer
57	-	Plug - retainer
58	-	Spring - rear servo control valve
59	-	Valve - rear servo control
60	-	Clip - retainer
61	-	Plug - retainer
62	-	Spring - RS ISA select valve
63	-	Valve - RS ISA select
64	-	Clip - retainer

65	-	Plug - retainer
66	-	Spring - forward engagement control valve
67	-	Valve - forward engagement control
68	-	Plate
69	-	Spring - Overdrive (O/D) servo control
70	-	Valve - O/D servo control
71	-	Retainer - clip
72	-	Sleeve - converter clutch modulator control
73	-	Valve - converter clutch modulator control
74	-	Valve - converter clutch modulator
75	-	Spring - converter clutch modulator control
76	7Z490	Plate assembly - main control valve body separator
77	7E195	Ball - lubrication check
78	7E195	Ball - shuttle valve
79	7A101	Body - control valve lower
80	W701099	Screws - separator plate

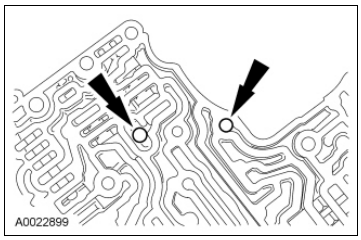
Disassembly

1. **NOTE:** The valve body separator plate has a bonded gasket. Do not reuse. Discard the plate.

   Remove and discard the valve body separator plate.



2. Remove the check balls.



3. **NOTE:** Refer to the disassembled view.

   Disassemble the main control valve body only if cleaning is required.

Assembly

1. ***NOTICE:*** **Do not lose parts when cleaning or repairing.**

   Thoroughly clean all parts in solvent and blow dry with moisture-free compressed air.

2. ***NOTICE:*** **Do not stone, file or sand the valves. This will remove the anodized finish and may**

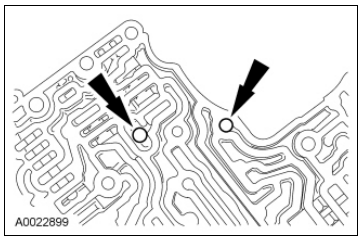
result in further main control or transmission damage.

After cleaning the main control valve body, carry out the following:

- Inspect all valve and plug bores for scoring or burrs.
- Check all fluid passages for obstructions.
- Inspect all valves and plugs for burrs.
- Inspect all mating surfaces for burrs or distortion.
- Inspect all springs for distortion.
- Check all valves and plugs for free movement in their respective bores.
    - ♦ Valves and plugs, when dry, must fall from their own weight into their respective bores.
- Roll the manual valve on a flat surface to check for a bent condition.

3. Assemble the main control valve body.

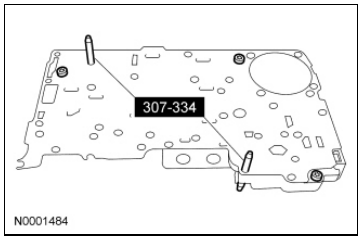
4. Install the main control valve body check balls.



5. **NOTE:** Use a new valve body separator plate for main control valve body installation.

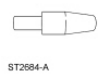
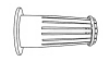
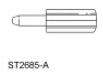
   Using the Valve Body Aligners, install a new main control valve body separator plate.

   - Tighten to 7 Nm (62 lb-in).



Fluid Pump

Special Tool(s)

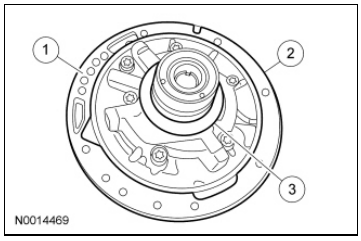
 ST2532-A	Alignment Gauge, Transmission Fluid Pump 307-431
 ST2533-A	Alignment Gauge, Transmission Fluid Pump 307-432
 ST2419-A	Alignment Pins, Transmission Fluid Pump 307-398
 ST1817-A	Alignment Set, Fluid Pump 307-S039 (T74P-77103-X)
 ST1833-A	Installer, Torque Converter Fluid Seal 307-349 (T97T-77000-A)
 ST1826-A	Sizer, Piston Seal 307-338 (T95L-70010-G)
 ST2684-A	Installer Tools, Transmission Fluid Pump Seal (Aligner) 307-451/1
 ST2686-A	Installer Tools, Transmission Fluid Pump Seal (Installer) 307-451/3
 ST2685-A	Installer Tools, Transmission Fluid Pump Seal (Sizer) 307-451/2

Material

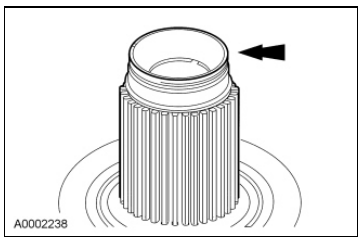
Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

Disassembly

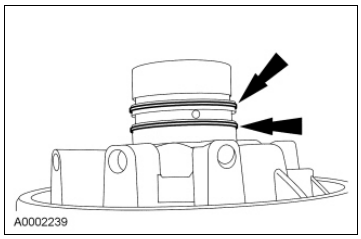
1. Remove the fluid pump gasket, fluid pump seal ring and the No. 1 thrust washer.
    1. Remove and discard the fluid pump gasket.
    2. Remove and discard the fluid pump seal ring (square cut).
    3. Remove and tag the No. 1 thrust washer.



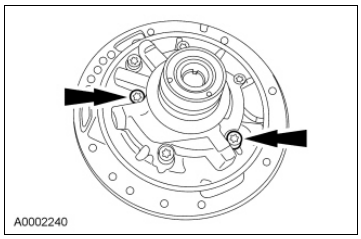
2. Remove the fluid pump support seal ring.



3. Remove the seal rings.



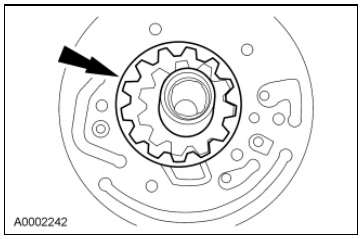
4. Remove the fluid pump housing.



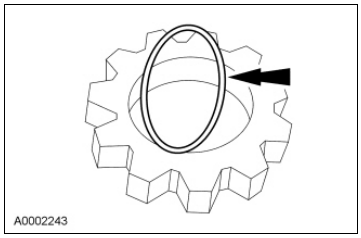
5. **NOTE:** A rough casting on the pump surface crescent is not a flaw.

   NOTE: The fluid pump gears are part of the pump assembly and are not repaired separately.

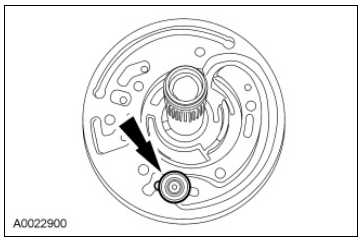
   Remove the fluid pump gears.



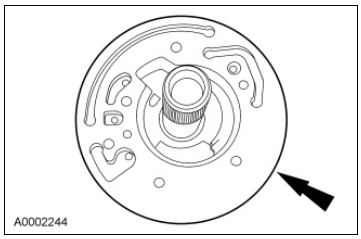
6. Remove the drive gear O-ring seal and discard. Inspect the fluid pump gears for cracks and scoring.



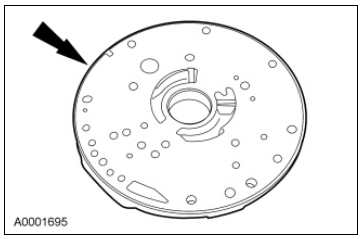
7. Remove and discard the valve.



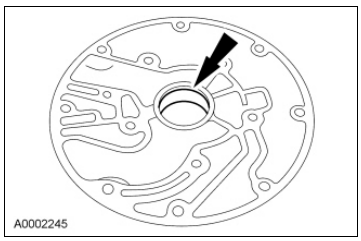
8. Inspect the Overdrive (O/D) pump.
   - Inspect the O/D pump support gear pockets for scoring and wear.
   - Clean and inspect the O/D and rear input shaft bushings.



9. Inspect the fluid pump adapter plate for scoring and wear.



10. Inspect the fluid pump-to-converter housing bushing.



Assembly

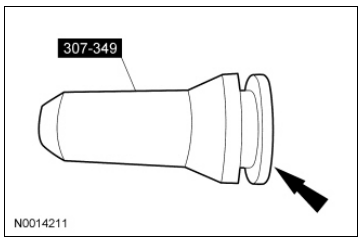
1. **NOTE:** Minor burrs and scoring may be removed with crocus cloth. If damage is found, install a new assembly.

   Inspect the fluid pump components for the following:

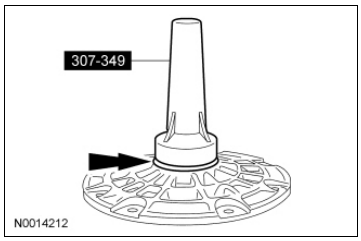
- Pump body and case for burrs
- Fluid passages for obstructions

2. **NOTE:** Check and make sure that the garter spring in the seal has not popped off of the converter hub seal.

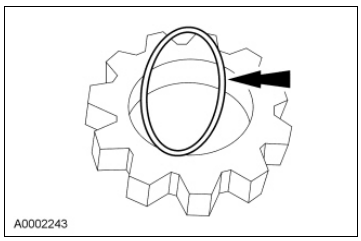
   Install a new seal onto the Torque Converter Fluid Seal Installer.



3. Using the Torque Converter Fluid Seal Installer, install the converter hub seal.

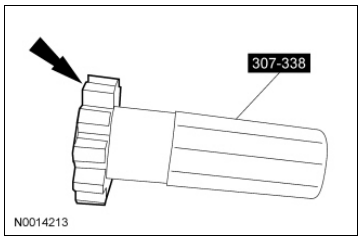


4. Install a new O-ring seal in fluid pump drive gear.



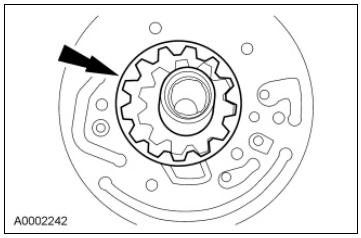
5. **NOTE:** Lubricate the Piston Seal Sizer with multi-purpose grease.

   Using the Piston Seal Sizer, seat the O-ring seal in the pump gear.

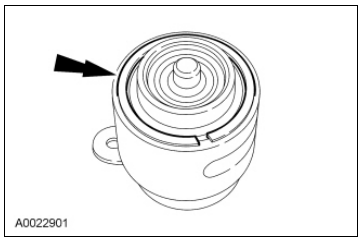


6. **NOTE:** The chamber on the inside edge of the small gear must be UP when in the pump housing gear pocket. The dimple on the larger gear must be DOWN when in the pump housing gear pocket.

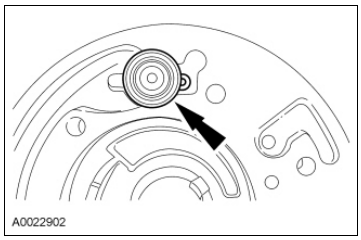
   Install the pump gears into the fluid pump housing. Apply multi-purpose grease to the pump gear to prevent scoring at start up.



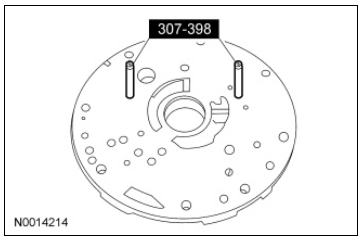
7. Install a new seal on the new valve.



8. Install a new valve with the tab facing down.

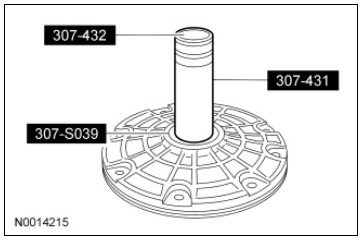


9. First install the fluid pump adapter plate and then the Transmission Fluid Pump Alignment Pins in their correct location.

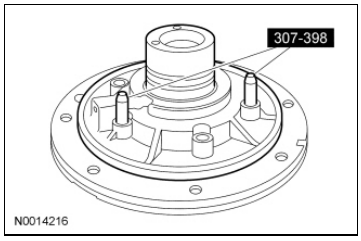


10. ***NOTICE:*** **The Fluid Pump Alignment Set and the Transmission Fluid Pump Alignment Gauge must be used to correctly align the pump with the adapter plate to reduce gear noise, bushing failure and leakage.**

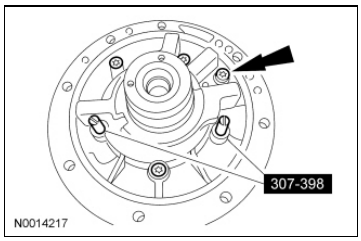
    Using the Fluid Pump Alignment Set and the Tranmission Fluid Pump Alignment Gauge, align the fluid pump to the adapter plate.



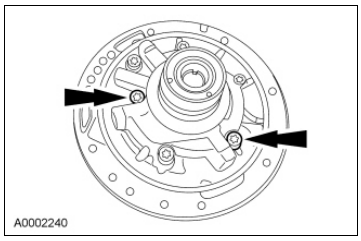
11. Using the Transmission Fluid Pump Alignment Pins, assemble the pump.



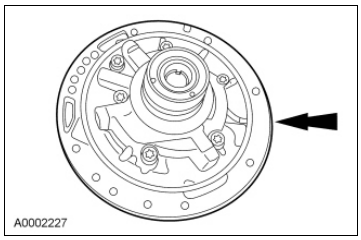
12. Loosely install the fluid pump housing screws in their correct location and remove the Transmission Fluid Pump Alignment Pins.



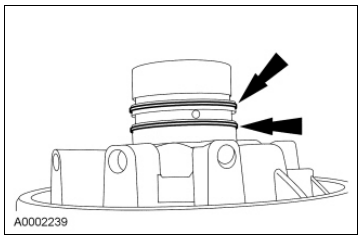
13. Install the 2 remaining screws and tighten all the transmission fluid pump housing-to-case screws in a star pattern.
    - Tighten to 22 Nm (16 lb-ft).



14. Install a new fluid pump seal ring.

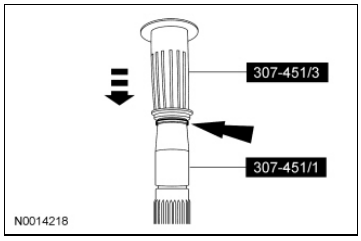


15. Install 2 new seal rings.



16. ***NOTICE:*** **Be careful not to overstretch the seal ring past the seal ring groove. Damage to the seal will occur.**

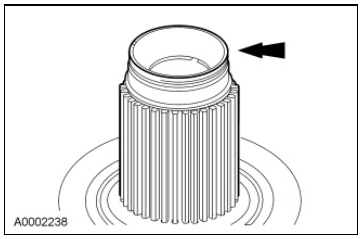
    Using the Transmission Fluid Pump Seal Installer Tools, install the fluid pump seal ring.



17. **NOTE:** Verify correct seal installation.

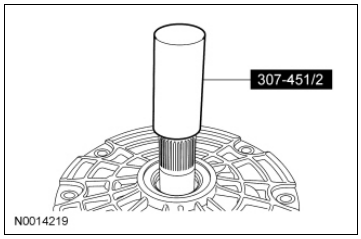
    NOTE: Make sure seal grooves are clean and free of burrs. Make sure that the seal is seated into the groove.

    Verify that the seal is installed correctly.



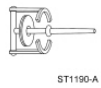
18. ***NOTICE:*** **Failure to correctly size the seal will cause damage to the seal when the torque converter is installed.**

    Using the Transmission Fluid Pump Seal Installer Tools, size the seal to the correct size. Leave the Transmission Fluid Pump Seal Installer Tools on the seal ring for 2 minutes to obtain the correct seal size.



Overdrive Brake and Coast Clutch Drum Assembly

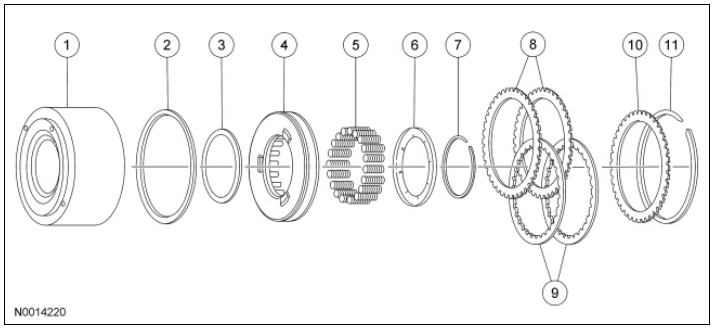
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST2431-A	Protector, Piston Seal 307-049 (T74P-77404-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Overdrive (O/D) Brake and Coast Clutch Drum Assembly

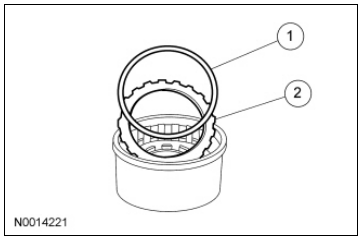


Item	Part Number	Description
1	7L669	Coast clutch drum
2	7A548	Overdrive (O/D) piston outer seal ring
3	7D404	O/D piston inner seal ring
4	7A262	O/D clutch piston
5	7A480	O/D piston spring (20 required)
6	7A527	Coast clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Coast clutch external plates - steel (2 required)
9	7B164	Coast clutch internal plates - friction (2 required)
10	7B066	Coast clutch pressure plate

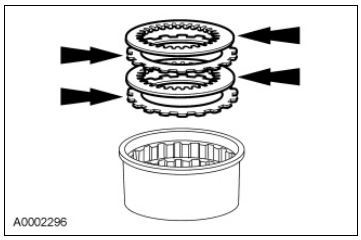
11	E860126S/129S	Retaining ring (select fit)

Disassembly

1. Remove the coast clutch pressure plate.
    1. Remove the coast clutch retaining ring.
    2. Remove the coast clutch pressure plate.



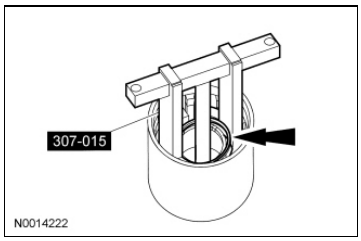
2. Remove the coast clutch disc pack.
    - Inspect for wear, install a new pack as necessary.



3. ⚠ **WARNING: While removing or installing the retaining ring, slowly release tool pressure on clutch piston springs. Failure to follow this instruction may cause the assembly to separate forcefully, resulting in serious personal injury.**

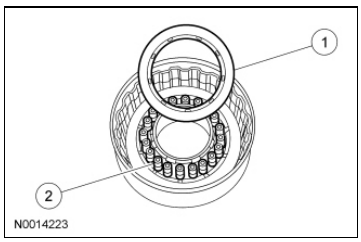
   NOTICE: **Do not fully compress the Clutch Spring Compressor or damage to the spring retainer may occur.**

   Using the Clutch Spring Compressor, remove the coast clutch piston retaining ring.



4. Relieve the coast clutch spring tension and remove the Clutch Spring Compressor.

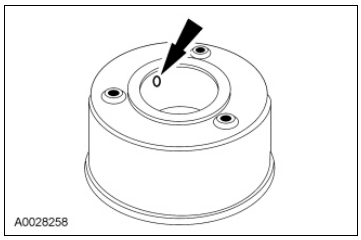
5. Remove the coast clutch piston springs.
    1. Remove the coast clutch piston retainer.
    2. Remove the clutch piston springs.



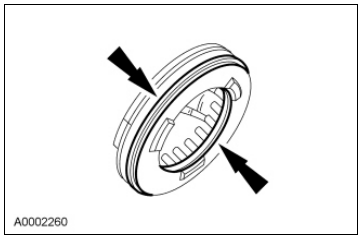
6. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

   Remove the coast clutch piston.

   - Apply air pressure to the hole in the drum to remove the coast clutch piston while blocking the other hole.



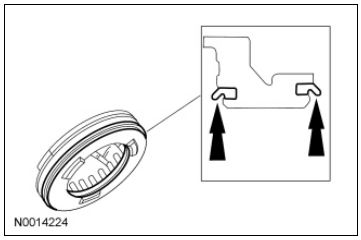
7. Remove and discard the coast clutch piston inner seal and the coast clutch piston outer seal.



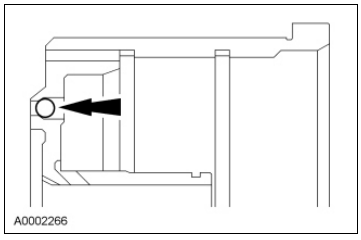
Assembly

1. ***NOTICE:*** **The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

   Install the new coast clutch piston inner and outer seal.



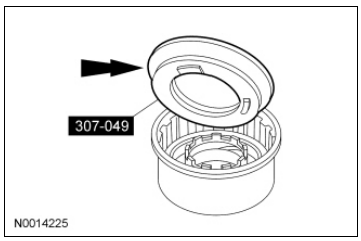
2. Verify the check ball is free to move.



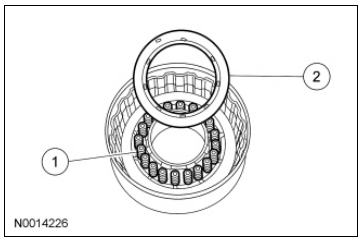
3. ***NOTICE:*** **Care must be taken to prevent damage to the seals during installation.**

   Using the Piston Seal Protector, install the coast clutch piston.

- Lubricate the seals with transmission fluid.

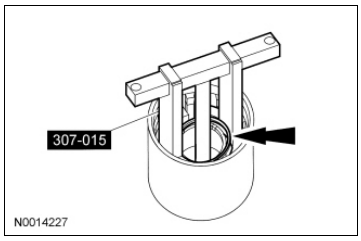


4. Install the coast clutch piston springs.
    1. Install the coast clutch piston springs.
    2. Install the coast clutch spring retainer.



5. ***NOTICE:*** **Do not fully compress the Clutch Spring Compressor or damage to the coast clutch piston spring retainer may occur.**

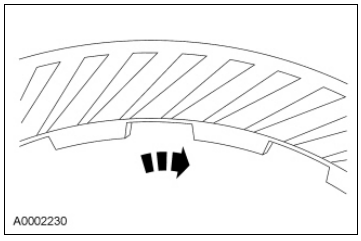
    Using the Clutch Spring Compressor, install the coast clutch piston spring retainer ring.



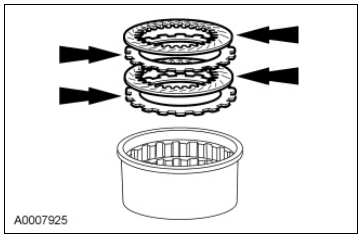
6. ***NOTICE:*** **Coast clutch friction plates are directional and must be installed with grooves clockwise (ID to OD). The word TOP should face up, otherwise transmission damage can occur.**

    NOTICE: **If new clutch plates are being used, they should be soaked in transmission fluid before assembly, otherwise transmission damage can occur.**

    When installing friction plates, the word TOP should face up. If reusing plates, grooves must be installed clockwise. Install the coast clutch disc pack.



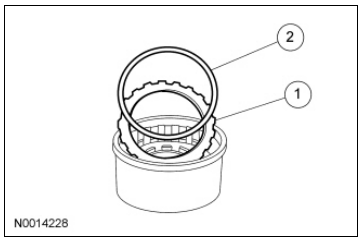
7. Install the 2 steel clutch plates and 2 friction clutch plates in alternating order starting with a steel clutch plate.



8. **NOTE:** The retaining ring is select fit.

   Install the coast clutch pressure plate.

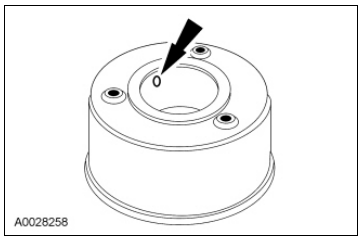
   1. Install the coast clutch pressure plate.
   2. Install the original coast clutch retaining ring.



9. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

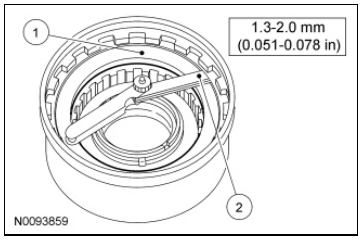
   Air check the assembly.

   - Apply air pressure to the hole in the drum while blocking the other hole.



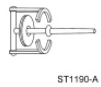
10. Check the coast clutch disc pack free play.
    1. Push down on the coast pressure plate.
    2. Check clearance between the coast clutch retaining ring and coast pressure plate. Clearance should be 1.3-2.0 mm (0.051-0.079 in). If clearance is not within the specification, install a correct coast clutch retaining ring that will provide the correct free play adjustment.

Part Number	Thickness		Diameter	
	mm	Inch	mm	Inch
E860126-S	1.37	0.053	130.1	5.122
E860127-S	1.73	0.068	130.1	5.122
E860128-S	2.08	0.081	130.1	5.122
E860129-S	2.44	0.096	130.1	5.122


1
1.3-2.0 mm
(0.051-0.078 in)
2
N0093859

Direct Clutch Drum Assembly

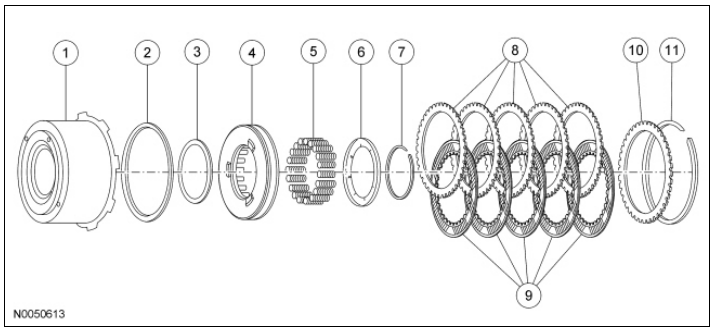
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST2431-A	Protector, Piston Seal 307-049 (T74P-77404-A)
 ST1756-A	Sizer, Piston Seal 307-336 (T95L-70010-E)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Direct Clutch Drum Assembly



Item	Part Number	Description
1	7D044	Intermediate brake drum assembly
2	7A548	Direct piston outer seal ring
3	7D404	Direct piston inner seal ring
4	7A262	Direct clutch piston
5	7A480	Direct piston spring (20 required)
6	7A527	Direct clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Direct clutch external spline plates - steel

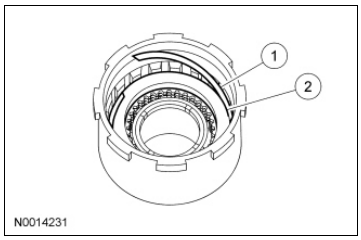
9	7B164	Direct clutch internal spline plates - friction
10	7B066	Direct clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

Disassembly

1. **NOTE:** The retaining ring is a select fit. See assembly procedure if installation of new ring or clutch pack is required.

   Remove the direct clutch retaining ring and the direct clutch pressure plate.

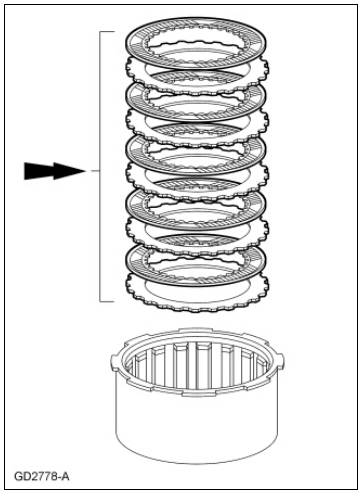
   1. Remove the direct clutch retaining ring.
   2. Remove the direct clutch pressure plate.



2. ***NOTICE:*** **Clutch plates are directional. Note the direction of the grooves for installation, otherwise transmission damage can occur.**

   Remove the direct clutch disc pack.

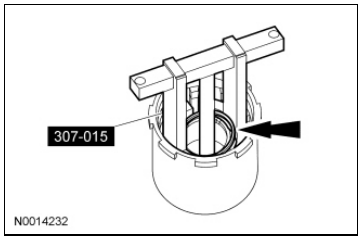
   - Inspect and install new friction plates if worn, damaged or overheated.
   - Measure and record the thickness of the steel plates for assembly.



3. ⚠ **WARNING: While removing or installing the retaining ring, slowly release tool pressure on clutch piston springs. Failure to follow this instruction may cause the assembly to separate forcefully, resulting in serious personal injury.**

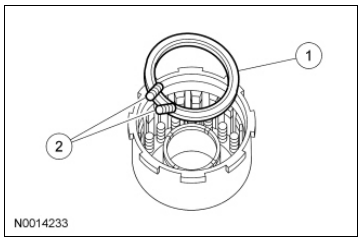
   NOTICE: **Do not fully compress the Clutch Spring Compressor or damage to the spring retainer may occur.**

   Using the Clutch Spring Compressor, remove the direct clutch piston retaining ring.



4. Relieve the direct clutch spring tension and remove the Clutch Spring Compressor.

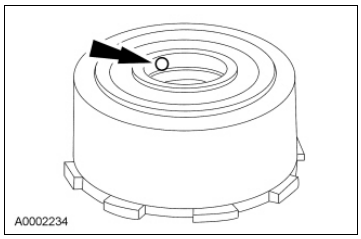
5. Remove the direct clutch piston spring retainer and the direct clutch piston springs.
    1. Remove the direct clutch piston spring retainer.
    2. Remove the direct clutch piston springs.



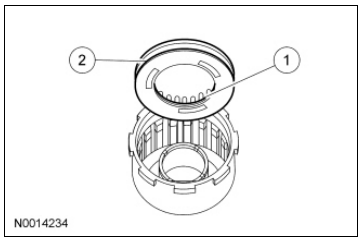
6. **⚠ WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

    Using compressed air, remove the direct clutch piston from the direct clutch drum.

    - Apply air pressure to the hole in the drum while blocking the other hole.



7. Remove and discard the direct clutch piston inner and outer seal.
    1. Remove and discard the direct clutch piston inner seal.
    2. Remove and discard the direct clutch piston outer seal.
    - Clean the components as necessary.

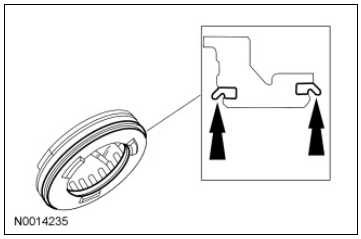


Assembly

1. ***NOTICE:*** **The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

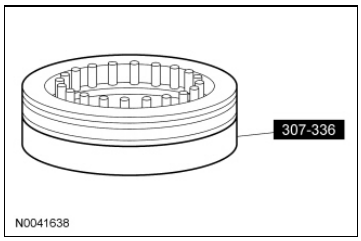
NOTE: Use new seals to help prevent seal failures.

Install the new direct clutch piston inner seal and the direct clutch piston outer seal.

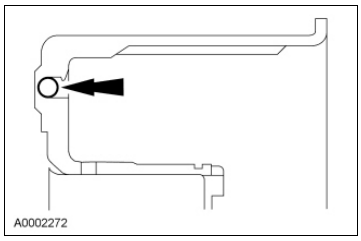


2. **NOTE:** Lubricate the direct clutch piston inner and outer seals with automatic transmission fluid.

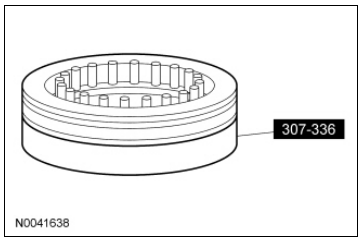
   Install the direct clutch piston into the Piston Seal Sizer.



3. Inspect the clutch components for damage or wear. Install new components as necessary.
   - Inspect the drum surface for damage.
   - Inspect the clutch piston bore and piston.
   - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
   - Inspect the clutch plates for damage.
   - Inspect the clutch springs.
   - Verify the check ball is free to move.



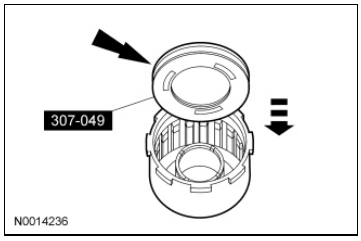
4. Carefully remove the direct clutch piston from the Piston Seal Sizer.



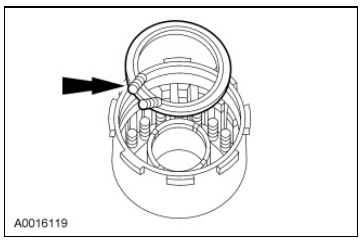
5. ***NOTICE:*** **Care must be taken to prevent damage to the seals during installation.**

   Using the Piston Seal Protector, install the direct clutch piston.

   - Lubricate the seals with transmission fluid before installing.



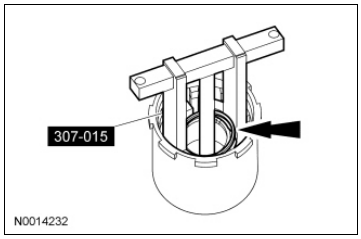
6. Install the direct clutch piston springs and the retainer.



7. ⚠ **WARNING: While removing or installing the retaining ring, slowly release tool pressure on clutch piston springs. Failure to follow this instruction may cause the assembly to separate forcefully, resulting in serious personal injury.**

   NOTICE: **Do not fully compress the Clutch Spring Compressor or damage to the spring retainer may occur.**

   Using the Clutch Spring Compressor, install the direct clutch piston retaining ring.

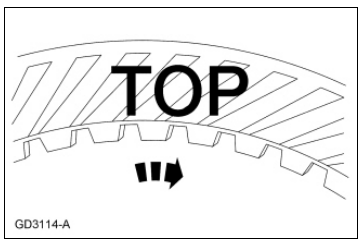


8. Relieve the direct clutch spring tension and remove the Clutch Spring Compressor.

9. ***NOTICE:*** **The direct clutch friction plates are directional and must be installed with grooves pointing clockwise (ID to OD) and the word TOP facing up, otherwise transmission damage can occur.**

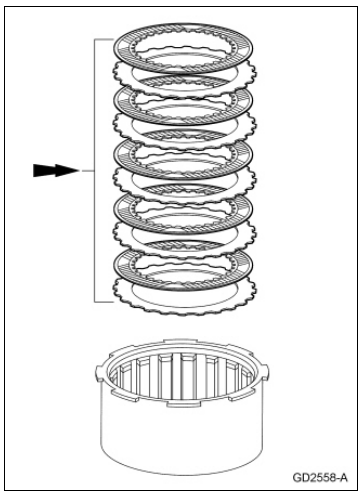
   NOTICE: **If new plates are used, they should be soaked in transmission fluid before assembly, or damage to the plates may occur.**

   When installing friction plates, the word TOP should face up. If reusing plates, grooves must be installed clockwise. Install the direct clutch disc pack.



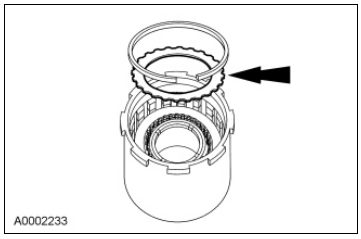
10. Install the steel clutch plates and friction clutch plates in alternating order starting with a steel clutch

plate.



11. **NOTE:** The retaining ring is a select fit.

    Install the direct clutch pressure plate using the original direct clutch retaining ring.

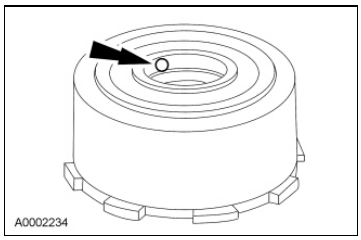


12. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

    NOTE: The direct clutch piston must apply with air pressure and release when air is removed.

    Air check the assembly.

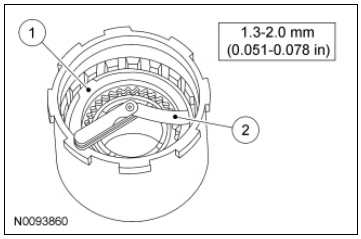
    - Apply air pressure to the hole in the drum while blocking the other hole.



13. Check the direct clutch pack gap.
    1. Push down on the direct clutch pack.
    2. Using a feeler gauge, check the gap between the direct clutch retaining ring and the direct clutch pressure plate.
        - ♦ If the specifications do not match, use a select fit direct clutch retaining ring to match specifications and verify with a feeler gauge.

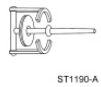
Direct Clutch

Part Number	Thickness		Diameter	
	mm	Inch	mm	Inch
E860126-S	1.37	0.053	130.1	5.122
E860127-S	1.73	0.068	130.1	5.122
E860128-S	2.08	0.081	130.1	5.122
E860129-S	2.44	0.096	130.1	5.122



Forward Clutch

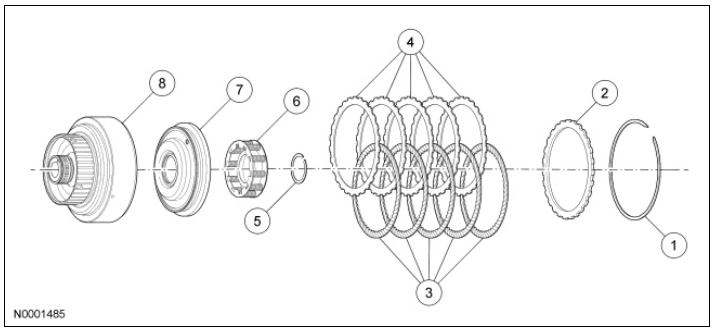
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST2534-A	Gauge, Forward Clutch Seal 307-434
 ST1813-A	Protector, Piston Seal 307-051 (T74P-77548-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Forward Clutch Assembly

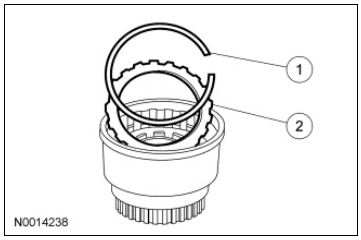


Item	Part Number	Description
1	7D483	Forward clutch retaining ring (select fit)
2	7B066	Forward clutch pressure plate
3	7B164	Forward clutch internal plates - friction (vehicle-dependent)
4	7B442	Forward clutch external plates - steel (vehicle-dependent)
5	E860109	Forward clutch retaining ring

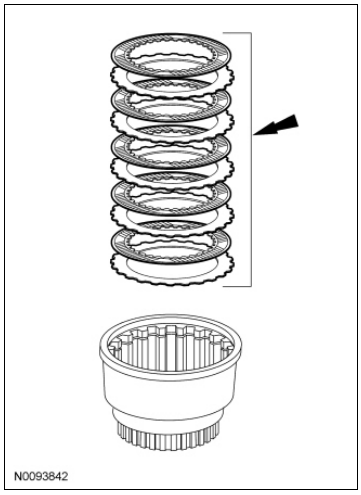
6	7G229	Forward clutch spring assembly
7	7A262	Forward clutch piston
8	7A360	Forward clutch cylinder assembly

Disassembly

1. Remove the pressure plate.
    1. Remove the forward clutch retaining ring.
    2. Remove the pressure plate.



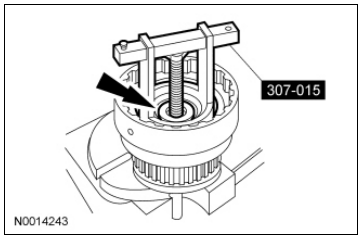
2. Remove the forward clutch disc pack.
    - Inspect the forward clutch plates for wear, damage or overheating.



3. ⚠ **WARNING: While removing or installing the retaining ring, slowly release tool pressure on clutch piston springs. Failure to follow this instruction may cause the assembly to separate forcefully, resulting in serious personal injury.**

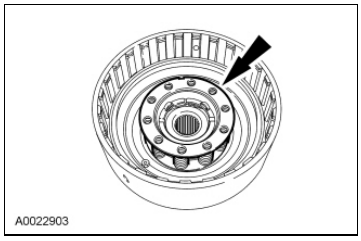
   NOTICE: **Do not fully depress the Clutch Spring Compressor or damage to the spring retainer may occur.**

   Using the Clutch Spring Compressor, remove the forward clutch piston retaining ring.



4. Relieve the forward clutch spring tension and remove the Clutch Spring Compressor.

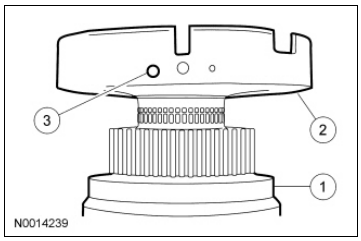
5. Remove the forward clutch piston spring assembly.



6. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

   Remove the forward clutch piston.

   1. Place the forward clutch cylinder with forward clutch piston facing down.
   2. Install the center support on the forward clutch cylinder.
   3. Apply air pressure to the left port of the center support.

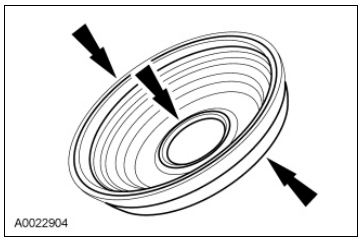


Assembly

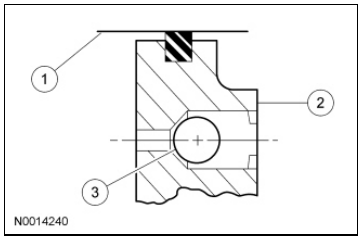
1. Inspect the clutch components for damage or wear. Install new components as necessary.
   - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
   - Inspect the clutch plates for damage.
   - Inspect the clutch springs.
   - Inspect the needle bearing and seal rings for damage.
   - Check clutch hub thrust surfaces for damage.
   - Check clutch plates for flatness and fit on the clutch hub serrations.

2. **NOTE:** If the seals on the forward clutch piston show any signs of damage, a new forward clutch piston will need to be installed.

   Inspect the forward clutch piston and seals.

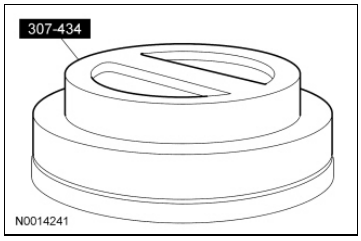


3. Inspect the forward clutch drum assembly.
   1. Inspect the forward clutch cylinder surfaces for scores or burrs.
   2. Inspect the forward clutch piston for scores or burrs.
   3. Verify the check ball is free to move in the piston.



4. **NOTE:** The Forward Clutch Seal Gauge must be installed on the forward clutch piston for a couple of minutes prior to installing it into the forward clutch cylinder.

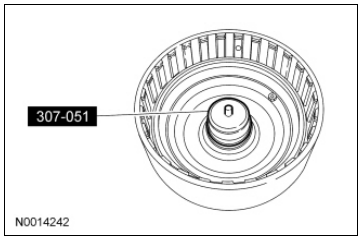
   Install the Forward Clutch Seal Gauge on the forward clutch piston.



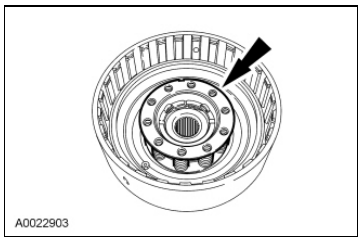
5. ***NOTICE:*** **Care must be taken to prevent damage to the seals.**

   NOTE: Lubricate the forward clutch piston inner and outer seal with transmission fluid.

   Using the Piston Seal Protector, install the forward clutch piston assembly into the forward clutch cylinder.

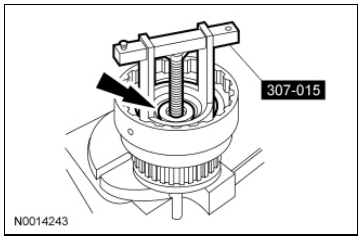


6. Install the forward clutch piston spring assembly.



7. ***NOTICE:*** **Do not fully depress the Clutch Spring Compressor or damage to the spring retainer may occur.**

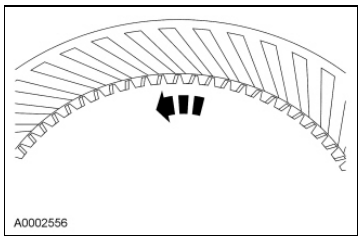
   Using the Clutch Spring Compressor, install the forward clutch piston spring retaining ring.



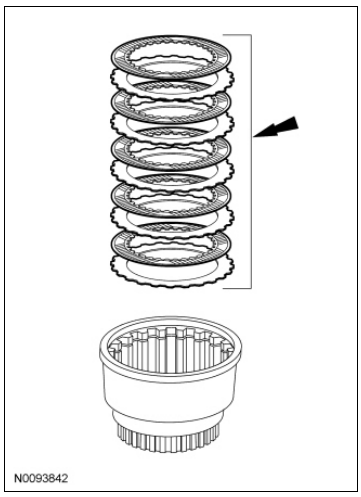
8. ***NOTICE:*** **The forward clutch friction plates are directional and must be installed with grooves pointing counterclockwise, otherwise transmission damage can occur.**

   NOTICE: **If new plates are used, they should be soaked in transmission fluid before assembly, or damage to the plates may occur.**

   If reusing plates, grooves must be installed counterclockwise. Install the forward clutch disc pack.



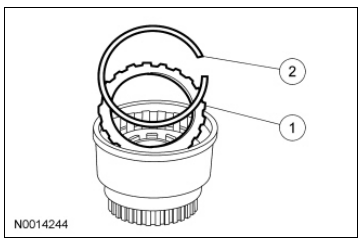
9. Install the steel clutch plates and friction clutch plates in alternating order starting with a steel clutch plate.



10. **NOTE:** The retaining ring is a select fit.

    Install the original selective retaining ring.

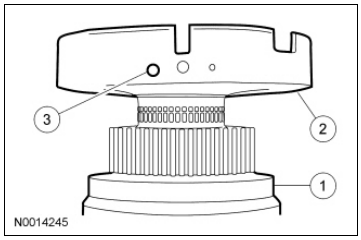
    1. Install the forward clutch pressure plate.
    2. Install the original selective retaining ring.



11. ⚠ **WARNING: When using compressed air, never let air pressure exceed 138 kPa (20 psi) and always wear safety glasses. Compressed air may cause foreign material or parts to become airborne. Failure to follow this instruction may result in serious personal injury.**

    Air check the forward clutch piston.

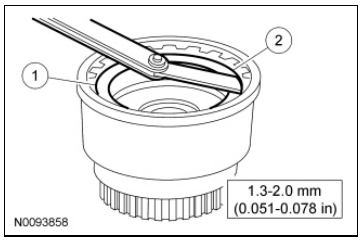
    1. Place the forward clutch cylinder with forward clutch piston facing down.
    2. Install the transmission center support on the forward clutch cylinder.
    3. Apply air pressure to the left port of the center support.



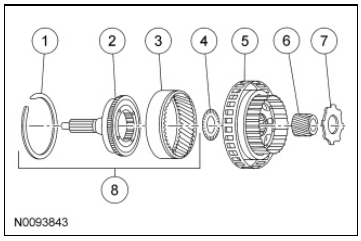
12. Check the forward clutch disc pack free play.
    1. Press down on the forward clutch disc pack.
    2. Using a feeler gauge, check the gap between the forward clutch retaining ring and the forward clutch pressure plate.

    • If the clearance is not within specifications, install the correct size retaining ring.

Part Number	Thickness		Diameter	
	mm	Inch	mm	Inch
XW4Z-7D483-AB	1.73	0.068	141.45	5.568
XW4Z-7D483-AC	2.08	0.081	141.45	5.568
XW4Z-7D483-AD	2.44	0.096	141.45	5.568



Overdrive Planetary and One-Way Clutch Assembly



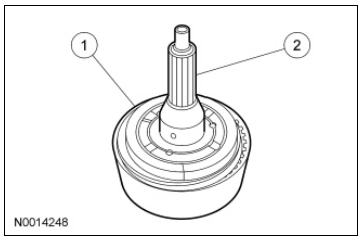
Item	Part Number	Description
1	W702037	Retaining ring
2	7A658	Center shaft
3	7A153	Overdrive (O/D) ring gear
4	7L495	No. 2 O/D planetary thrust bearing
5	7B446	O/D planetary gear carrier assembly
6	7D063	O/D sun gear
7	7660	Coast clutch adapter
8	7L678	O/D ring gear and center shaft assembly

Disassembly

1. **NOTE:** The Overdrive (O/D) One-Way Clutch (OWC) is serviced with the center shaft assembly.

   Remove the center shaft from the O/D ring gear.

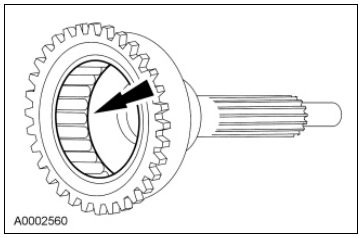
   1. Remove the O/D center shaft retaining ring.
   2. While rotating counterclockwise remove the center shaft from the ring gear.



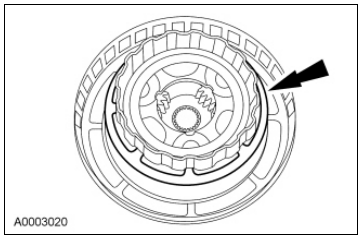
2. ***NOTICE:*** **Do not remove the Overdrive (O/D) One-Way Clutch (OWC). Damage to the clutch may occur if it is removed.**

   Clean and inspect the O/D OWC and center shaft.

   - Inspect for cracks in the roller cage and wear on the roller clutch and the press fit of the OWC to the center shaft.

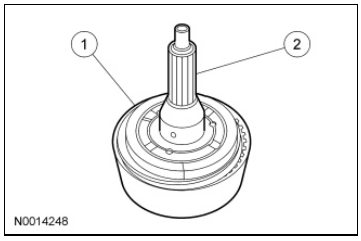


3. Inspect the OWC .
    - Temporarily insert the O/D planetary gear carrier assembly into the OWC rollers for verification of the OWC .
    - The planetary gear must rotate counterclockwise and hold when rotated clockwise.
    - Remove the planetary gear carrier assembly.



Assembly

1. Install the center shaft and OWC .
    1. Install the center shaft and OWC .
    2. Install the center shaft retaining ring.

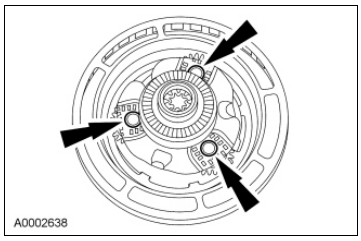


Overdrive Planetary Gears

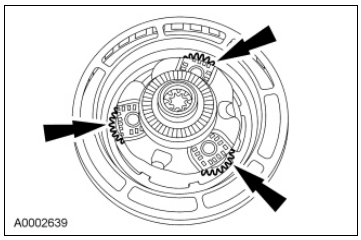
Disassembly

1. **NOTE:** Individual parts of the planetary carriers are not serviceable.

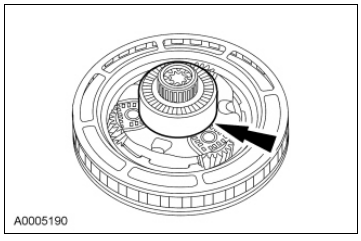
   Before installing a planetary assembly, the shaft retaining pins should be checked for adequate staking. Check the pins and shafts in the planetary assemblies for loose fit and/or complete disengagement. Install a new planetary assembly if necessary.



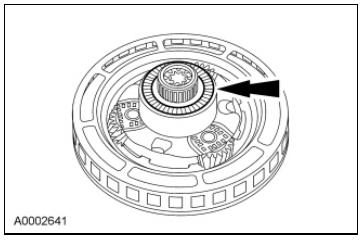
2. Inspect the pinion gears for damaged or excessively worn teeth and for free rotation.



3. Inspect the Overdrive (O/D) One-Way Clutch (OWC) inner race and the inner and outer races for scored or damaged surface areas where the rollers contact the races.

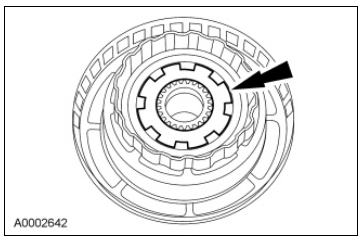


4. Remove and inspect the No. 2 O/D planetary thrust bearing on the nose of the O/D planetary gear carrier assembly.

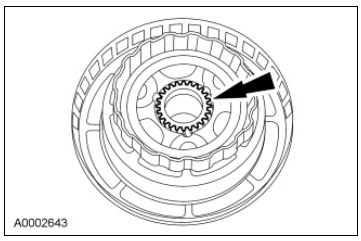


5. **NOTE:** Inspect the sun gear for damaged or worn teeth.

Remove the coast clutch-to- O/D carrier adapter.

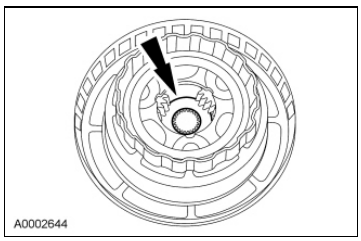


6. Remove and inspect the O/D sun gear.



7. ***NOTICE:*** **Do not attempt to remove the No. 12 bearing from behind the pinion gears or transmission damage can occur.**

   Inspect the No. 12 bearing for damage.

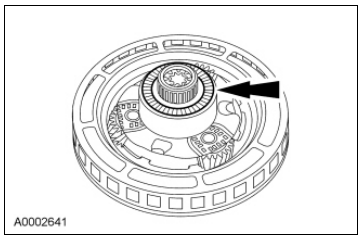


Assembly

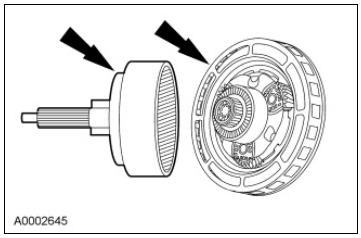
1. **NOTE:** Thoroughly clean all parts and blow dry with moisture-free compressed air.

   NOTE: Use petroleum jelly to hold the No. 2 O/D planetary thrust bearing in place.

   Install the No. 2 O/D planetary thrust bearing.

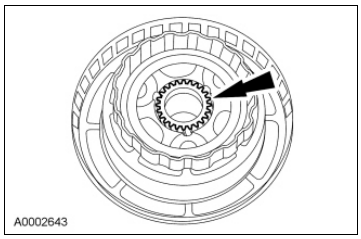


2. Install the O/D planetary gear carrier into the center shaft and O/D .



3. **NOTE:** Make sure that the No. 12 bearing is in place in the O/D planetary prior to installing the O/D sun gear.

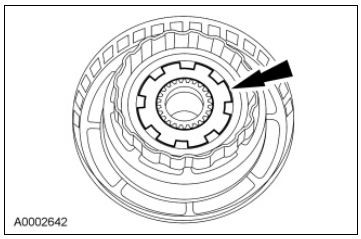
   Install the O/D sun gear with the recessed gear teeth facing toward the adapter.



4. **NOTE:** Adapter part number must not be visible after installation.

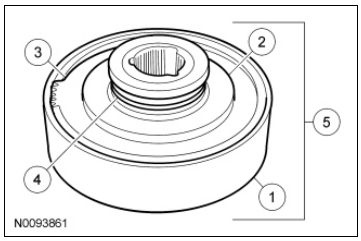
   NOTE: Inspect the sun gear for damaged or worn teeth.

   Install the coast clutch-to- O/D carrier adapter.



Output Shaft Ring Gear and Hub Shaft Assembly

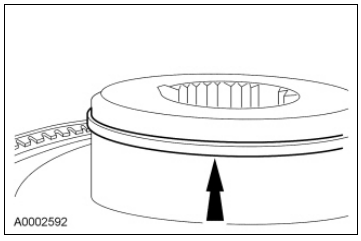
Disassembly



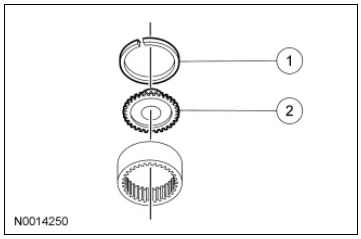
Item	Part Number	Description
1	7A153	Output shaft ring gear
2	7D164	Output shaft hub
3	7C122	Retaining ring
4	7D019	Output shaft hub seal
5	7D163	Output shaft ring gear and hub shaft assembly

1. Inspect the output shaft ring gear and hub shaft assembly for damage. If repair is necessary, use the following procedure.

2. Remove the seal.

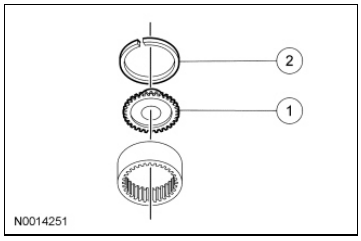


3. Remove the output shaft ring gear from the output shaft hub.
    1. Remove the retaining ring.
    2. Remove the output shaft ring gear.

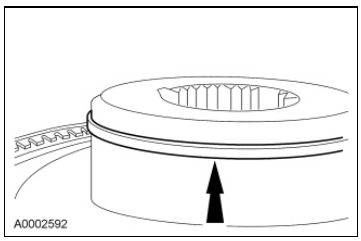


Assembly

1. Install the output shaft ring gear onto the output shaft hub.
    1. Install the output shaft ring gear.
    2. Install the retaining ring.

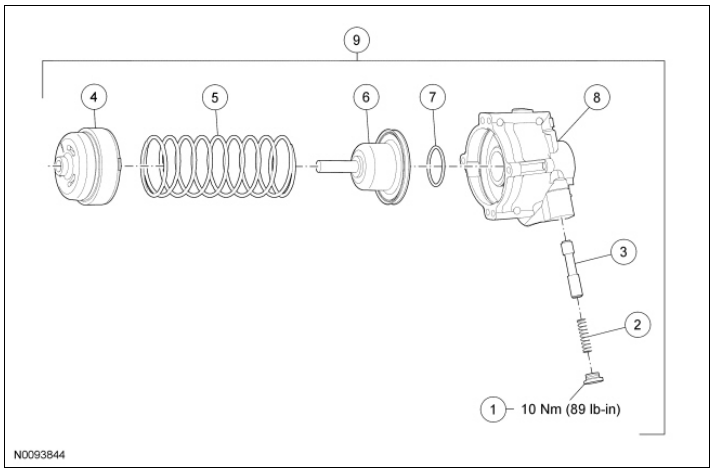


2. Install the seal.



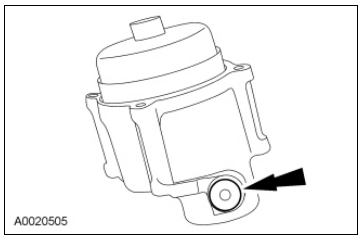
Reverse Servo Assembly

Disassembly

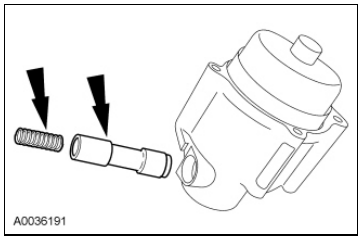


Item	Part Number	Description
1	7D321	Control valve spring retainer
2	7A270	Fluid pressure regulator valve spring
3	7D488	Reverse servo check valve
4	7D372	Reverse servo plate
5	7D466	Reverse servo accumulator spring
6	7D189	Reverse servo piston and seal
7	7423	Reverse servo piston O-ring
8	7D036	Reverse servo cover
9	7B193	Reverse servo assembly

1. Remove the control valve spring retainer.



2. Remove the reverse servo spring and check valve.

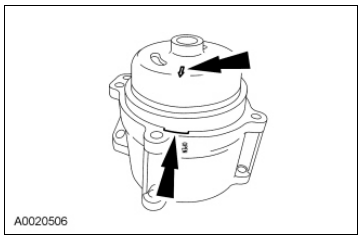


3. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

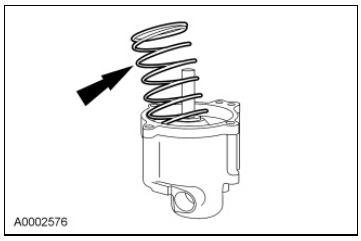
   NOTE: Tabs on servo plate mate with slots on cover every 120 degrees.

   Remove the reverse servo plate by turning in either direction to release.

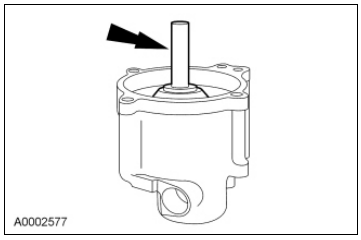
   - Align the arrow on the servo plate with any slot on the cover.



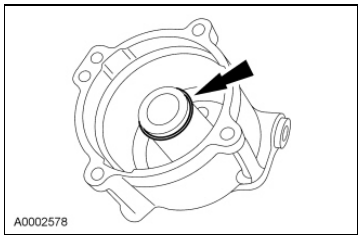
4. Remove the reverse servo spring.



5. Remove the reverse servo piston and seal assembly.
   - Inspect the seal for damage, install a new reverse servo piston if necessary.



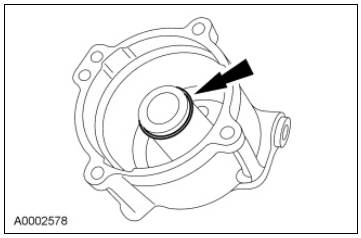
6. Remove and discard the reverse servo piston seal.



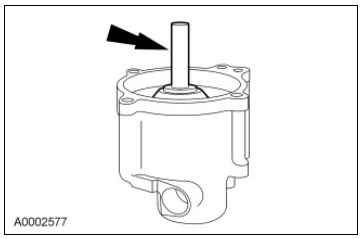
Assembly

1. ***NOTICE:*** **Try not to roll the seal onto the housing when installing the seal, or damage to the seal may occur.**

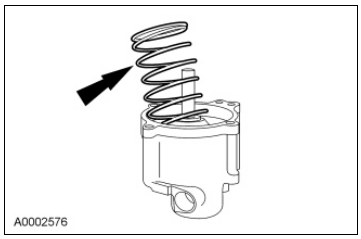
   Lubricate and install a new reverse servo piston seal.



2. Lubricate and install the reverse servo piston and seal assembly.



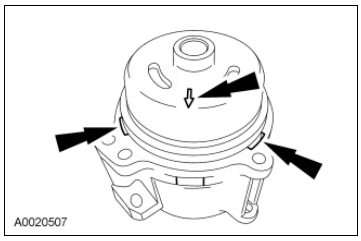
3. Install the reverse servo spring.



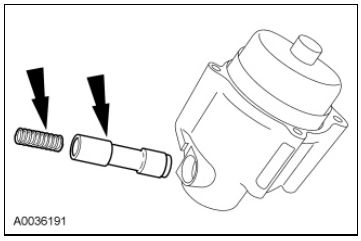
4. ⚠ **WARNING: Follow the specified procedure when using the tool to remove the servo cover. The servo and servo cover are under high spring force and can separate forcefully, which may result in serious personal injury.**

   NOTE: The arrow on the servo plate must be aligned evenly between any 2 slots on the cover.

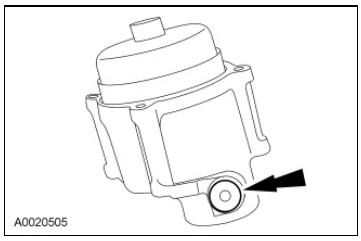
   Install the reverse servo plate.



5. Install the reverse servo spring and check valve.

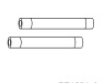


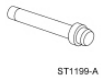
6. Install the control valve spring retainer.
    - Tighten to 10 Nm (89 lb-in).



Transmission

Special Tool(s)

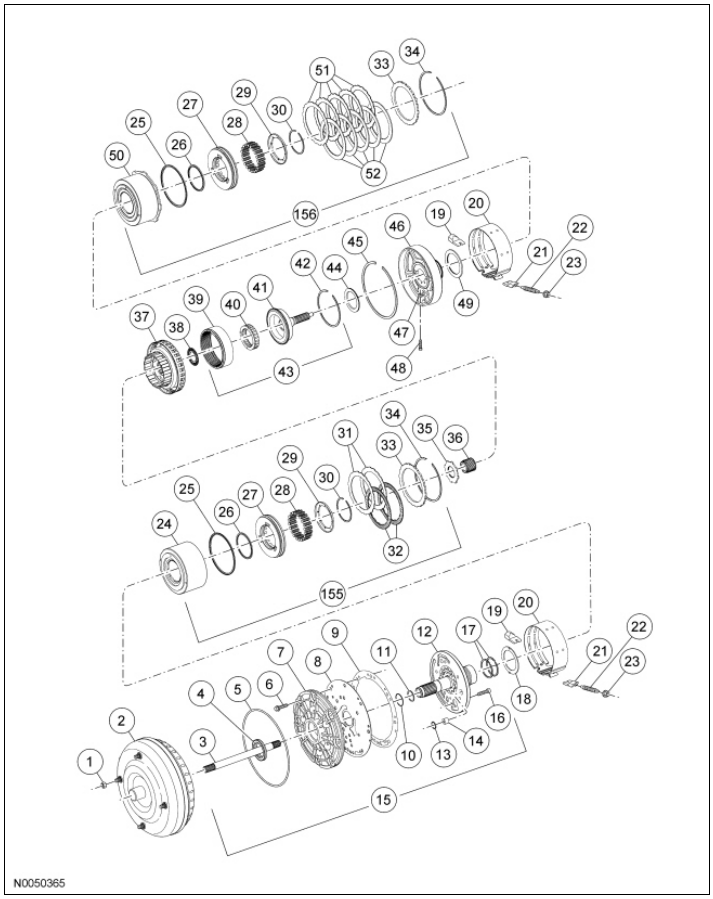
 ST1792-A	Adjustment Set, Transmission Band 307-S022 (T71P-77370-A)
 ST2538-A	Air Test Plate and Gaskets, Transmission 307-433-01, 307-433-2, 307-433-3
 ST1639-A	Aligner, Valve Body 307-334 (T95L-70010-C)
 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
 ST2532-A	Alignment Gauge, Tranmission Fluid Pump 307-431
 ST2533-A	Alignment Gauge, Transmission Fluid Pump 307-432
 ST2433-A	Alignment Pins, Transmission Fluid Pump 307-399
 ST1817-A	Alignment Set, Fluid Pump 307-S039 (T74P-77103-X)
 ST2424-A	Compressor, Cushion Spring 307-401
 ST2393-A	Compressor, Servo Cover 307-402
 ST1274-A	Depth Micrometer 303-D026 (D80P-4201-A) or equivalent
 ST2432-A	Gauge Bar 307-400
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)

 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST3003-A	Installer, Extension Housing Seal 307-435
 ST1199-A	Installer, Shift Shaft Fluid Seal 307-050 (T74P-77498-A)
 ST1188-A	Installer, Transmission Extension Housing Fluid Seal 307-038 (T74P-77052-A)
 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)
 ST1826-A	Sizer, Piston Seal 307-338 (T95L-70010-G)

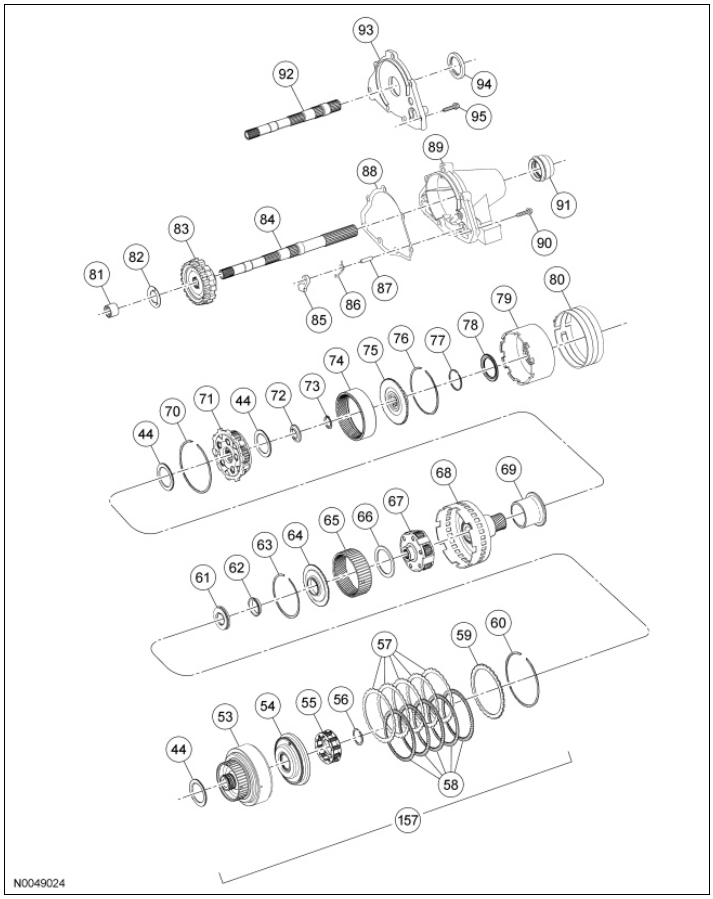
Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

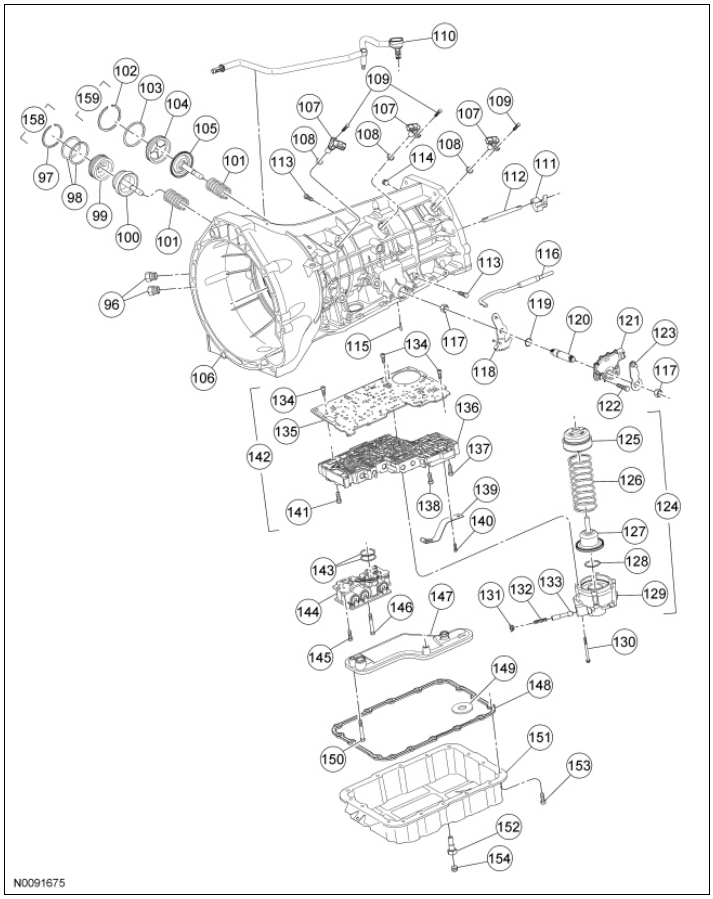
Disassembled Views



Disassembled Views



Disassembled Views



Item	Part Number	Description
1	379299	Torque converter-to-flexplate nut (attaches the converter assembly to the flexplate) (4 required)
2	7902	Torque converter assembly (4.0L)
3	7017	Input shaft
4	7A248	Front fluid pump seal assembly
5	7A248	Front fluid pump seal
6	W704892	M8 x 35 internal lobe screw and washer assembly (attaches pump to case) (8 required)
7	7G187	Fluid pump cover assembly
8	7B472	Fluid pump adapter plate
9	7A136	Fluid pump gasket
10	W701431	Fluid pump shaft-to-inner gear O-ring seal (also in pump assembly)
11	7L323	Stator support seal
12	7A108	Fluid pump support assembly
13	7H416	O-ring
14	7H411	Fluid pump control valve
15	7A103	Fluid pump assembly
16	W701429	M8 x 1 x 35 internal lobe screw (attaches pump support to pump assembly) (6 required)
17	7D025	Overdrive (O/D) brake drum seals
18	7D014	Fluid pump input thrust washer No. 1
19	7D029	Intermediate and O/D brake band anchor struts (2 required)
20	7D034	Intermediate and O/D brake bands (2 required)
21	7D029	Intermediate and O/D brake band apply struts (2 required)
22	7C492	O/D and intermediate band adjusting screws (2 required)
23	71000	O/D and intermediate locking nuts (2 required)
24	7L669	O/D brake band drum assembly
25	7A548	Direct and O/D piston outer seals
26	7D404	Direct and O/D piston inner seals
27	7A262	Direct and O/D clutch pistons
28	7A480	Direct and O/D clutch piston springs
29	7A527	Clutch piston spring retainers (2 required)
30	E860125	Retaining rings (retains 7D041 to drum) (2 required)
31	7B442	Coast clutch external splined plates (steel) (2 required)
32	7B164	Coast clutch internal splined friction plates (2 required)
33	7B066	Coast and direct clutch pressure plates (2 required)
34	E860126-S/129-S	Coast and direct clutch plates retaining rings (select fit) (2 required)
35	7660	Coast clutch-to- O/D carrier adapter

36	7D063	O/D sun gear
37	7B446	O/D planetary gear carrier (with trigger wheel)
38	7L495	O/D planet thrust bearing No. 2
39	7A153	O/D ring gear
40	7A089	Center shaft One-Way Clutch (OWC) assembly
41	7A658	O/D center shaft (part of 7L678)
42	W702037	Retaining ring (retains 7A658 to 7A153)
43	7L678	Hub and ring gear assembly (includes 7C109, 7A153, 7A658, W702037-S300)
44	7M153	Center shaft and forward clutch cylinder bearing assembly No. 3, No. 5, No. 8 and No. 9 (4 required)
45	W702465	Retaining ring
46	7A130	Center support assembly
47	E826160	Nut and cage assembly (attaches center support to case)
48	W705407	Bolt
49	7D014	Intermediate clutch drum bearing No. 4
50	7D044	Intermediate brake drum assembly
51	7B442	Direct clutch external splined steel plates (5 required)
52	7B164	Direct clutch internal splined friction plates (5 required)
53	7A360	Forward clutch cylinder
54	7A262	Forward clutch piston assembly
55	7G299	Forward clutch support and spring assembly
56	E860109	Forward clutch piston and spring retaining ring in forward clutch cylinder
57	7B442	Forward clutch external spline steel plates (5 required)
58	7B164	Forward clutch internal spline friction plates (5 required)
59	7B066	Forward clutch pressure plate
60	7D483	Retaining ring 141.45 x 1.37 internal (select fit)
61	7D234	Forward ring gear hub thrust bearing No. 6A
62	7D090	Forward clutch thrust washer No. 6B
63	7G375	Forward clutch hub retainer ring
64	7B067	Forward ring gear hub
65	7D392	Forward ring gear
66	7F374	Forward planet thrust bearing No. 7
67	7A398	Forward planetary
68	7A019	Shell and sun gear assembly
69	7C167	Low and reverse spacer gear
70	W702775	Reverse carrier drum snap ring
71	7D006	Reverse planet assembly
72	7B176	Output shaft sleeve
73	E860527	External retainer ring
74	7A153	Output shaft ring gear
75	7D164	Output shaft hub

76	7C122	Output shaft ring gear retaining ring
77	7D019	Output shaft hub seal
78	7H027	Low/intermediate sun gear bearing assembly
79	7C498	Reverse brake drum and clutch assembly - includes OWC
80	7D095	Low/reverse band assembly
81	7R205	Output shaft bearing (R15)
82	7B368	Output shaft thrust washer No. 11
83	7A233	Transmission park gear assembly
84	7060	Output shaft Rear Wheel Drive (RWD)
85	7A441	Park pawl
86	7D070	Park pawl return spring
87	7D071	Park pawl shaft
88	7086	Extension housing gasket
89	7A039	Extension housing RWD
90	W500311	M8 x 1.25 extension housing-to-case screw (7 required) RWD
91	7052	Extension housing seal RWD
92	7060	Output shaft assembly Four-Wheel Drive (4WD)
93	7A039	Extension housing 4WD
94	7052	Extension housing seal 4WD
95	W500224	Extension housing-to-case screw (7 required)
96	7D273	Transmission fluid tube connector assembly (2 required)
97	7H074	Ring O/D servo retainer
98	W703119	O/D servo cover seals (2 required)
99	7D027	O/D servo cover
100	7D021	O/D servo piston and rod
101	7D028	Intermediate and O/D servo piston springs (2 required)
102	W702777	Ring intermediate servo retainer
103	W702969	Intermediate servo cover seal
104	7D027	Intermediate servo cover
105	7D021	Intermediate servo piston and rod
106	7005	Case assembly
107	7H103	Output Shaft Speed (OSS), Turbine Shaft Speed (TSS) and intermediate shaft speed sensors
108	W702981	Speed sensor-to-case O-ring seals (3 required)
109	W708389	Speed sensor-to-case screws (M6 x 19) (3 required)
110	7034	Case vent RWD
111	7A179	Reverse brake drum lever
112	7D433	Reverse band actuating lever shaft
113	390318	Pipe plug
114	6026	Fluid fill plug
115	7B210	Manual control lever shaft retaining pin

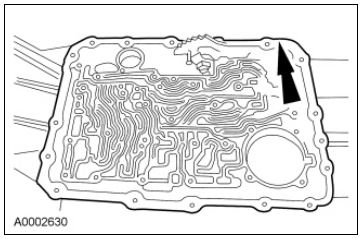
116	7A232	Park pawl actuating rod
117	W703001	Manual control lever shaft outer and inner nut (2 required)
118	7A115	Manual valve inner lever
119	7B498	Manual control lever seal
120	7C493	Manual control lever shaft
121	7F293	Transmission Range (TR) sensor
122	W500015	TR sensor screw and washer (2 required)
123	7A256	Manual control lever
124	7B193	Reverse servo assembly
125	7D372	Reverse servo plate
126	7D466	Reverse servo accumulator spring
127	7D189	Reverse servo piston and seal
128	7423	Reverse servo piston O-ring seal
129	7D036	Reverse servo cover
130	W702359	Reverse servo piston-to-case screw (4 required)
131	7D321	Control valve spring retainer
132	7A270	Main fluid pressure spring regulator valve
133	7D488	Reverse servo check valve
134	W701099	Main control valve body separating plate screws
135	7Z490	Main control valve body separating plate (bonded)
136	7A101	Lower main control valve body
137	W500102	Main control valve body screw (18 required)
138	W702791	Main control valve body screw
139	7E332	Manual valve detent spring
140	W500100	Screw detent spring
141	W706672	Main control valve body screws
142	7A100	Main control valve body assembly
143	W705928	Solenoid body connector O-ring seals
144	7G391	Transmission control solenoid body
145	W702921	Transmission control solenoid body screw
146	W703189	Transmission control solenoid body screw (7 required)
147	7A098	Transmission fluid pan filter
148	7A191	Transmission fluid pan gasket
149	7L027	Transmission fluid pan magnet
150	W500106	Transmission fluid filter screw (2 required)
151	7A194	Transmission fluid pan
152	7A010	Transmission fluid pan drain plug
153	W500213	Transmission fluid pan screw (16 required)
154	W707919	Transmission fluid pan drain plug (short hex)
155	-	O/D and coast clutch assembly
156	-	Direct clutch assembly
157	-	Forward clutch assembly
158	-	O/D servo

159	-	Intermediate servo

All vehicles

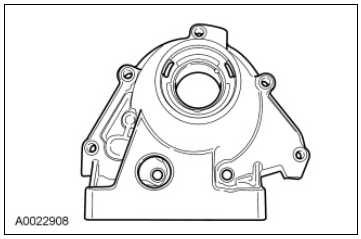
1. Thoroughly clean the transmission case and extension housing in solvent and blow dry with compressed air.

2. Inspect the transmission case for the following:
   - Stripped bolt hole threads
   - Gasket and mating surfaces for burrs or nicks
   - Obstructions to vent and fluid passages
   - Cracks or warping



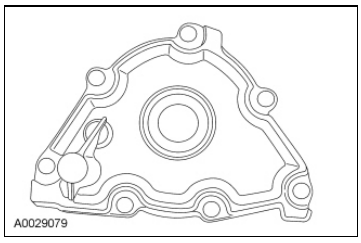
Rear Wheel Drive (RWD) vehicles

3. Inspect the extension housing for cracks, burrs or warping.



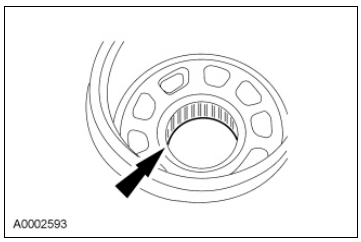
Four-Wheel Drive (4WD) vehicles

4. Inspect the extension housing for cracks, burrs or warping.



All vehicles

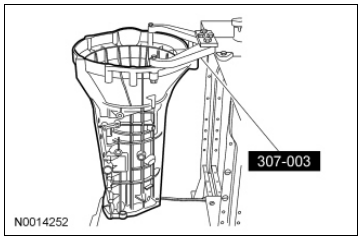
5. Inspect the case bearing for damage. If damage to the case bearing is indicated, install a new case.



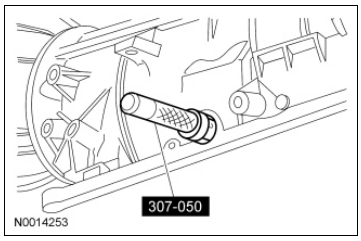
6. ⚠ **WARNING: Always verify that the lockpin on a bench-mounted holding fixture is correctly secured to help prevent unexpected component rotation. Failure to follow this instruction may result in serious personal injury.**

   NOTE: Inspect the intermediate and Overdrive (O/D) servo bores for excessive wear. Repair as required.

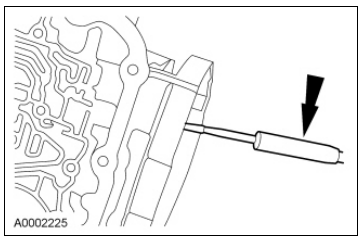
   Using the Transmission Holding Fixture, install the transmission onto the bench with the converter housing facing up.



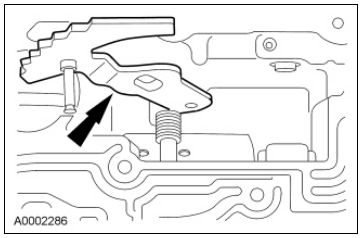
7. Using the Shift Shaft Fluid Seal Installer, install the manual control lever shaft seal and lubricate it with petroleum jelly.



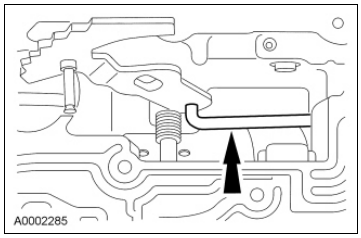
8. Install the park lever rod.



9. Install the manual valve inner lever.

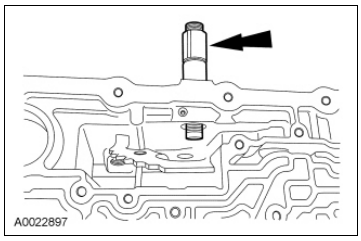


10. Assemble the manual valve inner lever and park lever actuating rod.

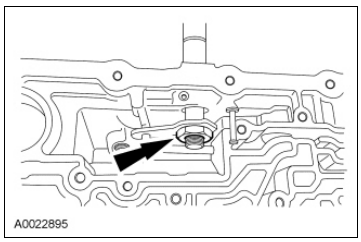


11. **NOTE:** Align the flats on the manual valve inner lever with the flats on the manual control lever shaft.

    Install the manual control lever shaft.



12. Install the manual valve inner lever onto the manual shaft and loosely install the inner nut.

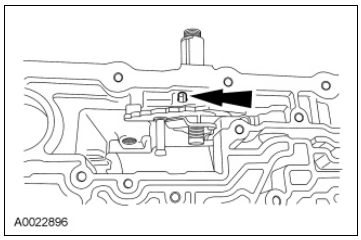


13. ***NOTICE:*** **Use care not to damage the fluid pan rail surface when installing the retaining pin.**

    NOTE: Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case.

    Install the manual control lever shaft spring pin.

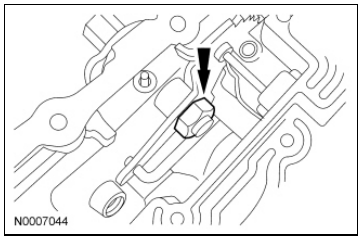
    - Tap the manual control lever shaft spring pin into the transmission case.



14. ***NOTICE:*** **To avoid damage, do not allow the wrench to strike the manual valve inner lever pin.**

    Tighten the inner nut.

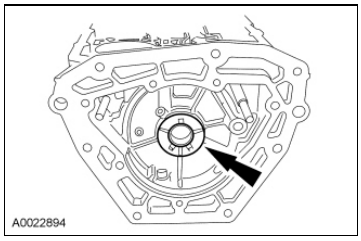
    - Tighten to 48 Nm (35 lb-ft).



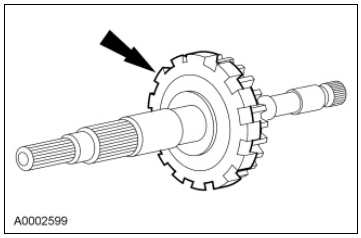
15. ***NOTICE:*** **The tabs on the output shaft thrust washer (No. 11) point into the case. Make sure the thrust washer is correctly seated or damage may occur.**

    Install the output shaft thrust washer (No. 11).

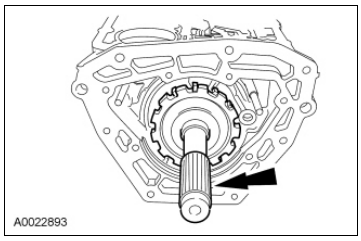
    - Coat the output shaft thrust washer with petroleum jelly.



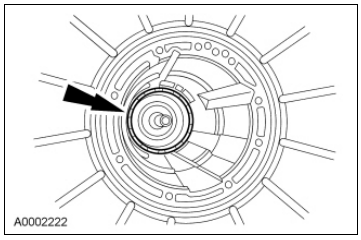
16. Install the park gear on the output shaft.



17. Install the output shaft and park gear.

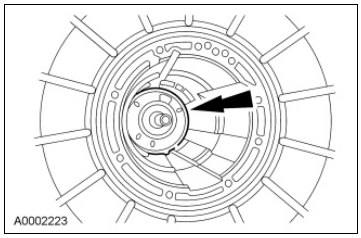


18. Install the low/reverse brake drum.
    - Rotate the low/reverse brake drum clockwise to install.



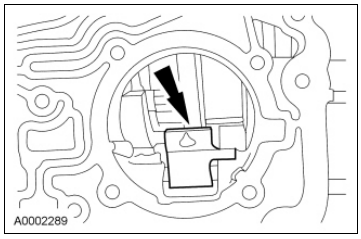
19. **NOTE:** Make sure band is resting on the 2 anchor pins in the case.

    Install the low/reverse band over the reverse drum.

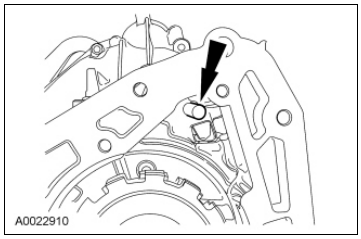


20. **NOTE:** The reverse band actuating lever must fit into the notches in the band.

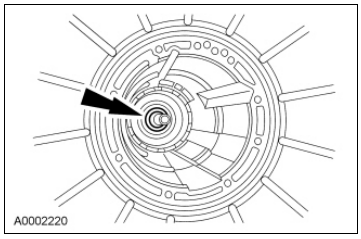
    Install the reverse band actuating lever into the reverse band.



21. Install the reverse band actuating lever shaft into the case and into the reverse band actuating lever.

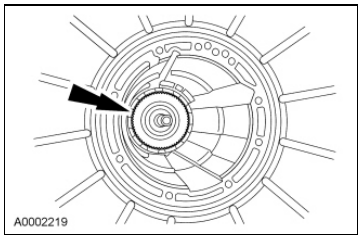


22. Install the No. 10 needle bearing into the case.



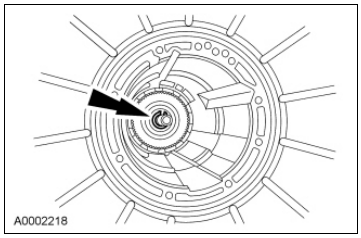
23. ***NOTICE:*** **Do not damage the seal against the case during assembly.**

    Install the output shaft ring gear, hub and seal.



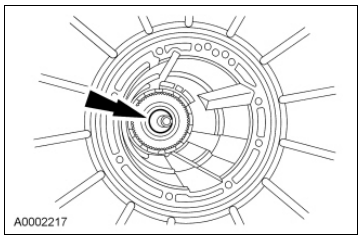
24. ***NOTICE:*** **Always install a new output shaft retaining ring, otherwise transmission damage can occur.**

    Install a new output shaft retaining ring.

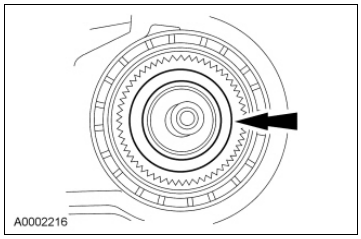


25. **NOTE:** Install the output shaft sleeve with the cone facing up. This sleeve will snap into place when correctly installed.

    Install the output shaft sleeve.

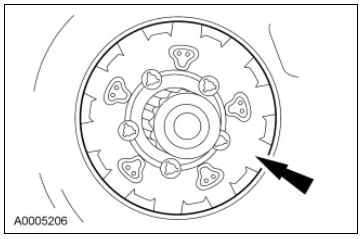


26. Install low/reverse planetary carrier needle bearing (No. 9) onto the output shaft ring gear and hub assembly.



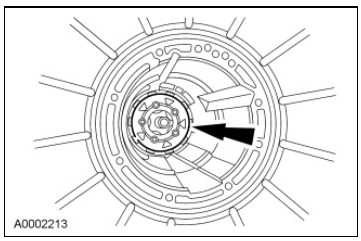
27. ***NOTICE:*** **Make sure the needle bearings stay in place or damage may occur.**

    Install the low/reverse planetary assembly.

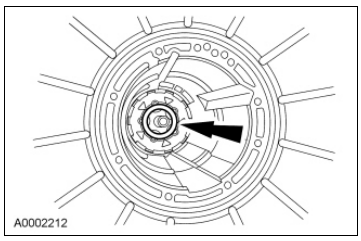


28. **NOTE:** The low/reverse brake drum must be pulled forward to install the low/reverse planet retaining ring.

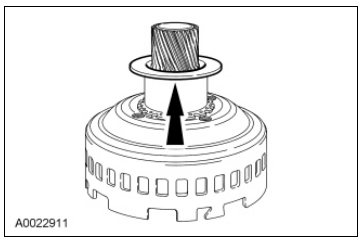
    Install the retaining ring.



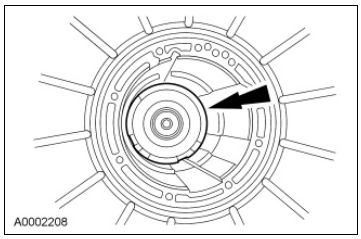
29. Install the No. 8 thrust bearing.



30. Install the spacer on the input shell, using petroleum jelly to hold it in place.

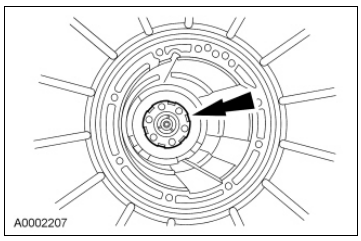


31. Install the input shell and sun gear assembly.

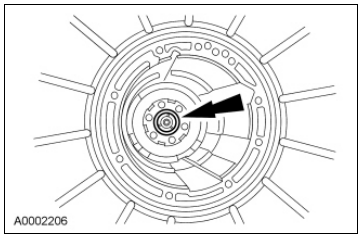


32. **NOTE:** The No. 13 bearing must be correctly seated in the forward planet assembly so the sun gear can be installed correctly.

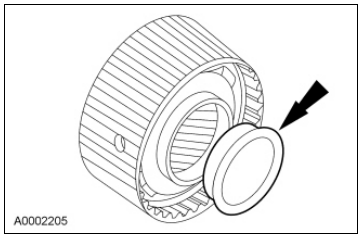
    Install the forward planetary assembly.



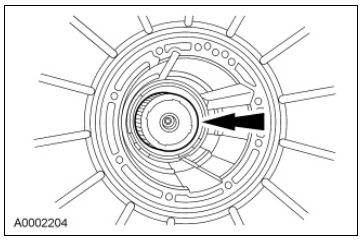
33. Install the No. 7 forward planet thrust bearing into the forward ring gear and hub assembly. Use petroleum jelly to hold the bearing in place.



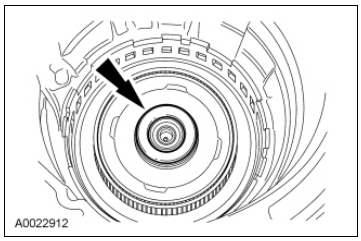
34. Install the No. 6B forward clutch thrust washer onto the forward ring gear hub.



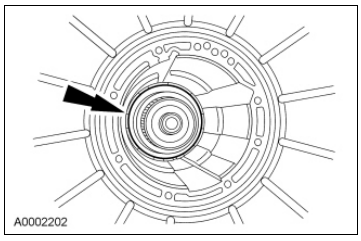
35. Install the forward ring gear and hub as an assembly.



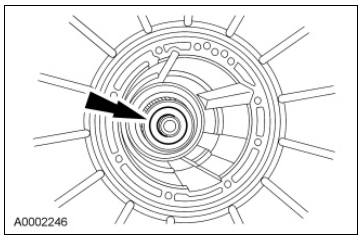
36. Install the No. 6A forward ring gear hub thrust bearing into the forward ring gear and hub.



37. Install the forward clutch cylinder.



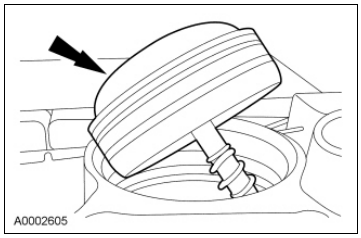
38. Install the No. 5 thrust bearing.



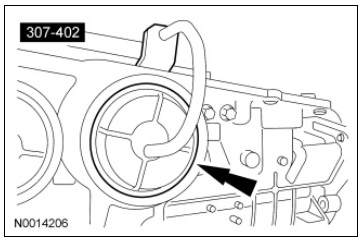
39. **NOTE:** Inspect the intermediate servo bore for excessive wear. Repair as required.

    Install the intermediate servo piston and spring.

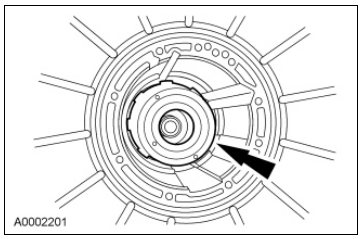
    - Lubricate the servo bore with transmission fluid.



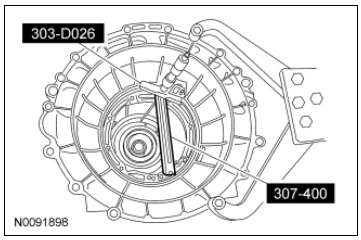
40. Using the Servo Cover Compressor, install the retaining ring.



41. Install the direct clutch drum.



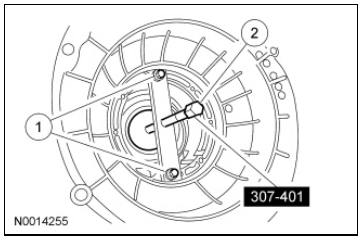
42. Using a Depth Micrometer with an appropriate length extension, measure from the top of the Gauge Bar to the center support ledge in the case at 4 places 90 degrees apart.
    - Add the 4 measurements, divide by 4 and record as dimension A.



43. ***NOTICE:*** **The torque specifications are critical for this procedure. Failure to use the correct torque specifications may cause transmission damage.**

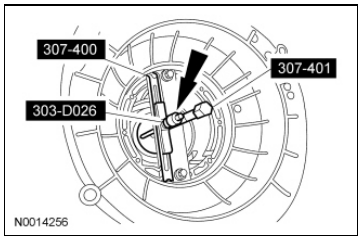
    Install the Cushion Spring Compressor.

    1. Install the Cushion Spring Compressor and the bolts using the 2 pump screw locations at approximately 6 and 12 o'clock positions.
        - ♦ Tighten to 15 Nm (133 lb-in).
    2. Tighten the center screw.
        - ♦ Tighten to 1.13 Nm (10 lb-in).



44. **NOTE:** Align the disc holes on the Cushion Spring Compressor with the slot in the Gauge Bar for correct measurement.

    Measure the distance with the Depth Micrometer from the top of the Gauge Bar to the drum bearing surface through the hole in the disc and record as dimension B. Repeat the measurement 180 degrees on the opposite side of the Gauge Bar and record as dimension C.



45. Add dimension B to C, divide by 2 and record as dimension D.

46. Subtract A from D and record as dimension E.

47. Select the bearing from the following chart, using dimension E.

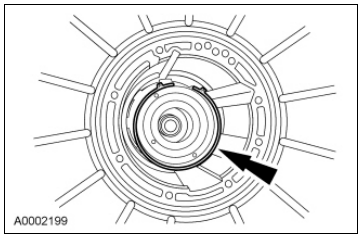
Dimension E	Service Part Number (7D014)	Bearing Thickness	Identification (Notches)
1.69-1.87 mm (0.066-0.073 in)	XW4Z-CA	2.65-2.80 mm (0.104-0.11 in)	None
1.88-2.04 mm (0.074-0.08 in)	XW4X-DA	2.83-2.98 mm (0.111-0.117 in)	1
2.05-2.22 mm (0.08- 0.087 in)	XW4Z-EA	3.01-3.16 mm (0.118-0.124 in)	2
2.23-2.43 mm (0.087-0.095 in)	XW4Z-FA	3.21-3.36 mm (0.126-0.132 in)	3

48. **NOTE:** Make sure that the intermediate band apply strut is aligned with the band notch.

    NOTE: If the intermediate band is reused, it must be installed in the same position as it was when removed.

    NOTE: The new intermediate band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

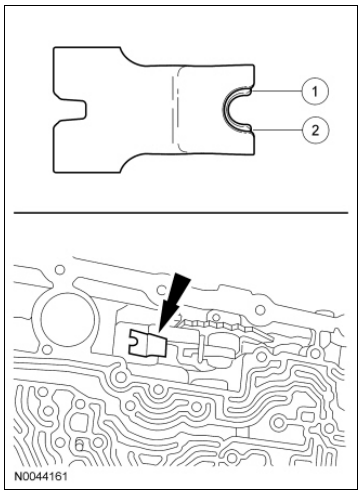
    Install the intermediate band.



49. ***NOTICE:*** **To avoid a fall out condition of the strut from the screw during assembly and function, the small U-shaped notch should be toward the band and the large U-shaped notch toward the main control side.**

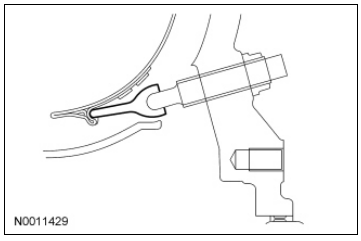
    Install the intermediate band anchor strut.

    1. Band/case side of anchor (small U notch).
    2. Main control side of anchor (large U notch).

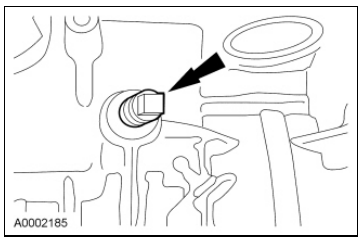


50. ***NOTICE:*** **If the strut is installed incorrectly, transmission damage will occur.**

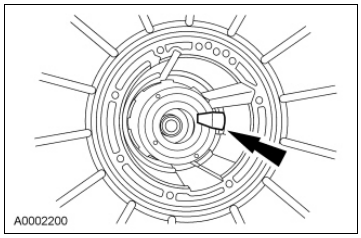
    Make sure that the intermediate band anchor strut is installed in the correct orientation to the case and adjustment screw.



51. Loosely install the adjustment screw.

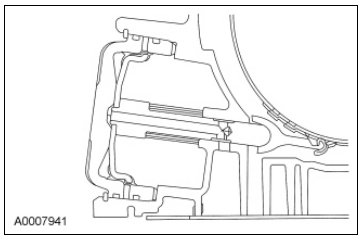


52. Install the intermediate band apply strut.

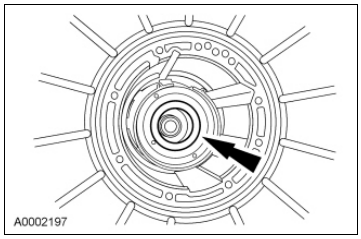


53. ***NOTICE:*** **If the strut is installed incorrectly, transmission damage will occur.**

    Make sure that the intermediate band apply strut is installed in the correct orientation to the case and piston rod.

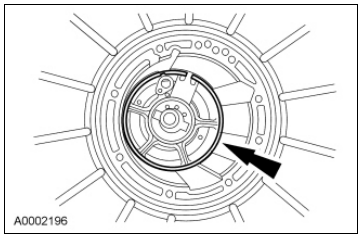


54. Install the selected No. 4 thrust washer on the direct clutch drum.
    - Coat the thrust washer with petroleum jelly.

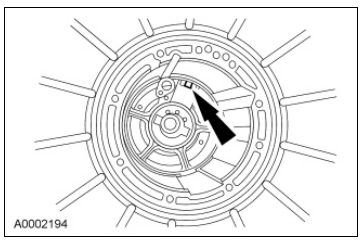


55. **NOTE:** Align the center support screw hole with correct case hole.

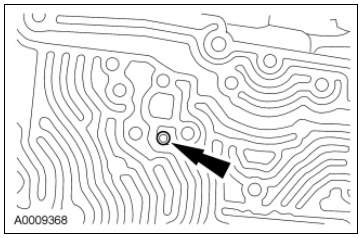
    Install the center support.



56. Install the center support locknut and cage.



57. Loosely install the center support screw.

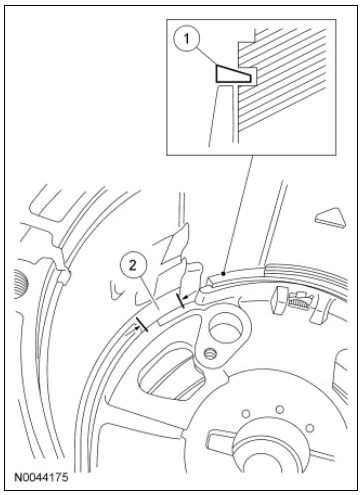


58. ***NOTICE:*** **Install the center support retaining ring with the tapered side facing up or damage may occur.**

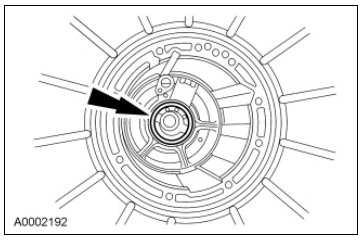
    NOTICE: **Make sure the notch opening is not obstructed by the center support retaining ring or damage may occur.**

    Install the center support retaining ring.

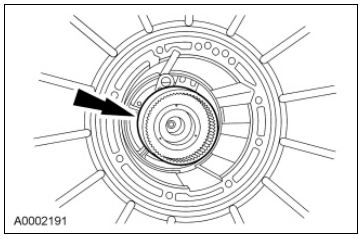
    1. Make sure the center support retaining ring is installed with the tapered side facing up.
    2. Make sure the opening of the center support retaining ring is positioned correctly.



59. Install the center shaft thrust bearing (No. 3).

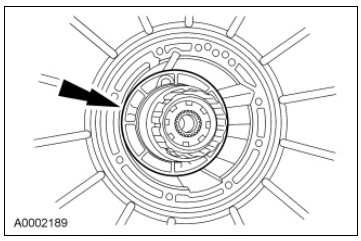


60. Install the O/D ring gear, O/D One-Way Clutch (OWC) and center shaft assembly.

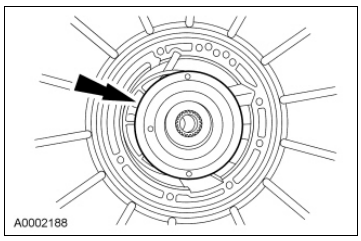


61. ***NOTICE:*** **Do not bend the trigger wheel. Make sure that the No. 2 thrust bearing is in this assembly.**

Install the planetary gear O/D carrier.



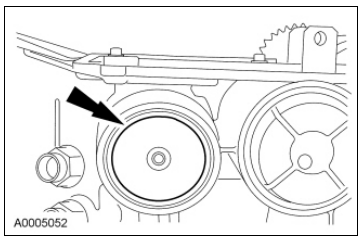
62. Install the O/D brake drum and coast clutch drum assembly.



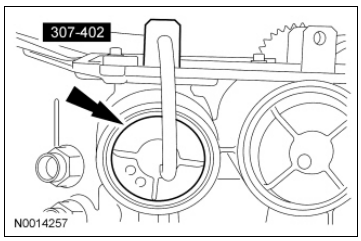
63. **NOTE:** Inspect the O/D servo bore for excessive wear. Repair as required.

Install the O/D band servo piston and spring.

- Lubricate the servo bore with transmission fluid.



64. Using the Servo Cover Compressor, install the retaining ring.

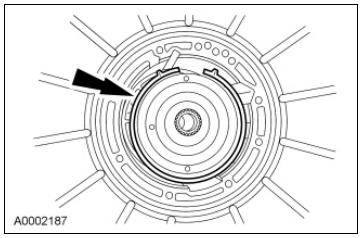


65. **NOTE:** If the O/D band is reused, it must be installed in the same position as when removed.

NOTE: Make sure that the O/D band apply strut is aligned with the band notch.

NOTE: The new O/D band is dark in color. This is a normal condition of the band. Hairline cracks in the band are also considered normal. Do not install a new band based solely on the color.

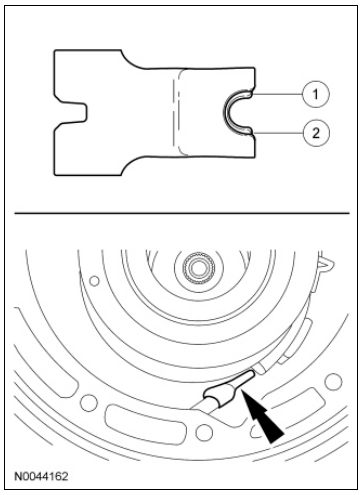
Install the O/D band.



66. ***NOTICE:*** **To avoid a fall out condition of the strut from the screw during assembly and function, the small U-shaped notch should be toward the band and the large U-shaped notch toward the main control side.**

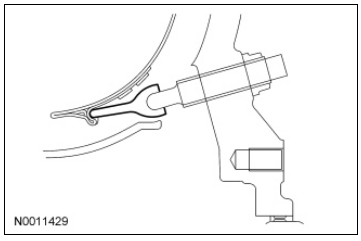
    Install the O/D anchor strut.

    1. Band/case side of anchor (small U notch).
    2. Main control side of anchor (large U notch).

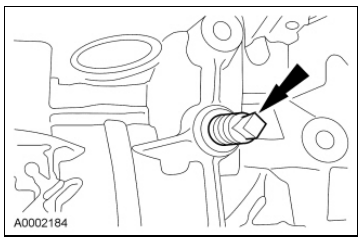


67. ***NOTICE:*** **If the strut is installed incorrectly, transmission damage will occur.**

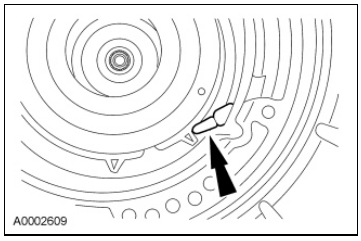
    Make sure that the O/D band anchor strut is installed in the correct orientation to the case and adjustment screw.



68. Loosely install the adjustment screw.

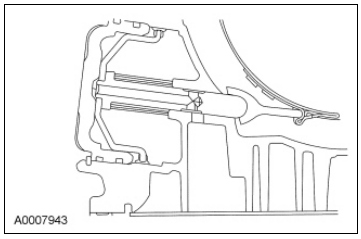


69. Install the O/D apply strut.



70. ***NOTICE:*** **If the strut is installed incorrectly, transmission damage will occur.**

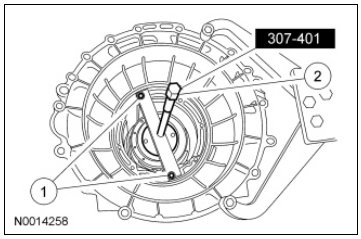
    Make sure that the O/D band apply strut is installed in the correct orientation to the case and piston rod.



71. ***NOTICE:*** **The torque specifications are critical for this procedure. Failure to use the correct torque specifications may cause transmission damage.**

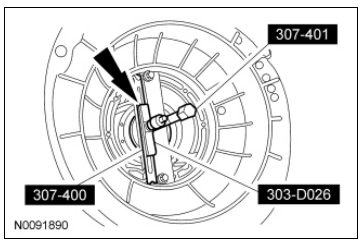
    Install the Cushion Spring Compressor.

    1. Install the Cushion Spring Compressor and the bolts using the 2 pump screw locations at approximately 6 and 12 o'clock positions.
        - Tighten to 15 Nm (133 lb-in).
    2. Tighten the center screw.
        - Tighten to 1.13 Nm (10 lb-in).



72. **NOTE:** Align the disc holes on Cushion Spring Compressor with the slot in the Gauge Bar for correct measurement.

    Measure the distance with the Depth Micrometer from the top of the Gauge Bar to the drum bearing surface through the hole in the disc and record as dimension A. Repeat the measurement 180 degrees on the opposite side of the Gauge Bar and record as dimension B.



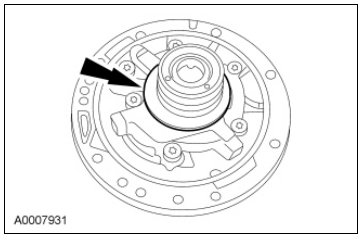
73. Add dimension A to B, divide by 2 and record as dimension C.

74. Subtract the thickness of the Gauge Bar 17.78 mm (0.70 in) from dimension C and record as dimension D.

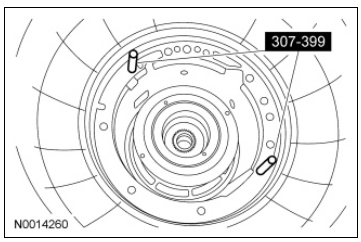
75. Select the No. 1 thrust bearing from the following chart using dimension D.

Dimension D	Service Part Number (7D014)	Bearing Thickness	Identification (Color/ID)
38.05-38.13 mm (1.498-1.501 in)	F7TZ-TA	1.55-1.6 mm (0.061-0.062 in)	White
38.14-38.28 mm (1.501-1.507 in)	F7TZ-MA	1.75-1.80 mm (0.068-0.07 in)	Green
38.29-38.42 mm (1.507-1.52 in)	F7TZ-NA	1.85-1.90 mm (0.072-0.074 in)	Red
38.43-38.61 mm (1.512-1.52 in)	F7TZ-RA	2.05-2.10 mm (0.08-0.082 in)	Black
38.63-38.74 mm (1.52-1.525 in)	F7TZ-SA	2.15-2.20 mm (0.084-0.086 in)	Yellow

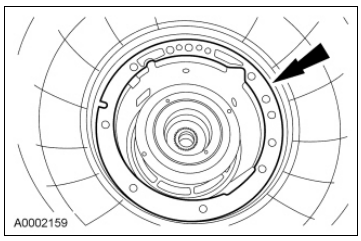
76. Install the selected No. 1 fluid pump input thrust washer.
    - Coat the fluid pump input thrust washer with petroleum jelly.



77. Install the Transmission Fluid Pump Alignment Pins into the transmission case.

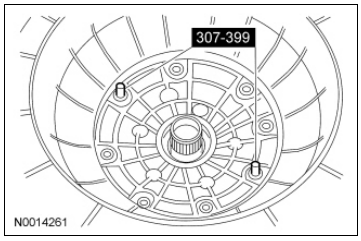


78. Install the fluid pump gasket.



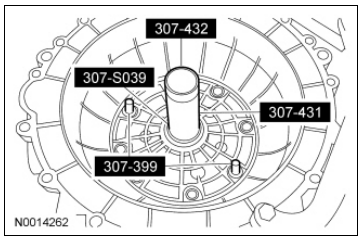
79. ***NOTICE:*** **Make sure that the fluid pump inlet thrust washer (No. 1), selective thrust washer, fluid pump gasket and the fluid pump-to-case O-ring seal remain in the correct position throughout this step or damage may occur.**

    Install the fluid pump.

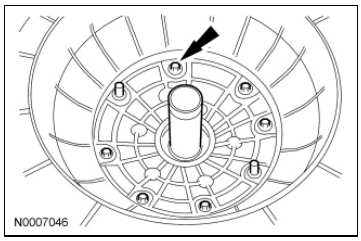


80. ***NOTICE:*** **The Transmission Fluid Pump Alignment Pins, Fluid Pump Alignment Set and the Transmission Fluid Pump Alignment Gauge must be used to correctly align the pump with the adapter plate to reduce gear noise, bushing failure and leakage.**

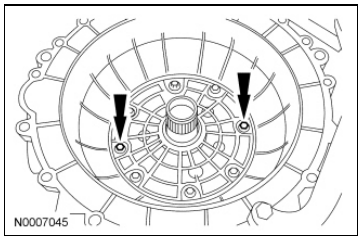
    Using the Transmission Fluid Pump Alignment Pins, Fluid Pump Alignment Set and the Transmission Fluid Pump Alignment Gauge align the fluid pump to the adapter plate.



81. Install 6 transmission fluid pump housing-to-case screws. Tighten the screws in a star pattern.
    - Tighten to 22 Nm (16 lb-ft).



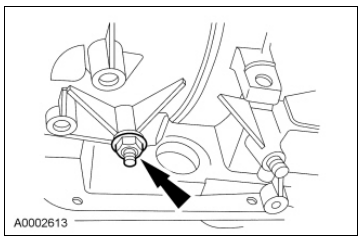
82. Remove Transmission Fluid Pump Alignment Pins and install the 2 remaining screws.
    - Tighten to 22 Nm (16 lb-ft).



83. ***NOTICE:*** **Do not allow the Overdrive (O/D) band adjustment screw to back out. Band strut may fall out of position.**

    NOTE: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

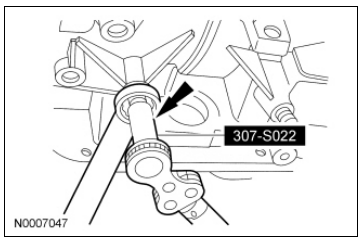
Install a new locknut on the band adjustment screw.



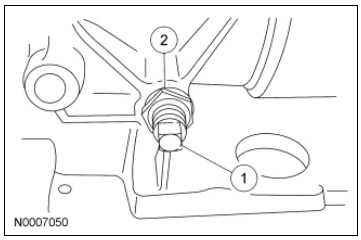
84. ***NOTICE:*** **The Overdrive (O/D) servo must be installed prior to band adjustment or damage may occur.**

    Using the Transmission Band Adjustment Set, tighten the O/D band adjustment screw.

    - Tighten to 13 Nm (115 lb-in).
    - Back the screw off exactly 2 turns and hold that position.



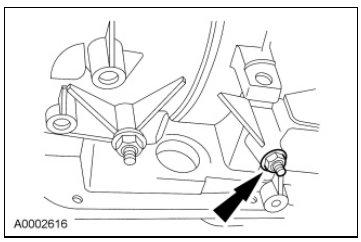
85. Tighten the O/D band locknut.
    1. Hold the O/D band adjustment screw stationary.
    2. Tighten the O/D band locknut.
    - Tighten to 54 Nm (40 lb-ft).



86. ***NOTICE:*** **Do not allow the intermediate band adjusting screw to back out. The band strut may fall out of position.**

    NOTE: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

    Install a new locknut on the band adjustment screw.

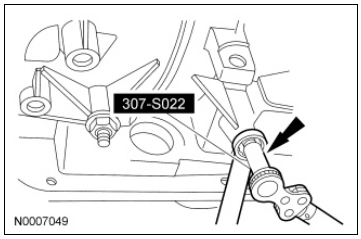


87. ***NOTICE:*** **The intermediate servo must be installed prior to band adjustment or damage may**

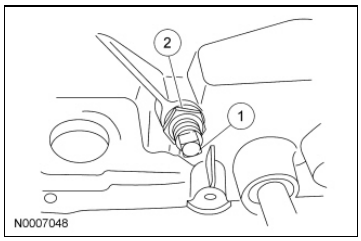
occur.

Using the Transmission Band Adjustment Set, tighten the intermediate band adjustment screw.

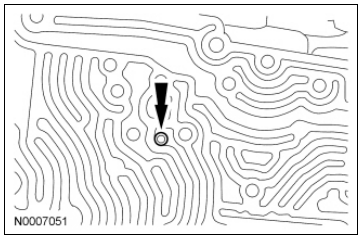
- Tighten to 13 Nm (115 lb-in).
- Back the screw off exactly 2 turns and hold that position.



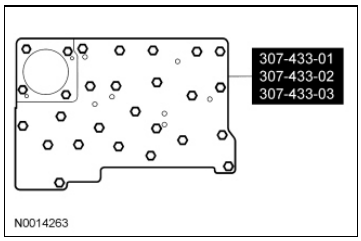
88. Tighten the intermediate band locknut.
    1. Hold the intermediate band adjustment screw stationary.
    2. Tighten the intermediate band locknut.
    - Tighten to 54 Nm (40 lb-ft).



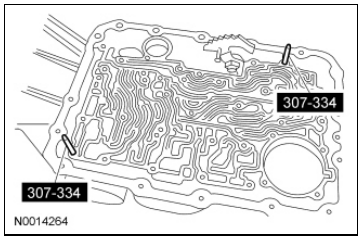
89. Tighten the center support screw.
    - Tighten to 11 Nm (97 lb-in).



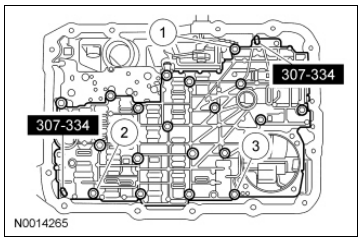
90. Using the Transmission Air Test Plate and Gaskets, carry out the air pressure test procedure. For additional information, refer to Special Testing Procedures in this section.



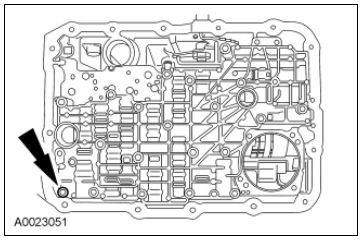
91. Install the Valve Body Aligners into the transmission case.



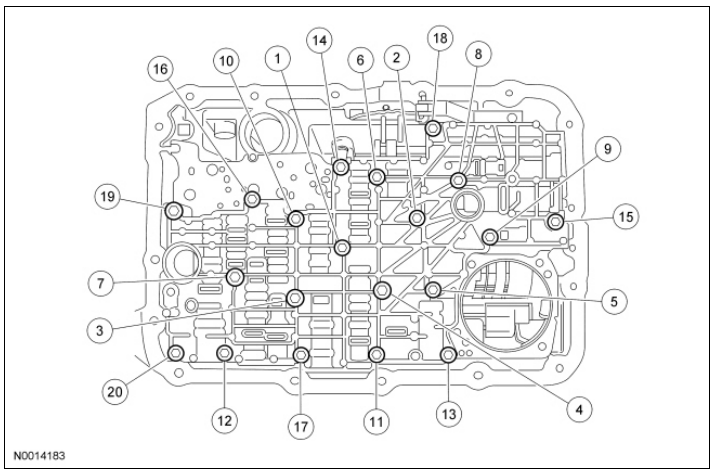
92. Using the Valve Body Aligners, install the main control valve body and loosely install the main control valve body screws.
    1. Install the short main control valve body screw.
    2. Install the screw with the larger head.
    3. Install the remaining main control valve body screws.



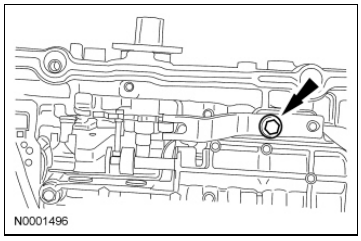
93. Remove the Valve Body Aligners and loosely install the main control valve body screw.



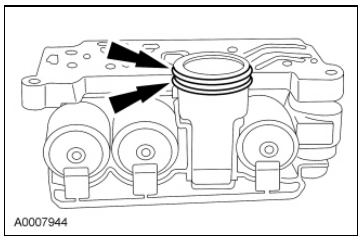
94. Tighten the main control valve body screws in the sequence shown.
    - Tighten to 10 Nm (89 lb-in).



95. With the manual lever in the NEUTRAL position, install the manual valve detent spring.
    - Tighten to 10 Nm (89 lb-in).



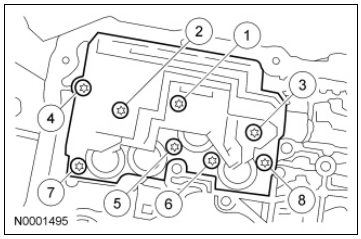
96. Install new O-ring seals on the transmission control solenoid body harness connector. Lubricate the O-ring seals with transmission fluid.



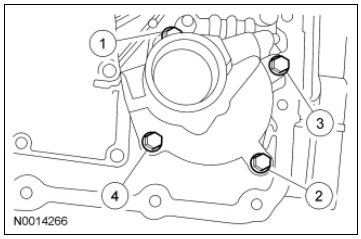
97. ***NOTICE:*** **Inspect the transmission case bore to make sure it is free of foreign material and not damaged. If damaged, transmission leak may occur.**

    Install the transmission control solenoid body. Tighten the transmission control solenoid body screws in the sequence shown.

    - Tighten to 8 Nm (71 lb-in).



98. Install the reverse servo. Tighten the bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten bolts to 5 Nm (44 lb-in).
    - Stage 2: Tighten bolts to 11 Nm (97 lb-in).

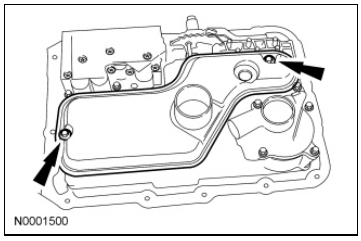


99. ***NOTICE:*** **Lubricate the transmission fluid filter seals with transmission fluid or they may be damaged.**

    NOTE: Make sure that the transmission fluid filter seals are correctly seated on the transmission fluid filter.

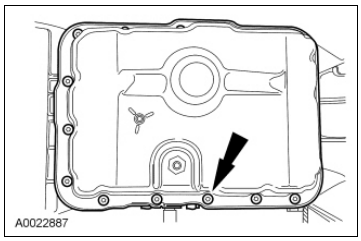
    Lubricate the transmission fluid filter seals and install the transmission fluid filter.

    - Tighten to 10 Nm (89 lb-in).

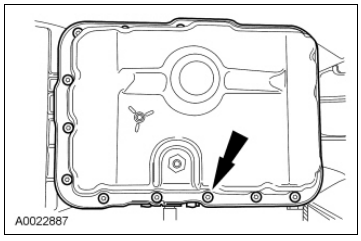


100. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage. If not damaged, the transmission fluid pan gasket should be reused.

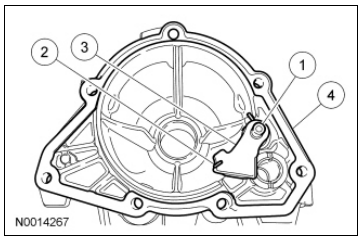
    Install the transmission fluid pan and transmission fluid gasket and loosely install the transmission fluid pan screws.



101. Tighten the 16 transmission fluid pan screws in a crisscross sequence.
    - Tighten to 11 Nm (97 lb-in).

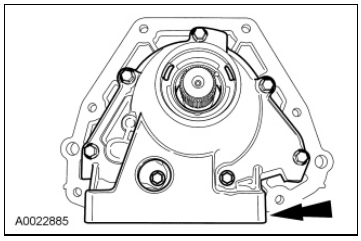


102. Install the park pawl assembly and gasket.
    1. Install the park pawl shaft.
    2. Install the park pawl return spring.
    3. Install the park pawl.
    4. Install a new gasket.

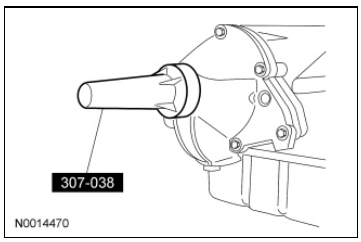


RWD vehicles

103. Install the extension housing and the extension housing screws.
    - Tighten to 30 Nm (22 lb-ft).

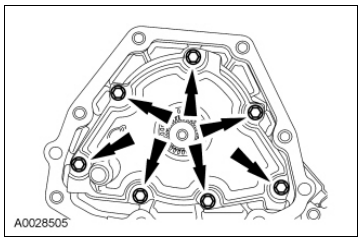


104. Using the Transmission Extension Housing Fluid Seal Installer, install the extension housing seal.

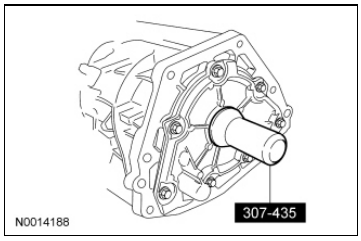


4WD vehicles

105. Install the extension housing and the extension housing screws.
    - Tighten to 30 Nm (22 lb-ft).

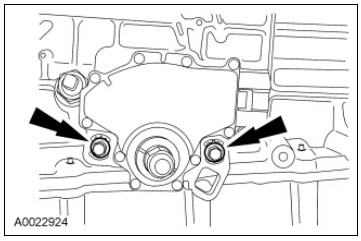


106. Using the Extension Housing Seal Installer, install the extension housing seal.



107. ***NOTICE:*** **The Transmission Range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.**

    Install the Transmission Range (TR) sensor and loosely install the screws.

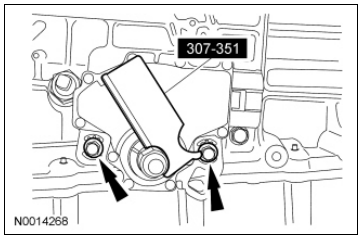


108. ***NOTICE:*** **Tightening one screw before tightening the other may cause the sensor to bind or become damaged.**

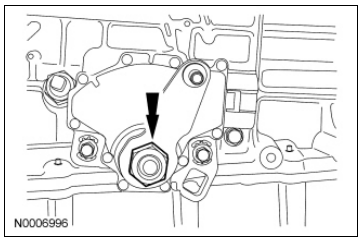
NOTE: The manual lever must be in the NEUTRAL position.

Using the TR Sensor Alignment Gauge, align the TR sensor and tighten the screws in an alternating sequence.

- Tighten to 8 Nm (71 lb-in).

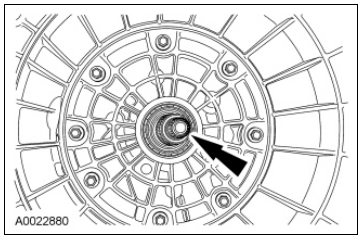


109. Install the manual control lever and the manual lever shaft outer nut.
    - Tighten to 48 Nm (35 lb-ft).

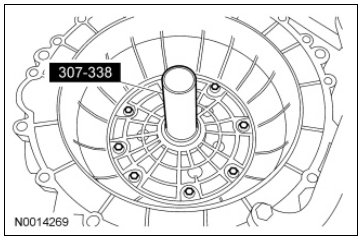


110. ***NOTICE:*** **The splines of the input shaft are not the same length on each end. Install the shaft with the shorter splines on the end into the fluid pump or damage may occur.**

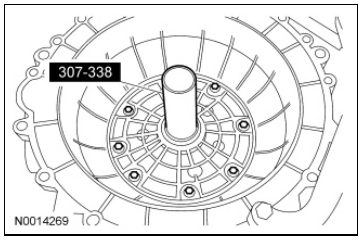
    Install the input shaft.



111. Using the Piston Seal Sizer, make sure that the fluid pump gear seal ring is fully seated.



112. Remove the Piston Seal Sizer.

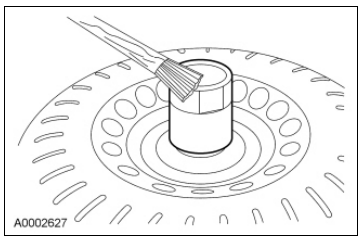


113. ***NOTICE:*** **Do not damage the fluid pump gear O-ring seal when installing the torque converter.**

    NOTICE: **Make sure the torque converter hub is fully engaged in the pump support and the gear rotates freely. Do not damage the hub seal.**

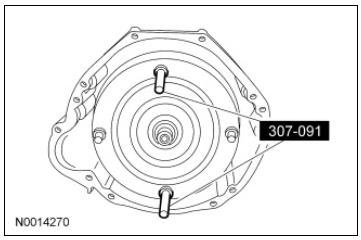
    NOTICE: **If the torque converter slides out, the hub seal may be damaged.**

    Lubricate the converter hub with transmission fluid.

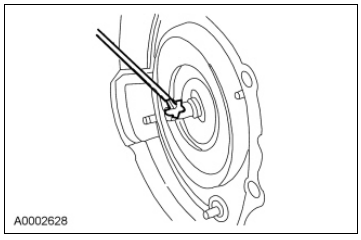


114. ⚠ **WARNING: Secure the torque converter in the transmission during removal or installation. The torque converter is heavy and may result in injury if it falls out of the transmission. Failure to follow this instruction may result in serious personal injury.**

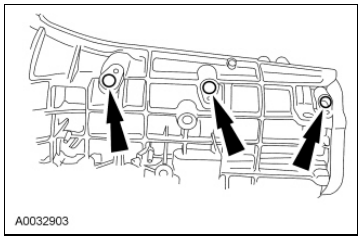
    Using the Torque Converter Handles, install the torque converter by pushing and rotating.



115. Lubricate the torque converter pilot hub with multi-purpose grease.



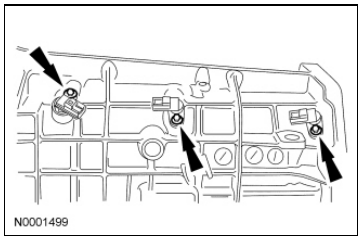
116. Using one of the speed sensor holes, fill the transmission with 8.5L (9 qt) of transmission fluid.



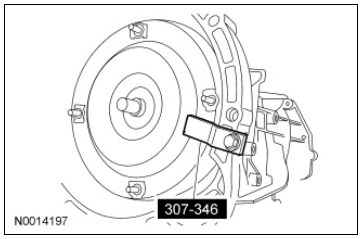
117. **NOTE:** Inspect the speed sensor O-ring seals for damage. Install new O-ring seals if damaged. Lubricate the O-ring seals with petroleum jelly to prevent damage to the O-ring seals.

    Install the speed sensors.

    - Tighten to 14 Nm (124 lb-in).



118. Install the Torque Converter Retainer.



Transmission - Rear Wheel Drive (RWD)

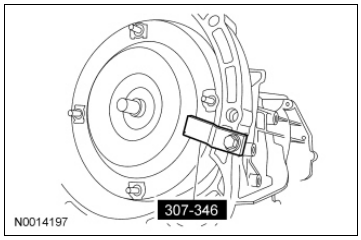
Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

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

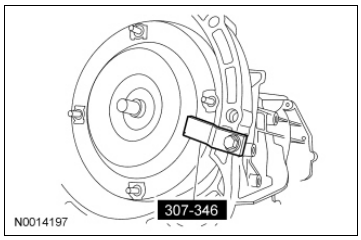
   NOTE: Rotate the torque converter so that the torque converter paint mark is in the 12 o'clock position.

   Install the Torque Converter Retainer if not done during assembly.

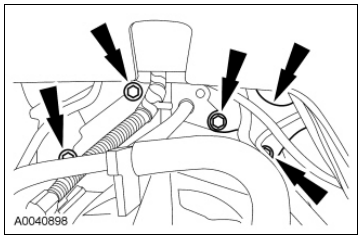


2. Raise and position the transmission to the back of the engine.

3. Remove the Torque Converter Retainer.



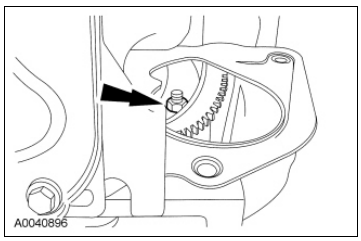
4. Position the fuel line bracket in place and install the 6 transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).



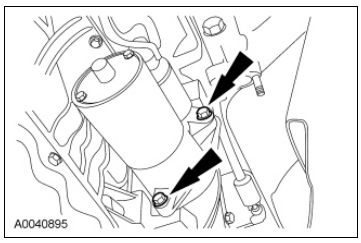
5. ***NOTICE:*** **Rotating the crankshaft pulley bolt counterclockwise could cause a reduction in clamp load on the crankshaft pulley and timing sprocket, which could cause severe engine damage.**

   Install 4 new torque converter-to-flexplate nuts.

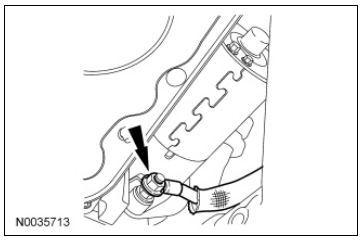
   - Tighten to 44 Nm (32 lb-ft).



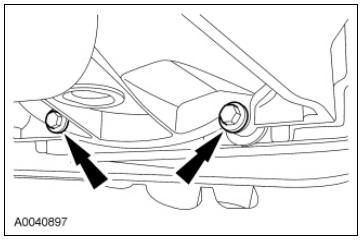
6. Install the starter motor and starter motor bolts.
   - Tighten to 25 Nm (18 lb-ft).



7. Install the ground cable and ground cable nut.
   - Tighten to 13 Nm (115 lb-in).



8. Install the lower transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).

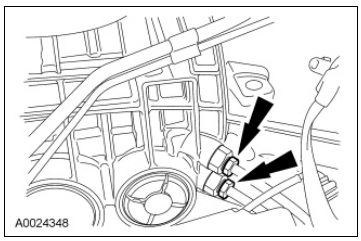


9. ***NOTICE:*** **Use care not to bend or force the transmission fluid cooler tubes, otherwise, damage to the transmission fluid cooler tubes and the transmission may result.**

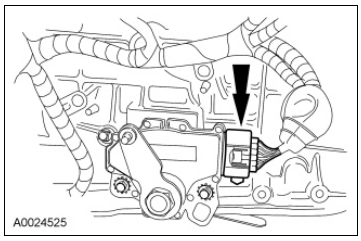
   NOTE: Hold the transmission case fittings with a backup wrench.

   Install the transmission fluid cooler tubes nut-to-case fitting.

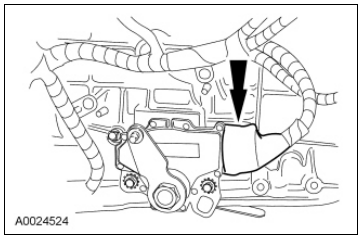
- Tighten to 40 Nm (30 lb-ft).



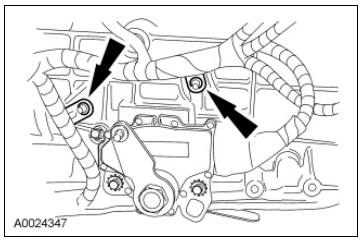
10. Connect the Transmission Range (TR) sensor connector.



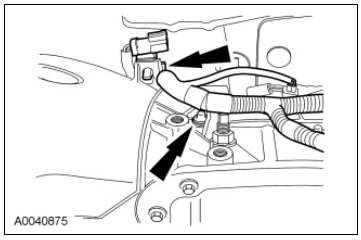
11. Move the TR sensor boot back over the TR sensor connector.



12. Position the wire harness and install the retainers.



13. Attach the LH Heated Oxygen Sensor (HO2S) to the transmission and install the wire harness retainer.



14. ***NOTICE:*** **Damage will occur to the transmission control solenoid body assembly if the screw is tightened above the specification.**

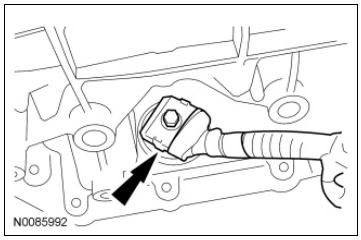
    NOTE: Always install new O-ring seals on the transmission solenoid body harness connector.

NOTE: Clean the area around the transmission vehicle harness connector to prevent contamination of the transmission solenoid body harness connector.

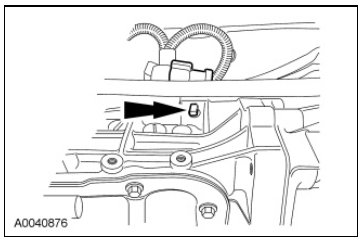
NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

Install and lubricate new O-ring seals on the transmission solenoid body harness connector and connect the transmission vehicle harness connector.

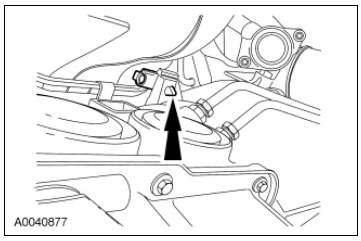
- Tighten to 5 Nm (44 lb-in).



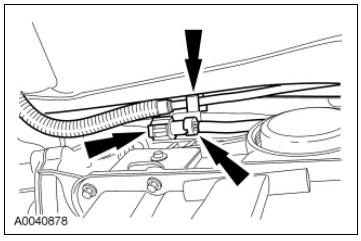
15. Attach the LH Catalyst Monitor Sensor (CMS) connector to the transmission.



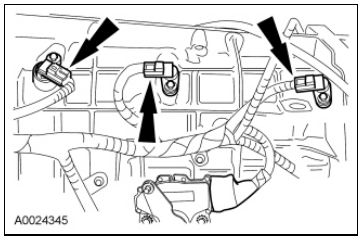
16. Attach the RH HO2S to the transmission.



17. Attach the fuel lines and the RH CMS connector to the bracket.



18. Connect the Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor and intermediate shaft speed sensor connectors.

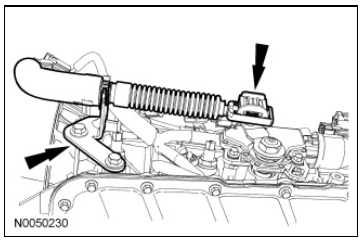


19. *NOTICE:* **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

    NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector cable end is securely installed onto the manual control lever.

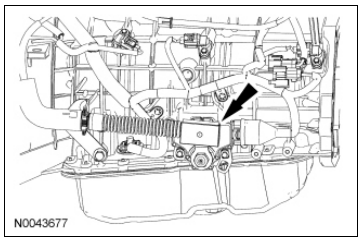
    Install the selector lever cable end onto the manual control lever, selector lever cable bracket and selector lever cable bracket screws.

    - Tighten to 40 Nm (30 lb-ft).

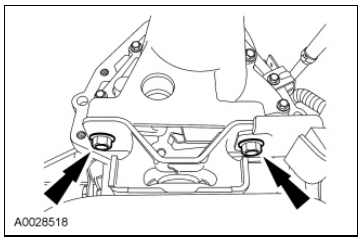


20. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

    Install the selector lever cable shield.



21. If removed, install the transmission support insulator and transmission support insulator-to-extension housing screws.
    - Tighten to 90 Nm (66 lb-ft).

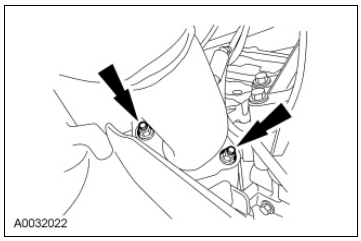


22. *NOTICE:* **Prior to Installation, Inspect the HO2S and the CMS wiring harness for damage.**

    NOTE: RH side shown, LH side similar.

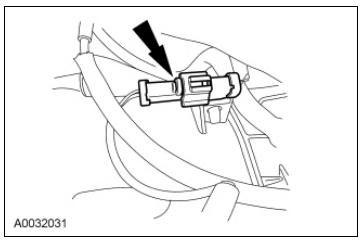
NOTE: This step may require an assistant.

Position the catalytic converter assembly and loosely install the 4 catalytic converter-to-manifold nuts.



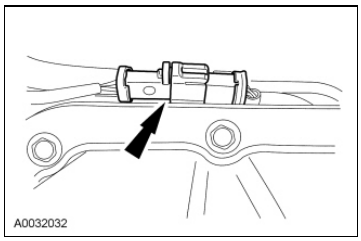
23. **NOTE:** LH side shown, RH side similar.

    Connect the 2 HO2S connectors.

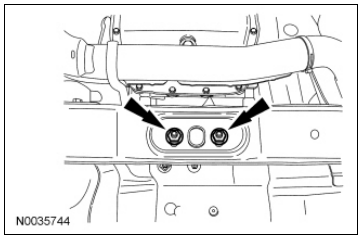


24. **NOTE:** LH side shown, RH side similar.

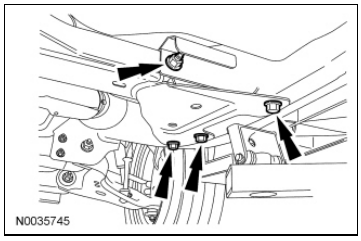
    Connect the 2 CMS sensor connectors.



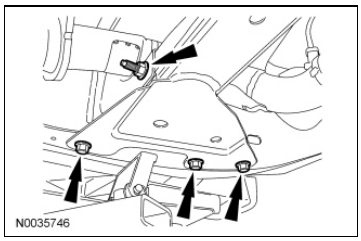
25. Position the crossmember in place and loosely install the 2 transmission support insulator-to-crossmember nuts to support the crossmember.



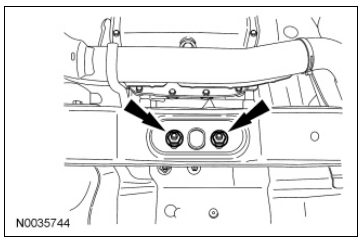
26. Install the 4 RH side crossmember bolts and the nut.
    - Tighten to 70 Nm (52 lb-ft).



27. Install the 4 LH side crossmember bolts and the nut.
    - Tighten to 70 Nm (52 lb-ft).

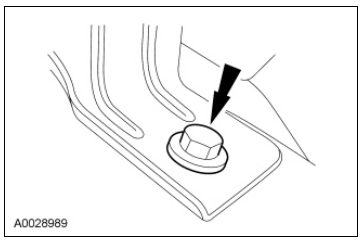


28. Tighten the transmission support insulator-to-crossmember nuts.
    - Tighten to 90 Nm (66 lb-ft).

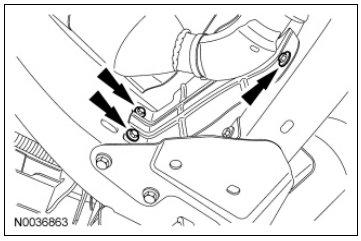


29. Remove the transmission jack from under the transmission.

30. Install the LH exhaust heat shield bolts.
    - Tighten to 20 Nm (177 lb-in).



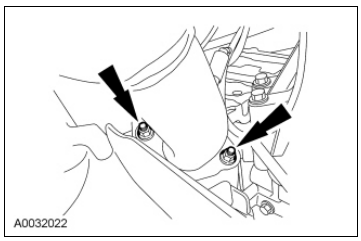
31. If equipped, install the RH exhaust heat shield.
    - Tighten to 20 Nm (177 lb-in).



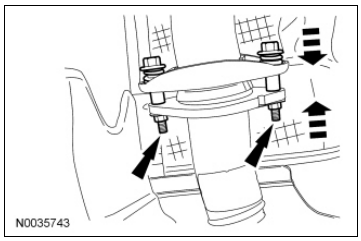
32. **NOTE:** RH shown, LH similar.

    Tighten the 4 catalytic converter-to-manifold nuts.

- Tighten to 40 Nm (30 lb-ft).



33. Using a new gasket, install the catalytic converter-to-muffler pipe and the heat shield. Install the catalytic converter-to-muffler pipe bolts, springs and flagnuts.
    - Tighten to 40 Nm (30 lb-ft).



34. Install the driveshaft. For additional information, refer to Section 205-01 .

35. Use the following guidelines for installing the in-line transmission fluid filter:
    - If the transmission was overhauled and the vehicle was equipped with an in-line transmission fluid filter, install a new in-line transmission fluid filter.
    - If the transmission was overhauled and the vehicle was not equipped with an in-line transmission fluid filter, install a new in-line transmission fluid filter kit.
    - If the transmission is being installed for a non-internal repair, do not install an in-line transmission filter or filter kit.
    - If installing a new or a Ford-authorized remanufactured transmission, install a new in-line transmission fluid filter.
        - Prior to lowering the vehicle, install a new in-line transmission filter or a filter kit. For additional information, refer to Transmission Filter - In Line in this section.

36. **NOTE:** When the battery has been disconnected and reconnected, some abnormal drive symptoms can occur while the vehicle relearns its adaptive strategy. The customer needs to be notified that they can experience slightly different upshifts (either soft or firm) and that this is a temporary condition and will eventually return to normal operating condition.

    Connect the battery ground cable. For additional information, refer to Section 414-01 .

37. Position the cooling fan shroud and install the bolts.
    - Tighten to 7 Nm (62 lb-in).

38. Position the coolant expansion tank and install the bolts.
    - Tighten to 7 Nm (62 lb-in).

39. Carry out the transmission fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

40. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

41. Check the operation of the transmission and inspect for leaks.

Transmission - Four Wheel Drive (4WD)

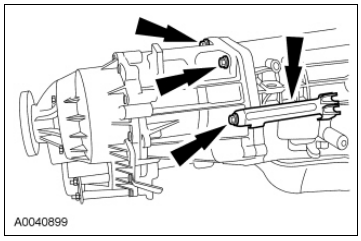
Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

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

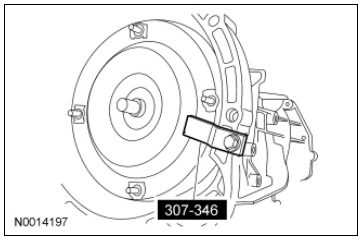
   If removed, install the transfer case to the back of the transmission. Install the transfer case bolts, bracket and connect the vent hose.

   - Tighten to 41 Nm (30 lb-ft).



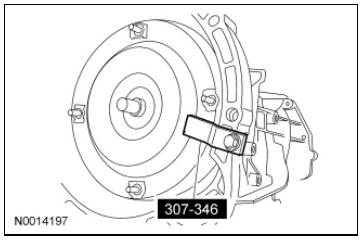
2. **NOTE:** Rotate the torque converter so that the torque converter paint mark is in the 12 o'clock position.

   Install the Torque Converter Retainer if not done during assembly.

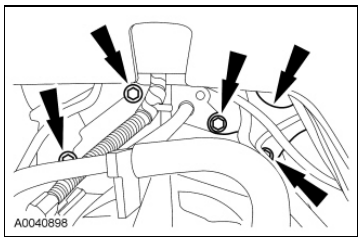


3. Raise and position the transmission and transfer case to the back of the engine.

4. Remove the Torque Converter Retainer.



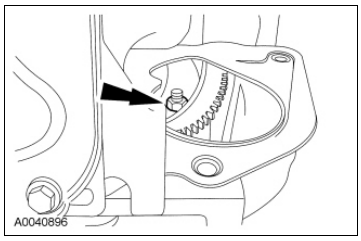
5. Position the fuel line bracket in place and install the 6 transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).



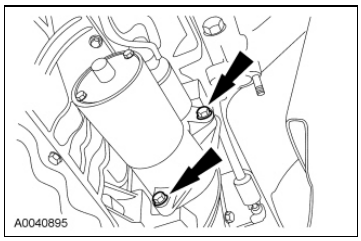
6. ***NOTICE:*** **Rotating the crankshaft pulley bolt counterclockwise could cause a reduction in clamp load on the crankshaft pulley and timing sprocket, which could cause severe engine damage.**

   Install 4 new torque converter-to-flexplate nuts.

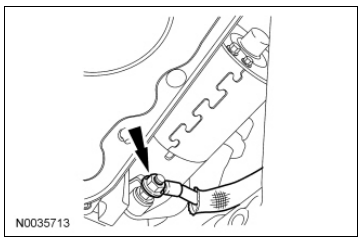
   - Tighten to 44 Nm (32 lb-ft).



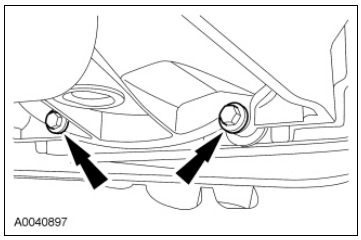
7. Install the starter motor and starter motor bolts.
   - Tighten to 25 Nm (18 lb-ft).



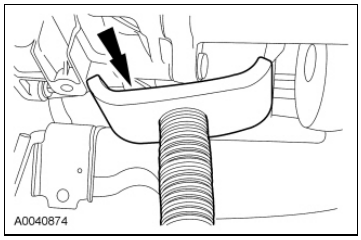
8. Install the ground cable and ground cable nut.
   - Tighten to 13 Nm (115 lb-in).



9. Install the lower transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).



10. Install a jackstand under the transfer case.



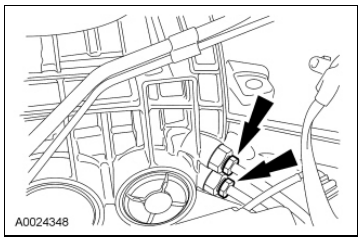
11. Remove the transmission jack from under the transmission.

12. ***NOTICE:*** **Use care not to bend or force the transmission fluid cooler tubes, otherwise damage to the transmission fluid cooler tubes and the transmission may result.**

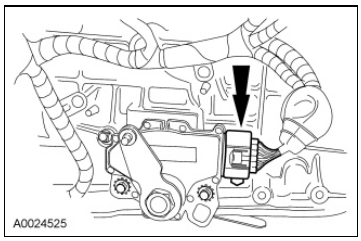
    NOTE: Hold the transmission case fittings with a backup wrench.

    Install the transmission fluid cooler tubes nut-to-case fitting.

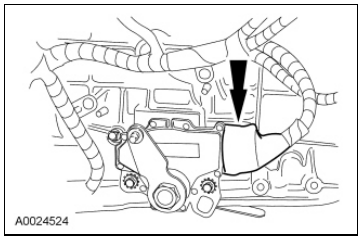
    - Tighten to 40 Nm (30 lb-ft).



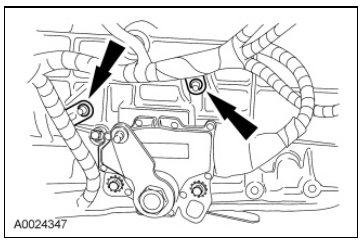
13. Connect the Transmission Range (TR) sensor connector.



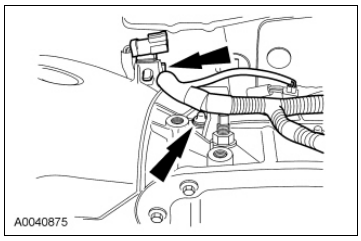
14. Move the TR sensor boot back over the TR sensor connector.



15. Position the wire harness and install the retainers.



16. Attach the LH Heated Oxygen Sensor (HO2S) to the transmission and install the wire harness retainer.



17. ***NOTICE:*** **Damage will occur to the transmission control solenoid body assembly if the screw is tightened above the specification.**

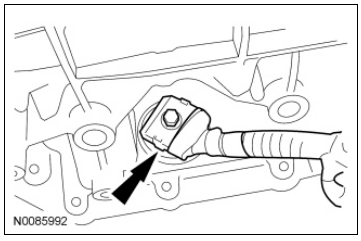
    NOTE: Always install new O-ring seals on the transmission vehicle harness connector.

    NOTE: Clean the area around transmission vehicle harness connector to prevent contamination of the transmission vehicle harness connector.

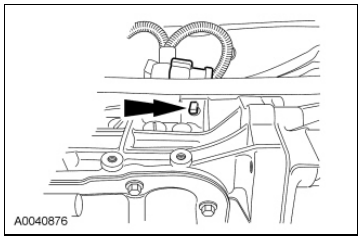
    NOTE: Use petroleum jelly to lubricate the O-ring seals to aid in the installation process.

    Install and lubricate new O-ring seals on the transmission vehicle harness connector and connect the transmission vehicle harness connector.

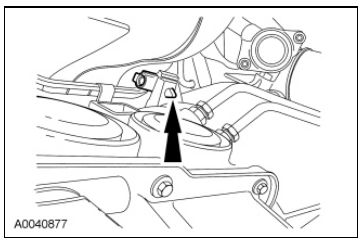
    - Tighten to 5 Nm (44 lb-in).



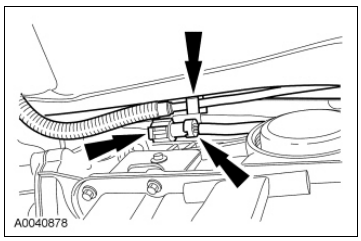
18. Attach the LH Catalyst Monitor Sensor (CMS) connector to the transmission.



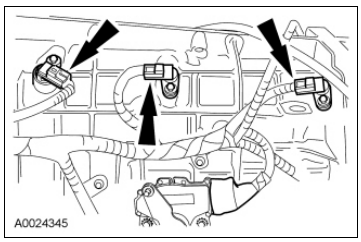
19. Attach the RH HO2S to the transmission.



20. Attach the fuel lines and the RH CMS connector to the bracket.



21. Connect the Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor and intermediate shaft speed sensor connectors.

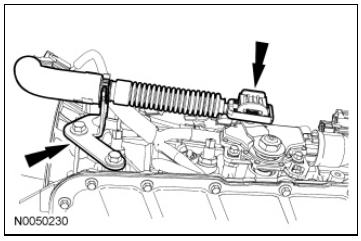


22. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

    NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector cable end is securely installed onto the manual control lever.

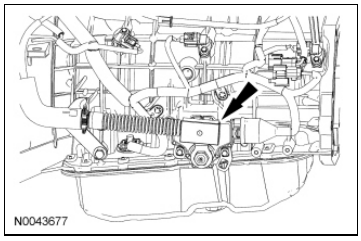
    Install the selector lever cable end onto the manual control lever, selector lever cable bracket and selector lever cable bracket screws.

    - Tighten to 40 Nm (30 lb-ft).



23. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

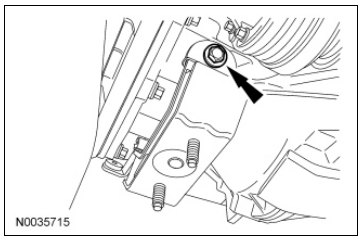
    Install the selector lever cable shield.



24. **NOTE:** LH side shown, RH similar.

    If removed, install the transmission support insulator and transmission support insulator screws.

    - Tighten to 90 Nm (66 lb-ft).

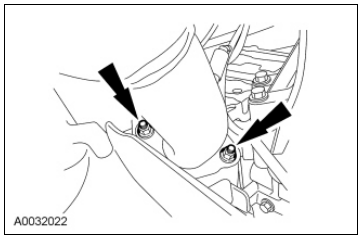


25. ***NOTICE:*** **Prior to Installation, Inspect the HO2S and the CMS wiring harness for damage.**

    NOTE: RH side shown, LH side similar.

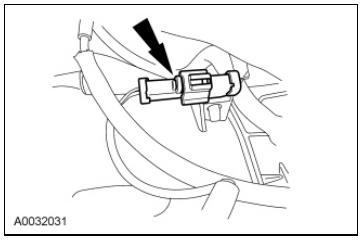
    NOTE: This step may require an assistant.

    Position the catalytic converter assembly and loosely install the 4 catalytic converter-to-manifold nuts.



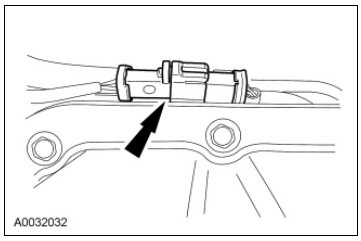
26. **NOTE:** LH side shown, RH side similar.

    Connect the 2 HO2S connectors.

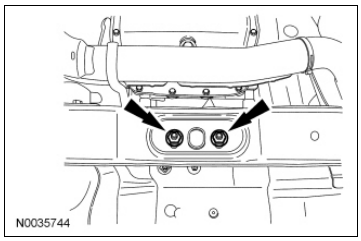


27. **NOTE:** LH side shown, RH side similar.

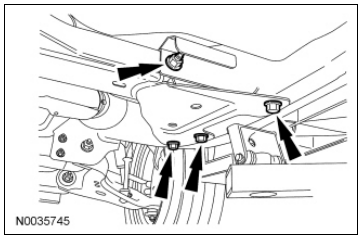
    Connect the 2 CMS sensor connectors.



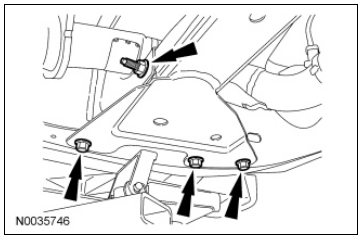
28. Position the crossmember in place and loosely install the 2 transmission support insulator-to-crossmember nuts to support the crossmember.



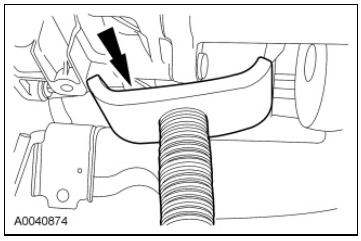
29. Install the 4 RH side crossmember bolts and the nut.
    - Tighten to 70 Nm (52 lb-ft).



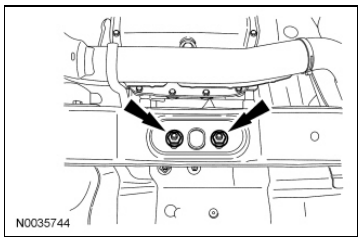
30. Install the 4 LH side crossmember bolts and the nut.
    - Tighten to 70 Nm (52 lb-ft).



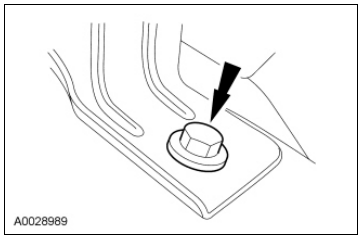
31. Remove the jackstand.



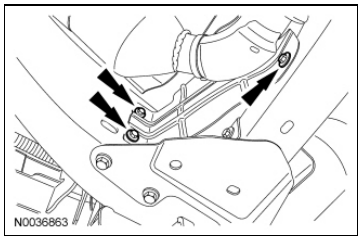
32. Tighten the transmission support insulator-to-crossmember nuts.
    - Tighten to 90 Nm (66 lb-ft).



33. Install the LH exhaust heat shield bolts.
    - Tighten to 20 Nm (177 lb-in).



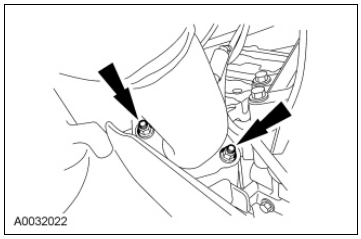
34. If equipped, install the RH exhaust heat shield.
    - Tighten to 20 Nm (177 lb-in).



35. **NOTE:** RH shown, LH similar.

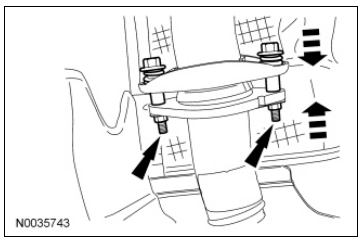
    Tighten the 4 catalytic converter-to-manifold nuts.

    - Tighten to 40 Nm (30 lb-ft).

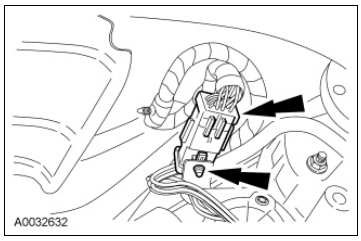


36. Using a new gasket, install the catalytic converter-to-muffler pipe and the heat shield. Install the catalytic converter-to-muffler pipe bolts, springs and flagnuts.

- Tighten to 40 Nm (30 lb-ft).



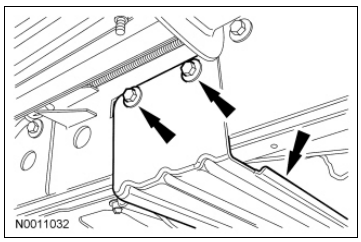
37. If equipped, connect the 4WD shift motor connector.



38. Install the driveshafts. For additional information, refer to Section 205-01 .

39. Use the following guidelines for installing the in-line transmission fluid filter:
    - If the transmission was overhauled and the vehicle was equipped with an in-line transmission fluid filter, install a new in-line transmission fluid filter.
    - If the transmission was overhauled and the vehicle was not equipped with an in-line transmission fluid filter, install a new in-line transmission fluid filter kit.
    - If the transmission is being installed for a non-internal repair, do not install an in-line transmission filter or filter kit.
    - If installing a new or a Ford-authorized remanufactured transmission, install a new in-line transmission fluid filter.
        - Prior to lowering the vehicle, install a new in-line transmission filter or a filter kit. For additional information, refer to in this section.

40. If equipped, position the skid plate and install the 4 skid plate bolts.
    - Tighten to 24 Nm (18 lb-ft).



41. **NOTE:** When the battery has been disconnected and reconnected, some abnormal drive symptoms can occur while the vehicle relearns its adaptive strategy. The customer needs to be notified that they can experience slightly different upshifts (either soft or firm) and that this is a temporary condition and will eventually return to normal operating condition.

    Connect the battery ground cable. For additional information, refer to Section 414-01 .

42. Position the cooling fan shroud and install the bolts.
    - Tighten to 7 Nm (62 lb-in).

43. Position the coolant expansion tank and install the bolts.

- Tighten to 7 Nm (62 lb-in).

44. Carry out the fluid level check. For additional information, refer to Transmission Fluid Level Check in this section.

45. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

46. Check the operation of the transmission and inspect for leaks.

Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV	11.45L (12.10 qt)
Multi-Purpose Grease Motorcraft® XL-5 (aerosol) and/or CRC® SL3151	ESB-M1C93-B	-

General Specifications

Item	Specification
Transmission Fluid **The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage. Refer to the material specification for the correct fluid.** • Normal maintenance: ♦ Transmission fluid change not necessary, filled for life. • Severe duty maintenance: ♦ Change the transmission fluid at 240,000 km (150,000 mi) intervals.	
NOTICE: The use of any fluid or cleaning agents other than what is recommended, will cause internal transmission damage.	
Transmission Fluid Filter	
Internal to the transmission	-

Assembly Weight

Description	Specification
Transmission	80.24 kg (215 lb)

Clutch Application Chart

Gear	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
Park				X	
Reverse		X		X	
Neutral				X	
1st Gear (M) Manual	X			X	
2nd Gear Manual	X		X		
3rd Gear Manual	X	X			
1st Gear D	X			X	
2nd Gear D	X		X		
3rd Gear D	X	X			
4th Gear D	X				X
5th Gear D		X			X
6th Gear D			X		X

Solenoid Application Chart

Gear	SSA (VFS1) Propor- tional	SSB (VFS2) Inversely Propor- tional	SSC (VFS3) Propor- tional	SSD (VFS4) Inversely Propor- tional	PCA (VFS5) Inversely Propor- tional	TCC (VFS6) Propor- tional	SSE (SS1) ON/ OFF
Park				X	a		
Reverse		X		X	a		
Neutral				X	a		
1st Gear Manual	X			X	a	a	
2nd Gear Manual	X		X		a	a	
3rd Gear Manual	X	X			a	a	
1st Gear D	X			X	a	a	
2nd Gear D	X		X		a	a	
3rd Gear D	X	X			a	a	
4th Gear D	X			X	a	a	X

5th Gear D		X		X	[a]	[a]	X
6th Gear (D)			X	X	[a]	[a]	X

[a] Transmission Control Module controlled

Gear Ratio	
1st	4.17 to 1
2nd	2.34 to 1
3rd	1.52 to 1
4th	1.14 to 1
5th	0.87 to 1
6th	0.69 to 1
Reverse	3.40 to 1

Stall Speed

Engine	Min	Max
4.6L (3V)	2,373	2,778

End Play

NOTE: All friction and steel plates use a wave design plate.

Item	Specifications
Forward Clutch (A)	0.71-1.10 mm (0.028-0.043 in)
Direct Clutch (B)	0.50-1.30 mm (0.019-0.051 in)
Intermediate Clutch (C)	0.71-1.10 mm (0.028-0.043 in)
Low/Reverse Clutch (D)	1.0-1.6 mm (0.039-0.063 in)
Overdrive (O/D) Clutch (E)	0.50-0.90 mm (0.019-0.035 in)

Clutch Plate Quantity Chart

Component	Number of Frictions	Number of Separator Plates	Separator Plate Thickness	Number of Pressure Plates	Pressure Plate Thickness
Forward Clutch (A)	4	5	3.0 mm (0.118 in)	1	3.0 mm (0.118 in)
Direct Clutch (B)	4	4	2.1 mm (0.082 in)	1	3.9 mm (0.153 in)
Intermediate Clutch (C)	4	4	3.0 mm (0.118 in)	1	3.9 mm (0.153 in)
Low/Reverse (D)	6	6	2.1 mm (0.082 in)	Select	5.4 mm (0.212 in)
				Select	5.7 mm (0.224 in)
			2.1 mm (0.082 in)	Select	6.0 mm (0.236 in)
Overdrive (O/D) Clutch (E)	6	6	6.15 mm (0.242 in)	1	3.0 mm (0.118 in)

Shift Speeds

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet. Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	Km/H	MPH
Light Throttle	1-2	13-21	8-13
Throttle Position (TP) Sensor	2-3	26-34	16-21
Voltage @ 1.25 Volts	3-4	35-43	22-27
	4-5	56-64	35-40
	5-6	71-79	44-49
Closed Throttle	6-5	56-64	35-40
	5-4	40-48	25-30
	4-3	13-21	8-13
	3-2	3-11	2-7
	2-1	2-6	1-4
Wide Open Throttle (WOT)	1-2	45-53	28-33
	2-3	87-95	54-59
	3-4	140-148	87-92

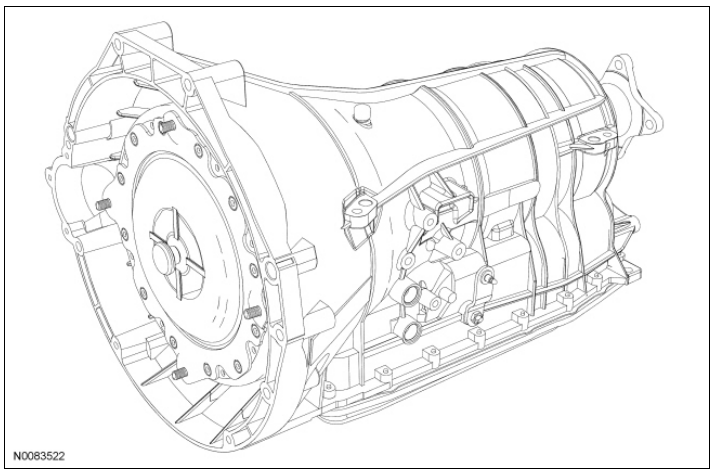
Torque Specifications

Description	Nm	lb-ft	lb-in
Detent spring bolts	12	-	106
Dual catalytic converter Y-pipe bolts	40	30	-
Exhaust flange nuts	40	30	-
Exhaust heat shield bolt	18	-	159
Flexplate inspection cover bolts	35	26	-
Flexplate-to-torque converter nuts	35	26	-
Front pump bolts [a]	-	-	-
Fuel line bracket bolt	25	18	-
Ground wire nut	23	17	-
Manual control lever nut	18	-	159
Mechatronic bolts [a]	-	-	-
Output shaft flange nut	80	59	-
Park rod actuating plate	12	-	106
Park pawl pin bolt	23	17	-
Pump plate assembly-to-front pump body bolts	15	-	133
Selector lever cable bracket bolts	48	35	-
Skid plate bolts	24	18	-
Solenoid bracket bolts	6	-	53
Starter B+ cable	12	-	106
Starter cable (small)	6	-	53
Starter motor bolts	26	19	-
Transmission Control Module (TCM) bolts [a]	-	-	-
Transmission crossmember nuts	143	105	-
Transmission crossmember bolts	80	59	-
Transmission-to-engine bolts	48	35	-
Transmission fluid cooler tube bracket front stud bolt nut	27	20	-
Transmission fluid cooler tubes bracket bolt	23	17	-
Transmission fluid fill plug	35	26	-
Transmission fluid pan bolts [a]	-	-	-
Transmission insulator and retainer bolts	90	66	-
Transmission insulator and retainer nuts	90	66	-

[a] Refer to the procedure in this section.

Transmission Description

6R80 Transmission



This transmission has an internal thermal bypass valve contained within the case.

This transmission uses planetary gears with hydraulic electronic controls. The Transmission Control Module (TCM) and the main control valve body units form a composite element that is installed as a single unit inside the automatic transmission.

This transmission has the following features:

- Six forward speeds
- Torque converter with an integral converter clutch
- Electronic shift and pressure controls
- Single planetary gear set
- Double planetary gear set
- Two fixed multi-disc clutches
- Three multi-plate clutches

All hydraulic functions are directed by electronic solenoids to control the following:

- Engagement feel
- Shift feel
- Shift scheduling
- Modulated Torque Converter Clutch (TCC) applications

This transmission has a mechatronic unit which contains:

- Transmission Control Module (TCM)
- Turbine Shaft Speed (TSS) sensor
- Output Shaft Speed (OSS) sensor
- An internal P, R, N, D selector shaft position sensor
- Transmission Fluid Temperature (TFT) sensor

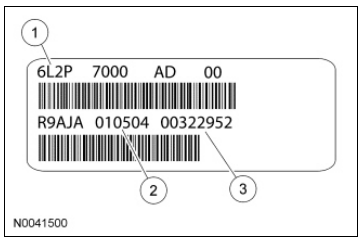
Engine power reaches the transmission by a torque converter with an integral clutch. The 6 forward gears and one reverse gear are obtained from 2 planetary gearsets.

This automatic transmission is a 6-speed electronically controlled transmission comprising the basic elements of a TCM , main control valve body unit, torque converter, 1 solenoid valve and 6 pressure regulators. Gear selection is achieved by the control of automatic transmission fluid flow to operate various internal clutches. The TCM operates the electrical components and provides for the control of gear selection shift pressure, which increases refinement and torque converter slip.

In the event of a system fault, the TCM also provides for Failure Mode Effect Management to maintain maximum functional operation of the transmission with a minimum reduction in driver, passenger or vehicle safety. In the event of a total loss of control or electrical power, the basic transmission functions P, R, N and D are retained. Also 3rd or 5th gear is retained by the hydraulic system. The gear retained is dependent upon the gear selected at the time of the failure.

Identification Tags

All vehicles come equipped with a Safety Compliance Certification Label. The location on the label marked TR is reserved for the transmission code. To determine the correct transmission for this vehicle, refer to the Owner's Literature, Transmission Code Designations. All transmissions are equipped with an identification tag located on the transmission case. For transmission part number, serial number and build date, refer to the transmission identification tag located on the transmission case.



Item	Description
1	Part number
2	Build date
3	Serial number

Major Components

Major Components

This transmission has the following major components:

- Transmission case with integral torque converter housing and extension housing
- Torque converter
- Fluid pump
- Three drive clutches:
  - Forward clutch (A)
  - Direct clutch (B)
  - Overdrive (O/D) clutch (E)
- Two brake clutches:
  - Intermediate clutch (C)
  - Low/reverse clutch (D)
- Two planetary gearsets:
  - Front single planetary gearset (1 sun gear, 1 carrier, 1 ring gear)
  - Rear ravigenaux planetary gearset (2 sun gears, 1 carrier with 2 sets of pinion gears and 1 ring gear)
- Main control (mechatronic assembly):
  - Upper valve body
  - Lower valve body
  - Transmission Control Module (TCM)
  - Transmission Range (TR) sensor
  - Turbine Shaft Speed (TSS) sensor
  - Output Shaft Speed (OSS) sensor

NOTE: Friction and steel plate quantity will vary based on engine displacement. Refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

In addition to the torque converter, the other shift elements are:

- three rotating multi-plate clutches: forward (A), direct (B) and overdrive (E).
- two fixed multi-disc brakes: intermediate (C) and low/reverse (D).

All gear shifts from 1st to 6th or from 6th to 1st are power-on overlapping shifts. That is, during the shift, one of the clutches must continue to transmit the drive at lower main pressure until the other clutch is able to accept the input torque.

The shift elements, clutches or brakes are engaged hydraulically. The transmission fluid pressure builds up between the cylinder and the piston, pressing the clutches together.

The purpose of these shift elements is to carry out in-load shifts with no interruption to traction.

Multi-plate clutches; forward, direct and overdrive, supply power from the engine to the planetary geartrain. Multi-disc brakes, intermediate and low/reverse, press against the transmission housing in order to achieve a torque reaction effect.

Multi-Plate Clutch

Clutches; O/D (E), forward (A) and direct (B) are balanced in terms of dynamic pressure. That is, their pistons are exposed to the transmission fluid flow on both sides, in order to prevent pressure buildup in the clutch as speed increases. This equalization process is achieved by a baffle plate and pressure-free transmission fluid supply by a lubricating passage, through which the space between piston and baffle plate is filled with transmission fluid.

The advantages of this dynamic pressure equalization are:

- reliable clutch engagement and release in all speed ranges.
- improved shift refinement.

Shift Overlap Control

The electro-hydraulic shift action is obtained by means of various valves in the TCM and main control valve body, actuated by pressure regulators. They engage or disengage the relevant clutches or brakes at the correct moments.

Hydraulic Systems

Fluid Pump

The torque converter is supported in the fluid pump by a needle roller bearing. The fluid pump is driven directly from the engine by the torque converter shell and supplies transmission fluid to the transmission and the hydraulic control unit.

The fluid pump draws in transmission fluid through a transmission fluid filter and delivers it at high pressure to the main pressure valve in the main control valve body unit. The valve adjusts the pressure and returns excess transmission fluid to the transmission fluid pan.

Fluid Filter

All transmission fluid that is picked up from the transmission fluid pan passes through the transmission fluid filter. The transmission fluid filter and its accompanying seal are part of the transmission fluid path from the pan to the transmission fluid pump.

Single Planetary Gearset

The single planetary gear O/D carrier is driven by the input shaft. The single planetary gear set consists of the following components:

- One sun gear
- Four planetary gears meshing with the sun gear
- One planetary carrier
- One ring gear

Ravigenaux Planetary Gearset

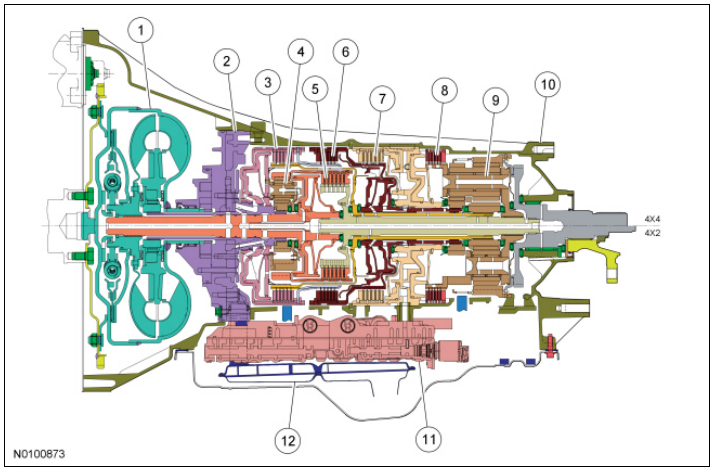
The ravigenaux planetary gearset is splined to the output shaft and consists of the following components:

- Two sun gears of different sizes
- Three short planetary gear pinions meshing with the sun gears
- Three long planetary gear pinions meshing with the sun gears
- One planetary carrier
- One ring gear

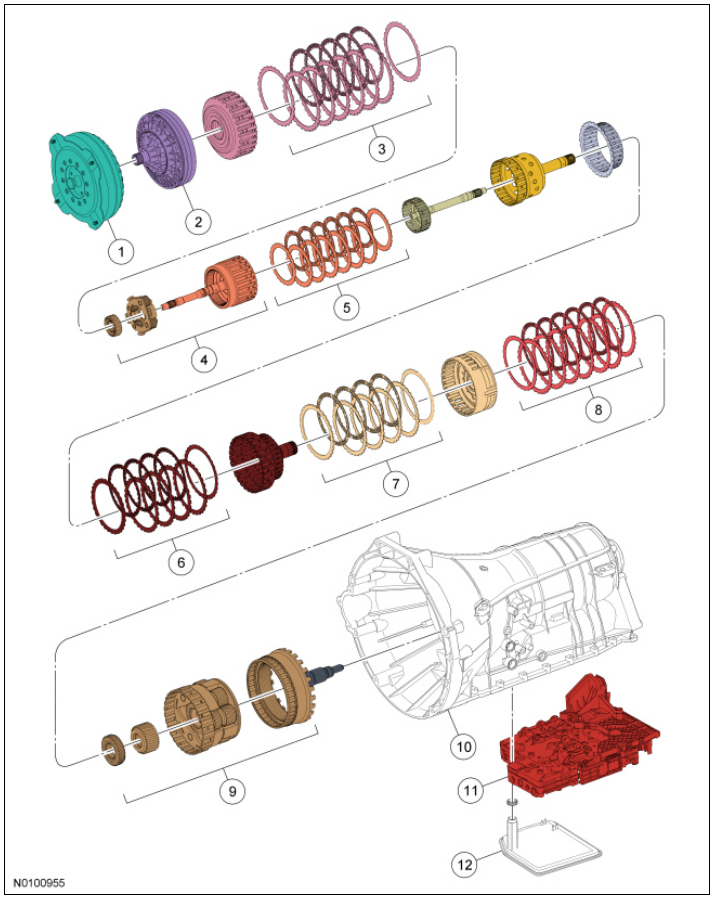
Output Shaft

The output shaft provides torque to the driveshaft and rear axle assembly. It is driven by the ring gear of the planetary gearset.

Major Components Cutaway View



Major Components Exploded View



Item	Part Number	Description
1	7902	Torque converter
2	7A103	Front pump assembly
3	-	Forward clutch (A) (quantity model dependant)
4	7A398	Front planetary gearset
5	-	Overdrive (O/D) clutch (E)
6	-	Direct clutch (B) (quantity model dependant)
7	-	Intermediate clutch (C) (quantity model dependant)
8	-	Low/reverse clutch (D)
9	7G224	Rear planetary gearset
10	7005	Transmission case
11	7A100	Main control assembly
12	7G186	Transmission fluid filter

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5
5.4L	Expedition, Navigator, F-150	5	6

Direct Clutch (B) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Intermediate Clutch (C) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

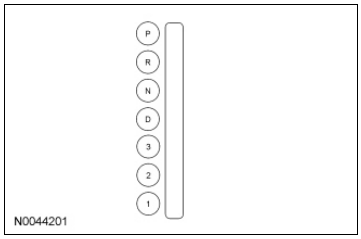
Gear Ratios

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Clutches are used to hold and drive certain combinations of gearsets. This results in 6 forward ratios and one reverse ratio which are transmitted to the rear planetary ring gear (output shaft). The planetary gearsets of this transmission provide the following ratios:

- Reverse:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 2.24:1 (reverse direction)
  - Total ratio of 3.40:1 (reverse direction)
- 1st gear:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 2.74:1
  - Total ratio of 4.17:1
- 2nd gear:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 1.54:1
  - Total ratio of 2.34:1
- 3rd gear:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 1:1
  - Total ratio of 1.52:1
- 4th gear:
  - Front planetary gearset provides ratios of 1:1 and 1.52:1 to different rear planetary gearset members
  - Rear planetary gearset ratio of 1.14:1
  - Total ratio of 1.14:1
- 5th gear:
  - Front planetary gearset provides ratios of 1:1 and 1.52:1 to different rear planetary gearset members
  - Rear planetary gearset ratio of 0.87:1
  - Total ratio of 0.87:1
- 6th gear:
  - Front planetary gearset ratio of 1:1
  - Rear planetary gearset ratio of 0.69:1
  - Total ratio of 0.69:1

Range Selection

The transmission has 7 range positions: P, R, N, D, 3, 2 and 1.



Park

In the PARK position:

- there is no power flow through the transmission.
- the park pawl locks the output shaft to the case.
- the engine can be started.
- the ignition key can be removed.

Reverse

In the REVERSE position:

- the vehicle can be operated in a rearward direction, at a reduced gear ratio.
- backup lamps are illuminated.

Neutral

In the NEUTRAL position:

- there is no power flow through the transmission.
- the output shaft is not held and is free to turn.
- the engine can be started.

D Position

The D is the normal position for most forward driving.

The D position provides:

- automatic shifts 1-6 and 6-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.

Position 3 - 3rd Gear

This position provides:

- manual 3rd gear.

Position 2 - 2nd Gear

This position provides:

- manual 2nd gear.

Position 1 - 1st Gear

This position provides:

- first gear operation only.
- engine braking for descending steep grades.

Gear Availability

MANUAL LEVER POSITION	TRANSAXLE GEAR OPERATION	DESCRIPTION
P	Park	Forward or reverse gears not available. Final drive is held to the transmission case.
R	Reverse	Transmission allows reverse only.
N	Neutral	Forward or reverse gears not available. Final drive moves freely.
D	[1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6]	6 forward gears are available. Gears are dependent on vehicle speed and throttle position with coast braking.
D Tow/Haul	[1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6]	1st through 6th gears are available. The shift scheduling is altered for higher shift speeds for a given throttle position. Transmission provides engine braking.
3	[1 ⇆ 2 ⇆ 3 ← 4 ← 5 ← 6]	3rd gear hold. Downshift to 3rd gear when 3 position is selected above a calibrated speed.
2	[1 ⇆ 2 ← 3 ← 4 ← 5 ← 6]	2nd gear hold. Downshift to 2nd gear when 2 position is selected above a calibrated speed.
1	[1 ← 2 ← 3 ← 4 ← 5 ← 6]	1st gear hold with engine braking, the transmission downshifts to 1st gear when 1 is selected above a calibrated speed under minimum to moderate accelerator pedal position.

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Torque Converter

The torque converter is a 4-element unit containing a 3-plate clutch. The clutch can be controlled and engaged in any gear 2 to 6. Calibration parameters may be set to allow lockup in a higher gear only. The clutch is applied by removing fluid pressure from one side of the plate. The torque converter transmits and multiplies torque. The torque converter includes the following 4 elements:

- Impeller assembly
- Turbine assembly
- Reactor assembly
- Torque Converter Clutch (TCC)

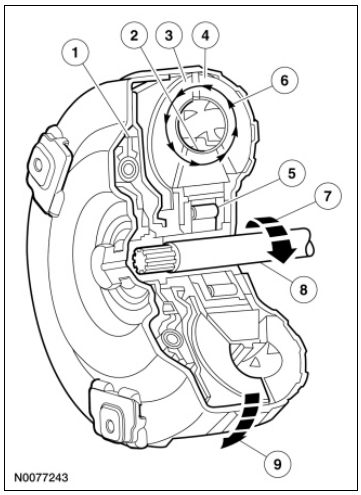
Rotation of the torque converter housing and impeller set the transmission fluid in motion by driving the impeller blades and pump.

The turbine is driven by the transmission fluid from the impeller and transmits power to the input shaft.

The reactor redirects transmission fluid flow returned from the turbine to the impeller so that it rotates in the same direction as the impeller. This action assists in torque multiplication.

The reactor has a One-Way Clutch (OWC) to hold it stationary during torque multiplication and allows it to rotate at higher vehicle speeds.

Torque Converter Operation



Item	Description
1	Torque Converter Clutch (TCC)
2	Reactor
3	Turbine
4	Impeller and cover assembly
5	One-Way Clutch (OWC)
6	Fluid motion
7	Input shaft rotation

8	Input shaft
9	Engine rotation

Torque Converter Clutch (TCC)

The TCC has a cover assembly with a 3-plate clutch and a turbine and damper assembly that connects to the transmission input shaft.

The TCC connects the cover to the turbine when the TCC is applied.

During TCC release, transmission fluid flows through the torque converter in one direction to release the 3-plate clutch.

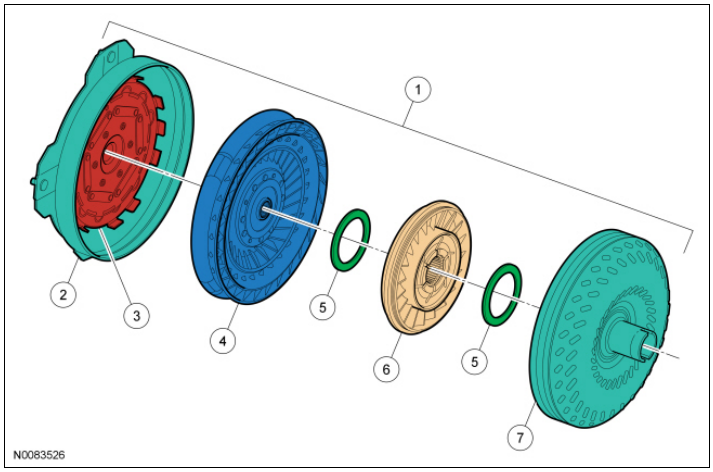
During TCC apply, transmission fluid flows through the torque converter in the opposite direction to apply the 3-plate clutch.

The TCC operates in 3 stages:

- Full release
- Controlled modulation
- Full apply

The Transmission Control Module (TCM) controls TCC operation using the TCC solenoid. TCC solenoid operation provides the modulation of hydraulic pressure to change the position of the bypass clutch control regulator valve. The valve changes the pressure and direction of transmission fluid flow in the torque converter. The TCC may be applied in forward gears, 2 to 6.

Torque Converter Exploded View



Item	Part Number	Description
1	7902	Torque converter assembly
2	-	Cover assembly with 3-plate clutch
3	-	3-plate clutch
4	-	Turbine and damper assembly
5	-	Needle bearing assemblies
6	-	Reactor assembly with One-Way Clutch (OWC)
7	-	Impeller assembly

Shift Patterns

Downshifts

Under certain conditions, the transmission will downshift automatically to a lower gear range (without moving the range selector lever). There are 3 categories of automatic downshifts:

- Coastdown
- Torque demand
- Forced or kickdown shifts

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

Mechanical Components and Functions

Planetary Gearset

This transmission has 2 planetary gearsets (front and rear) to provide operation in reverse and 6 forward speeds.

The front planetary gearset is a single planetary gearset and has the following components:

- Front planetary No. 1 sun gear
- Front planetary carrier
- Front planetary ring gear (part of the input shaft assembly)

The input shaft rotates the front ring gear as a driving member. The front sun gear is connected to the fluid pump and is held stationary. The front ring gear rotates the front planetary carrier assembly with a reduction ratio of 1.52:1

The front planetary carrier assembly is the only output member of the front planetary gearset in reverse, 1st gear, 2nd gear and 3rd gear. The front planetary gearset provides a 1.52:1 gear ratio to the rear planetary gearset.

In 4th gear and 5th gear, both the front ring gear and front planetary carrier assembly are output members of the front planetary gearset. The front planetary gearset provides both a 1:1 and 1.52:1 gear ratio to different members of the rear planetary gearset.

In 6th gear, the front ring gear is the only output member of the front planetary gearset. The front planetary gearset provides a 1:1 gear ratio to the rear planetary gearset.

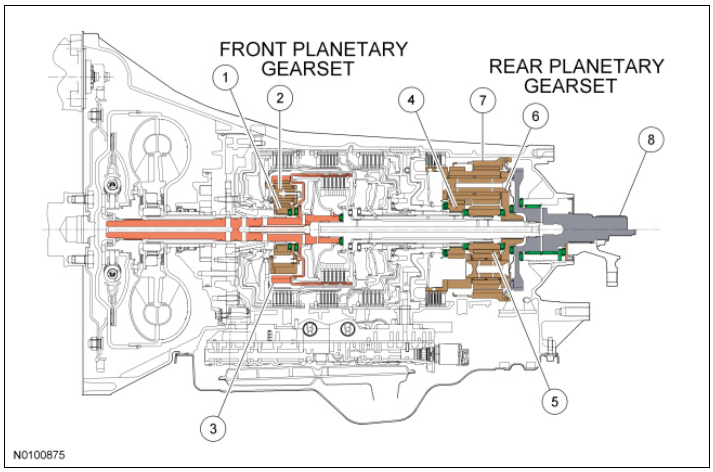
The rear planetary gearset is a ravigenaux planetary gearset and has the following components:

- Rear planetary No. 2 sun gear
- Rear planetary No. 3 sun gear
- Rear planetary carrier assembly (2 sets of pinion gears)
- Rear planetary ring gear assembly

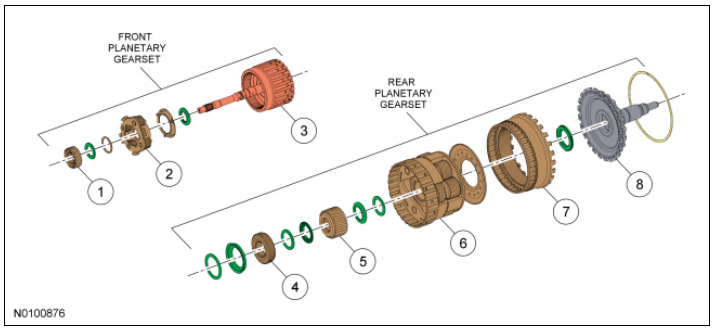
Powerflow through the rear planetary gearset is as follows:

- In reverse, rear sun gear No. 2 is driven, the rear planetary carrier is held and the ring gear is the output (2.24:1 with reverse direction)
- In 1st gear, sun gear No. 3 is driven, the rear planetary carrier is held and the ring gear is the output (2.74:1)
- In 2nd gear, sun gear No. 3 is driven, sun gear No. 2 is held and the ring gear is the output (1.54:1)
- In 3rd gear, sun gear No. 3 and sun gear No. 2 are driven and the ring gear is the output (1:1)
- In 4th gear, sun gear No. 3 and the rear planetary carrier are driven and the ring gear is the output (1.14:1)
- In 5th gear, sun gear No. 2 and the rear planetary carrier are driven and the ring gear is the output (0.87:1)
- In 6th gear, the rear planetary carrier is driven, sun gear No. 2 is held and the ring gear is the output (0.69:1)

Planetary Gearset Cutaway View



Planetary Gearset Exploded View



Item	Part Number	Description
1	7D063	Front planetary No. 1 sun gear
2	7A398	Front planetary carrier
3	7F207	Front planetary ring gear (part of input shaft assembly)
4	7D063	Rear planetary No. 2 sun gear
5	7D063	Rear planetary No. 3 sun gear
6	7D006	Rear planetary carrier
7	7A153	Rear planetary ring gear
8	7060	Output shaft

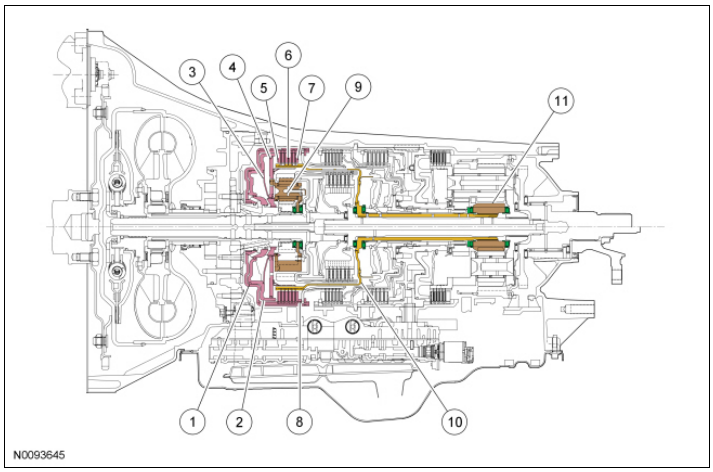
Forward Clutch (A)

NOTE: Friction and steel plate quantity will vary based on engine displacement. Refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

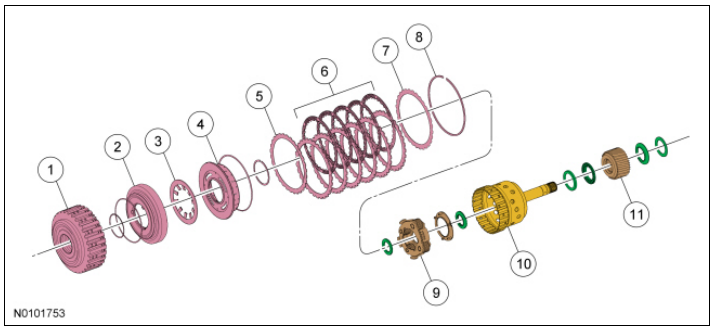
The forward clutch (A) connects the front planetary carrier to the rear No. 3 sun gear. This provides a reduction gear ratio of 1.52:1 from the input shaft to rear sun gear No. 3. The forward (A) is applied in 1st, 2nd, 3rd and 4th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the forward (A) clutch piston against the forward (A) clutch pack to apply the clutch. The front planetary carrier and the rear No. 3 sun gear are connected as a result of the clutch being applied.

Forward Clutch (A) Cutaway View



Forward Clutch (A) Exploded View



Item	Part Number	Description
1	7A360	Forward clutch (A) cylinder
2	7A262	Forward clutch piston
3	7A480	Forward clutch piston retaining spring
4	7H360	Forward clutch balance piston
5	7E085	Forward clutch wave spring
6	7B164	Forward clutch assembly (quantity model dependant)
7	7B066	Forward clutch pressure plate
8	7D483	Forward clutch snap ring
9	7A398	Front planetary carrier assembly
10	7B067	Rear planetary No. 3 sun gear hub and shaft assembly
11	7D063	Rear planetary No. 3 sun gear

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5

5.4L	Expedition, Navigator, F-150	5	6

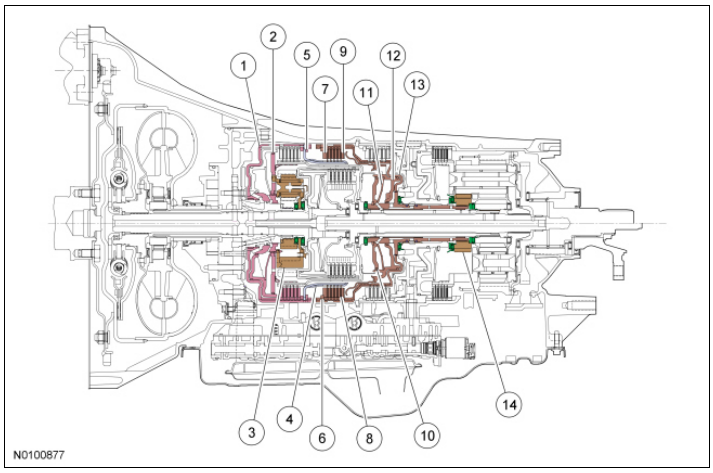
Direct Clutch (B)

NOTE: Friction and steel plate quantity will vary based on engine displacement. Refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

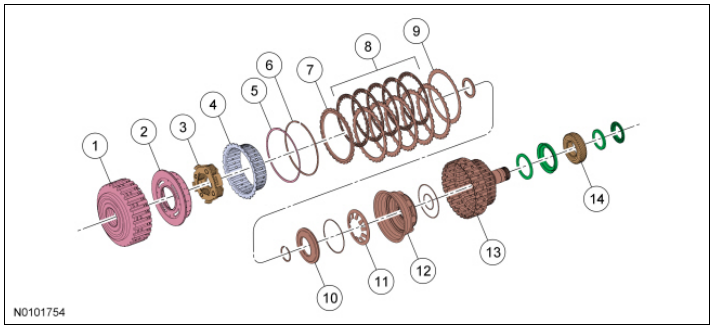
The direct clutch (B) connects the front planetary carrier to the rear No. 2 sun gear. This provides a reduction gear ratio of 1.52:1 from the input shaft to rear sun gear No. 2. The direct clutch (B) is applied in reverse, 3rd and 5th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the direct clutch (B) piston against the direct clutch (B) pack to apply the clutch. The front planetary carrier and the rear No. 2 sun gear are connected as a result of the clutch being applied.

Direct Clutch (B) Cutaway View



Direct Clutch (B) Exploded View



Item	Part Number	Description
1	7A360	Forward clutch (A) cylinder
2	7H360	Forward clutch balance piston
3	7A398	Front planetary carrier assembly
4	7F236	Direct clutch (B) hub
5	7C122	Direct clutch cylinder retaining ring
6	7D483	Direct clutch pressure plate retaining ring

7	7B066	Direct clutch pressure plate
8	-	Direct clutch assembly (quantity model dependant)
9	7E085	Direct clutch cushion plate
10	7H359	Direct clutch balance piston
11	7B488	Direct clutch piston return spring
12	7A262	Direct clutch piston
13	7F360	Direct clutch cylinder
14	7D063	Rear planetary sun gear No. 2

Direct Clutch (B) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

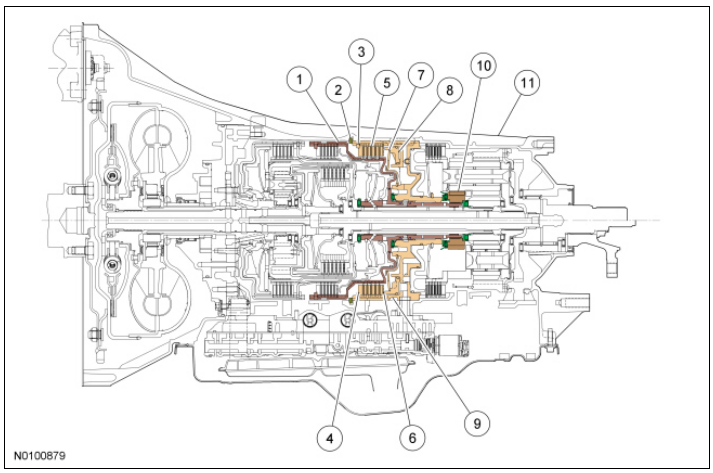
Intermediate Clutch (C)

NOTE: Friction and steel plate quantity will vary based on engine displacement. Refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

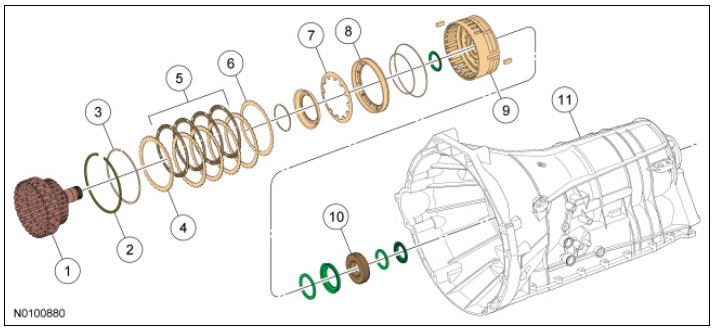
The intermediate clutch (C) holds the rear planetary No. 2 sun gear stationary to the transmission case. The intermediate clutch (C) is applied in 2nd and 6th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the intermediate clutch (C) piston against the intermediate clutch (C) pack to apply the clutch.

Intermediate Clutch (C) Cutaway View



Intermediate Clutch (C) Exploded View



Item	Part Number	Description
1	7F360	Direct clutch (B) cylinder
2	7D483	Center support retaining ring
3	7D483	Intermediate clutch (C) pressure plate retaining ring
4	7B066	Intermediate clutch pressure plate
5	7B164	Intermediate clutch assembly (quantity model dependant)
6	7E085	Intermediate clutch plate spring
7	7A480	Intermediate clutch piston return spring
8	7E005	Intermediate clutch piston
9	7A130	Center support assembly
10	7D063	Rear planetary sun gear No. 2
11	7005	Transmission case assembly

Intermediate Clutch (C) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

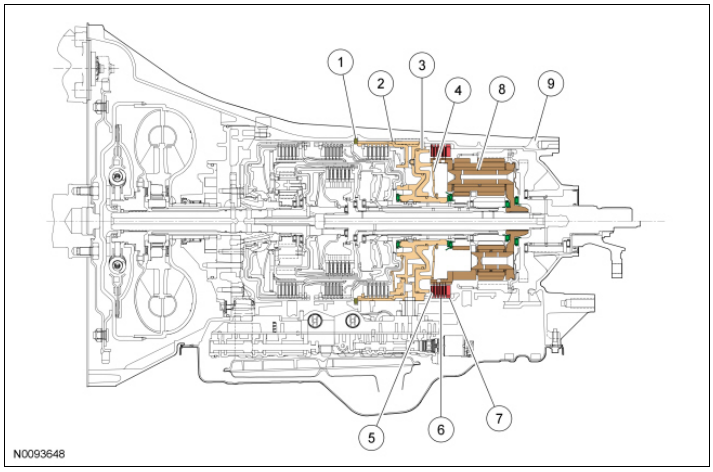
Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Low/Reverse Clutch (D)

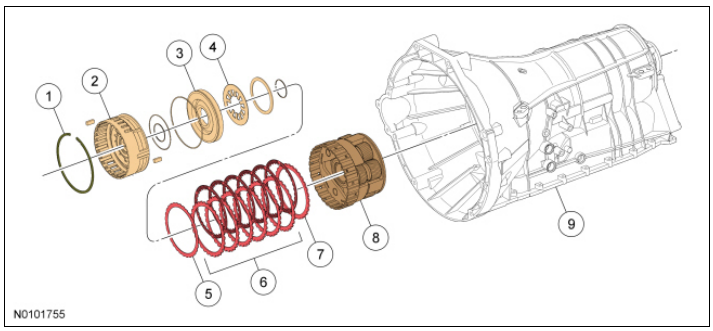
The low/reverse clutch (D) holds the rear planetary carrier stationary to the transmission case. The low/reverse clutch (D) is applied in park, reverse, neutral and 1st gear.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the low/reverse clutch (D) piston against the low/reverse clutch (D) pack to apply the clutch.

Low/Reverse Clutch (D) Cutaway View



Low/Reverse Clutch (D) Exploded View



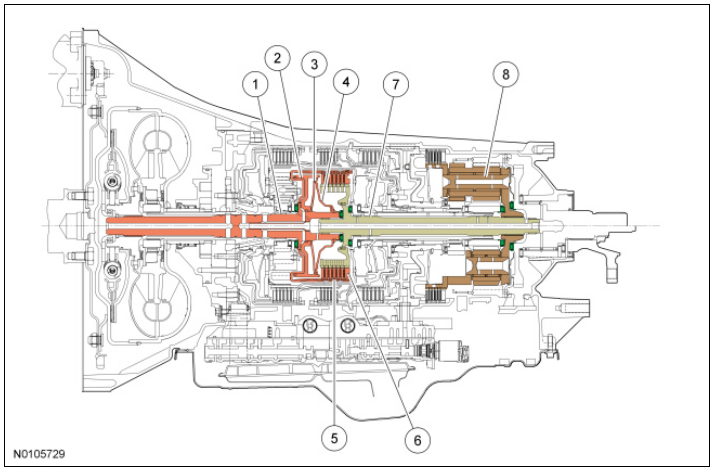
Item	Part Number	Description
1	7D483	Low/reverse clutch piston retaining ring
2	7A130	Center support assembly
3	7A262	Low/reverse clutch (D) piston
4	7B070	Low/reverse clutch piston return spring
5	7E085	Low/reverse clutch disc cushion plate
6	-	Low/reverse clutch assembly
7	7B442	Low/reverse clutch pressure plate
8	7D006	Rear planetary carrier assembly
9	7005	Transmission case assembly

Overdrive (O/D) Clutch (E)

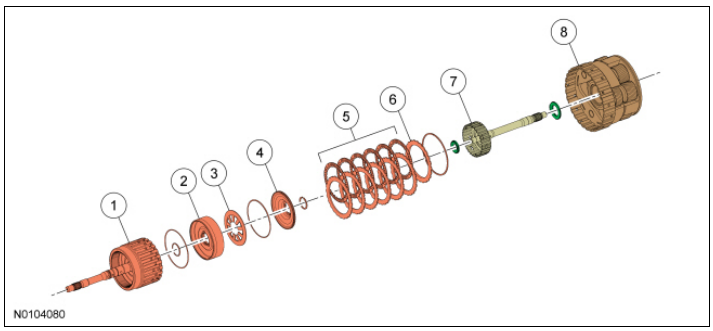
The O/D clutch (E) connects the input shaft with the rear planetary carrier. The O/D clutch (E) is applied in 4th, 5th and 6th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the O/D clutch (E) piston against the O/D clutch (E) pack to apply the clutch.

Overdrive (O/D) Clutch (E) Cutaway View



Overdrive (O/D) Clutch (E) Exploded View



Item	Part Number	Description
1	7F207	Input shaft assembly
2	7A262	Overdrive (O/D) clutch (E) piston
3	7B070	O/D clutch (E) piston spring
4	7H360	O/D clutch (E) balance piston
5	7B164	O/D clutch (E) assembly
6	7B066	O/D clutch (E) pressure plate
7	7F351	Intermediate shaft
8	7D006	Rear planetary carrier assembly

External Sealing

The pump assembly has a lip-type seal for the torque converter impeller hub. The pump assembly uses a large O-ring to seal the transmission case. The pump bolts also seal the pump to the transmission case.

The manual control shaft has a lip seal for its bore in the transmission case.

The transmission fluid pan uses a reusable gasket.

The Four-Wheel Drive (4WD) applications use a lip-type seal that seals the transmission case to the output shaft flange.

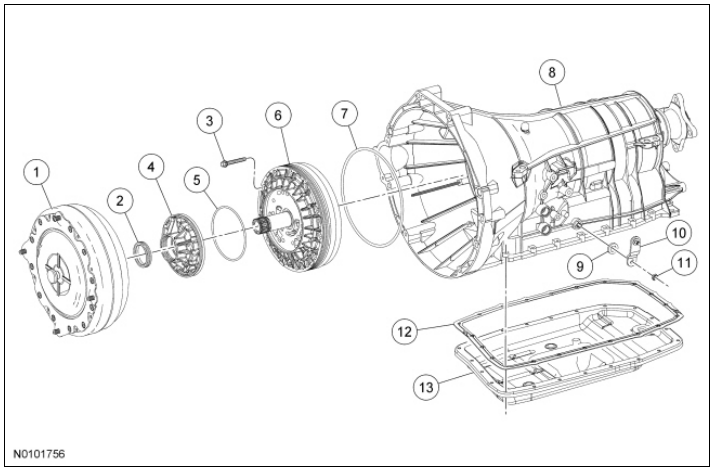
The Rear Wheel Drive (RWD) applications use a lip-type seal that seals the transmission case to the output shaft flange.

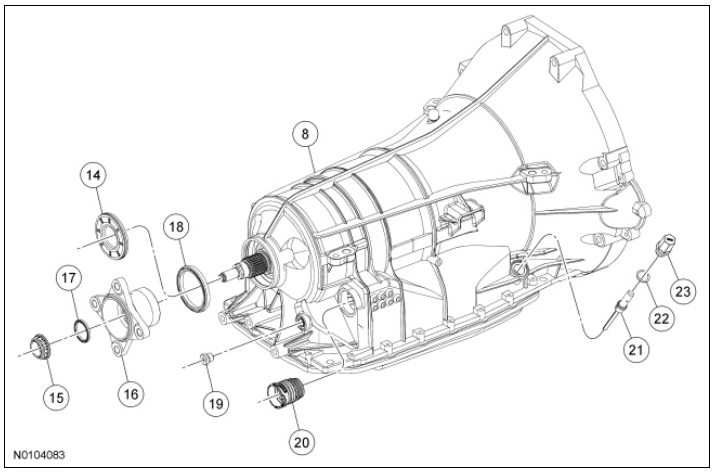
The transmission case housing plug provides access to the park pawl shaft. The plug has a seal that is serviced as an assembly with the plug.

The bulkhead connector sleeve has a seal for the transmission case bore. The seal is serviced as an assembly with the bulkhead connector sleeve.

The plug for the fluid level indicator uses an O-ring seal.

External Sealing (Gaskets, O-rings and Seals)





Item	Part Number	Description
1	7902	Torque converter
2	7A248	Torque converter hub seal
3	7N134	Pump assembly bolt
4	-	Pump body (part of 7A103)
5	7A248	Pump assembly inner seal
6	7A103	Pump assembly
7	7A248	Pump assembly outer seal
8	7005	Transmission case
9	7B498	Manual control lever shaft seal
10	7A256	Manual control lever
11	W708455	Manual control lever nut
12	7A191	Transmission fluid pan gasket

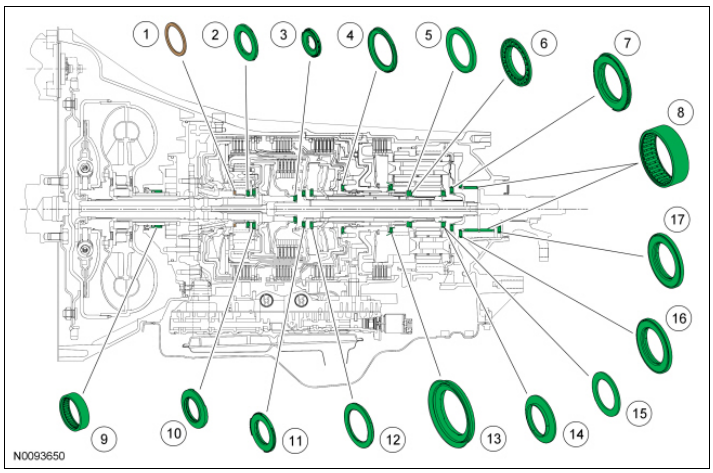
13	7A194	Transmission fluid pan
14	7052	Four-Wheel Drive (4WD) output shaft seal
15	7045	Rear Wheel Drive (RWD) output shaft flange nut
16	7089	RWD output shaft flange
17	7052	Extension housing flange seal
18	7052	RWD output shaft flange seal
19	7H398	Transmission case plug (park pawl shaft access)
20	7G276	Transmission bulkhead connector sleeve
21	7A010	Transmission fluid level indicator
22	-	Transmission fluid level indicator plug seal (part of 7A010)
23	-	Transmission fluid level indicator plug (part of 7A010)

Bushings, Bearings and Thrust Washer Locations

This transmission supports the rotating components of the transmission with bushings, bearings and thrust washers.

The pump assembly support thrust washer controls the amount of end play for components between the pump assembly and the center support (forward/Overdrive (O/D) clutch assembly, direct clutch cylinder).

The T8 thrust bearing outer race controls the amount of end play for components between the center support and the rear of the transmission case (rear planetary gearset assembly, output shaft assembly).



Item	Part Number	Description
1	7D014	Front pump support thrust washer
2	7H375	T1 thrust bearing
3	7C096	T3 thrust bearing
4	7F373	T6 thrust bearing
5	7D235	T8 thrust bearing outer race
6	7D234	T8 thrust bearing
7	7G178	T10 thrust bearing

8	7A415	Output shaft bearing assembly
9	-	Front oil pump bearing assembly (part of pump assembly, 7A103)
10	7L495	T2 bearing
11	7H375	T4 bearing
12	7C096	T5 bearing
13	7C041	T7 bearing
14	7D234	T9 bearing
15	-	T9 thrust bearing outer race
16	7B368	T11 bearing
17	7B368	T12 bearing

Lubrication

This transmission provides lubrication for rotating mechanical components through one main hydraulic circuit. The general flow of lubrication moves from the front of the transmission, through the input and intermediate shafts, to the rear of the transmission.

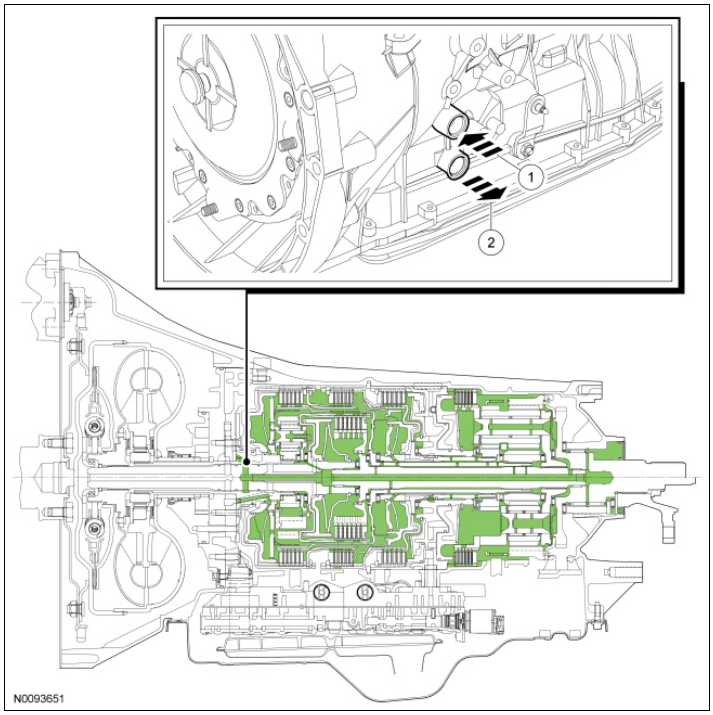
Transmission fluid from the pump assembly and the torque converter exit the transmission case to go to the transmission fluid cooler through the bottom transmission fluid cooler tube and returns to the transmission through the top transmission fluid cooler tube.

With lower transmission fluid temperatures, the thermal bypass valve in the transmission case will bypass the transmission fluid cooler tubes and redirect the fluid to the lubrication circuit. As transmission fluid temperature increases, the thermal bypass valve directs the fluid to the transmission fluid cooler.

Transmission fluid from the transmission fluid cooler or the thermal bypass valve enters the main lubrication circuit from the top transmission fluid cooler tube port.

Transmission fluid in the lubrication circuit flows to each of the balance pistons for the forward (A), direct (B) and Overdrive (O/D) (E) clutches. The balance pistons prevent unwanted clutch application when the clutch cylinder rotates at high speeds and hydraulic controls have released the clutch.

Lubrication Passages



Item	Description
1	Transmission fluid cooler return (inlet from the transmission fluid cooler)
2	Transmission fluid cooler pressure (outlet to the transmission fluid cooler)

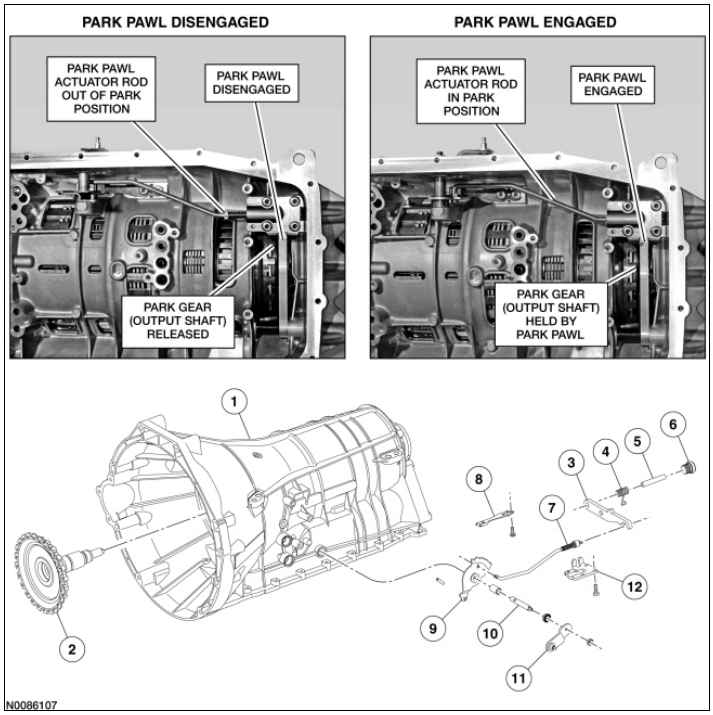
Park

The park gear is part of the output shaft assembly. The park gear has lugs on its OD surface that the park pawl engages with to lock the output shaft.

The park lock prevents the vehicle wheels from rotating by allowing the output shaft to be held stationary by the transmission case through the park pawl. When the park pawl is engaged in the park gear, the output shaft is held stationary.

When the manual control lever is rotated to the PARK position, the park lock works as follows:

- The detent assembly (connected to the manual control shaft) rotates and pushes the park pawl actuator rod into the park pawl. The actuator rod is spring loaded.
- The actuator rod is guided into the park pawl by the park pawl abutment.
- When the park pawl actuator rod is pushed into the park pawl, the park pawl pivots into the park gear and engages with the lugs.
- The park pawl holds the output shaft to the transmission case.



Item	Part Number	Description
1	7005	Transmission case
2	7060	Park gear (output shaft)
3	7A441	Park pawl
4	7D070	Park pawl return spring
5	7D010	Park pawl pin
6	7H398	Plug - park pawl pin
7	7G101	Park pawl actuator rod
8	7E332	Manual control lever detent spring
9	7A115	Manual valve detent assembly
10	7C493	Manual shaft
11	7A256	Manual control lever
12	7G101	Park pawl abutment

Hydraulic System

Pump Assembly and Transmission Fluid Filter

This transmission has a gear type pump that supplies transmission fluid pressure to the hydraulic system.

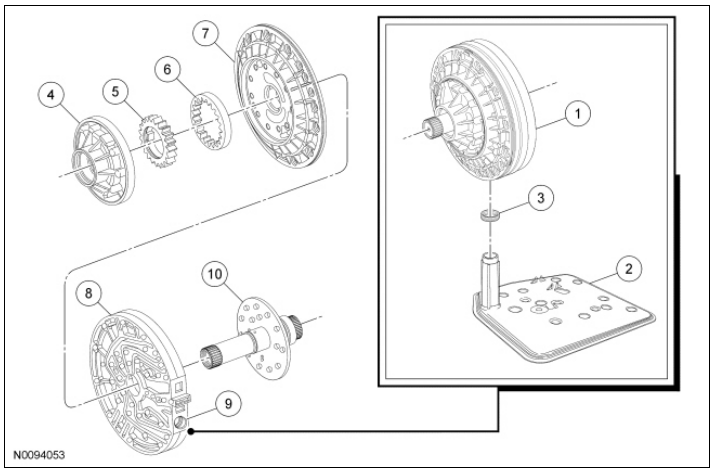
The inner (drive) gear is turned by the torque converter hub.

The transmission fluid pump has the following parts:

- Pump body, with inner (drive) and outer (driven) gears
- Centering plate
- Intermediate plate
- Stator shaft

The transmission fluid pump draws transmission fluid from the sump area, formed by the transmission fluid pan, through the transmission fluid filter, which is installed into the intermediate plate portion of the pump assembly and sealed by a rubber seal. A magnet attached to the transmission fluid pan collects any metallic material in the transmission fluid.

Pump Assembly and Transmission Fluid Filter Components



Item	Part Number	Description
1	7A103	Transmission fluid pump assembly
2	7A098	Transmission fluid filter
3	-	Transmission fluid filter seal (part of 7A098)
4	-	Transmission fluid pump body (part of 7A103)
5	-	Inner (drive) gear (part of 7A103)
6	-	Outer (driven) gear (part of 7A103)
7	-	Centering plate (part of 7A103)
8	-	Intermediate plate (part of 7A103)
9	-	Filter suction port

10	-	Stator shaft (part of 7A103)

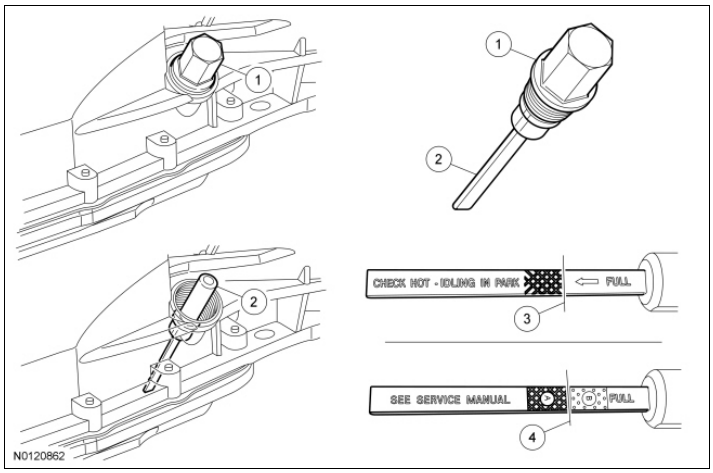
Transmission Fluid Level Indicator

A removable dipstick-type fluid level indicator is located on the right front area of the transmission case. It is held in by an external fluid fill plug. The transmission fluid level indicator is removed with the transmission fluid fill plug. The transmission fluid level indicator is removed from the fill plug to check the transmission fluid level.

The transmission fluid level is correctly checked when the transmission is at normal operating temperature, 80ºC-85ºC (175ºF-185ºF), and the vehicle is on a level surface.

The transmission can have 2 types of transmission fluid level indicators, the original or the replacement. The original transmission fluid level indicator has a single crosshatch area for the fluid level. The replacement has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the crosshatched area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.

Transmission Fluid Level Indicator



Item	Part Number	Description
1	-	Transmission fluid fill plug
2	7A010	Transmission fluid level indicator
3	-	Original transmission fluid level indicator FULL line
4	-	Replacement transmission fluid level indicator FULL line

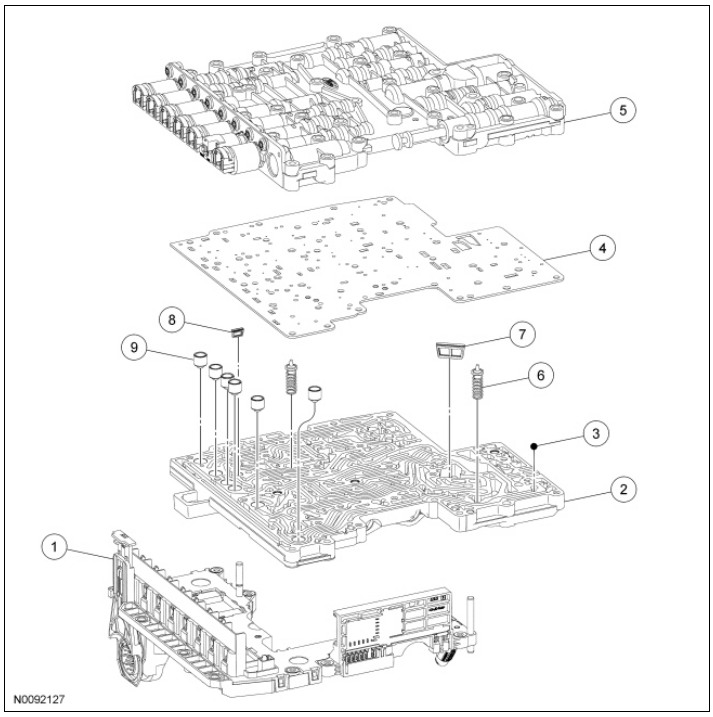
Main Control (Mechatronic) Assembly

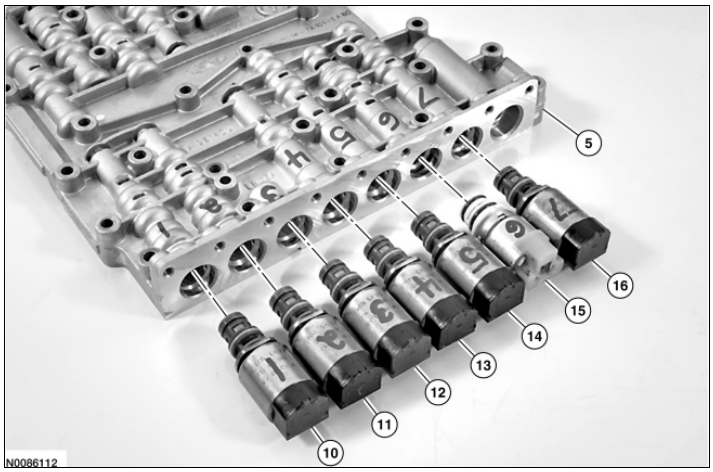
The hydraulic system of this transmission includes the fluid pump, a main control, or mechatronic assembly and fluid passages in the transmission case and center support to apply the clutches.

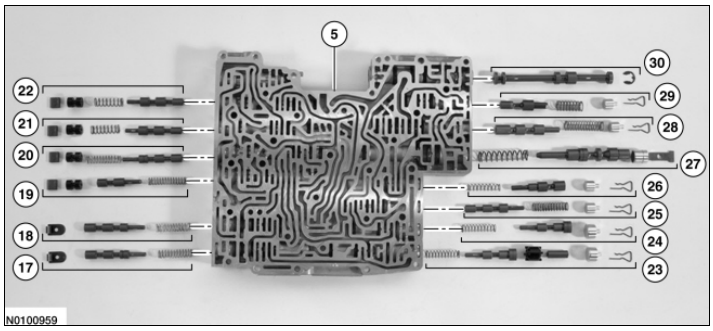
The main control assembly has an upper valve body assembly, a separator plate and a lower valve body assembly. The lower valve body assembly has 7 solenoids to control the valves in the main control.

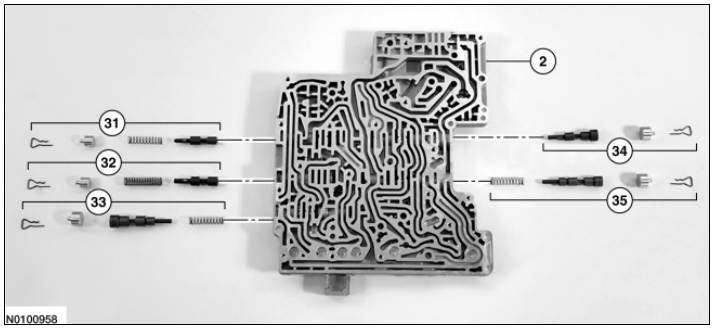
The Transmission Control Module (TCM) is part of the mechatronic assembly and is bolted to it. The Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor and the Transmission Fluid Temperature (TFT) sensor are all part of the TCM .

Mechatronic Assembly







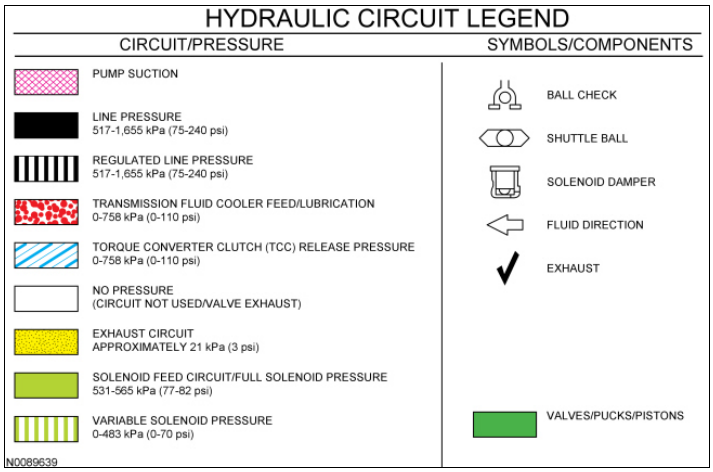


Item	Part Number	Description
1	-	Transmission Control Module (TCM) (part of 7A100)
2	-	Transmission control valve body (upper)
3	7E195	Transmission control valve check ball (8 required)
4	7Z490	Transmission control valve body separator plate
5	-	Transmission control valve body (lower)
6	-	Transmission control valve assembly
7	7H187	Transmission control filter assembly
8	7B155	Transmission fluid filter
9	-	Transmission solenoid damper valve assembly
10	7G383	Shift Solenoid A (SSA) Variable Force Solenoid (VFS)
11	7G383	Shift Solenoid B (SSB) VFS
12	7G383	Shift Solenoid C (SSC) VFS
13	7G383	Line Pressure Control (LPC) solenoid VFS
14	7G383	Shift Solenoid D (SSD) VFS
15	7G484	Shift Solenoid E (SSE) ON/OFF solenoid
16	7G383	Torque Converter Clutch (TCC) solenoid VFS
17	-	Forward (A) clutch latch valve assembly
18	-	Direct (B) clutch latch valve assembly
19	-	Solenoid regulator valve
20	-	Low/reverse (D1) clutch latch valve assembly
21	-	Drive enable valve
22	-	Solenoid multiplex valve
23	-	Forward (A) clutch regulator valve assembly
24	-	Overdrive (O/D) (E) clutch regulator valve assembly
25	-	O/D (E) clutch latch valve assembly
26	-	Bypass clutch control regulator valve assembly
27	-	Main regulator valve assembly
28	-	Converter release regulator valve assembly
29	-	Lubrication control valve assembly
30	-	Manual valve assembly
31	-	Low/reverse (D2) clutch latch valve assembly
32	-	Low/reverse (D2) clutch regulator valve assembly
33	-	Direct (B) clutch regulator valve assembly
34	-	Low/reverse (D1) clutch regulator valve assembly

35	-	Intermediate (C) clutch regulator valve

Hydraulic Circuits

Hydraulic Circuit Identification and Function



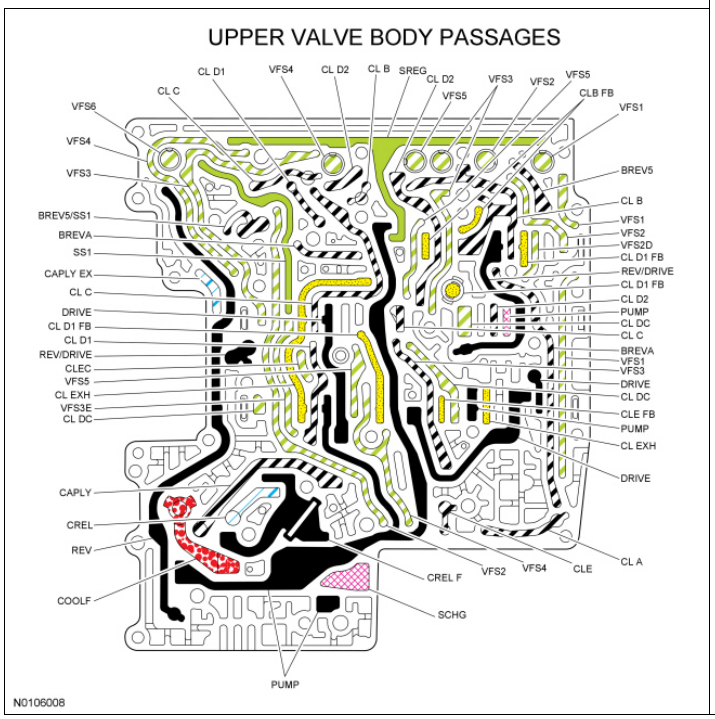
Hydraulic Circuit Identification Chart

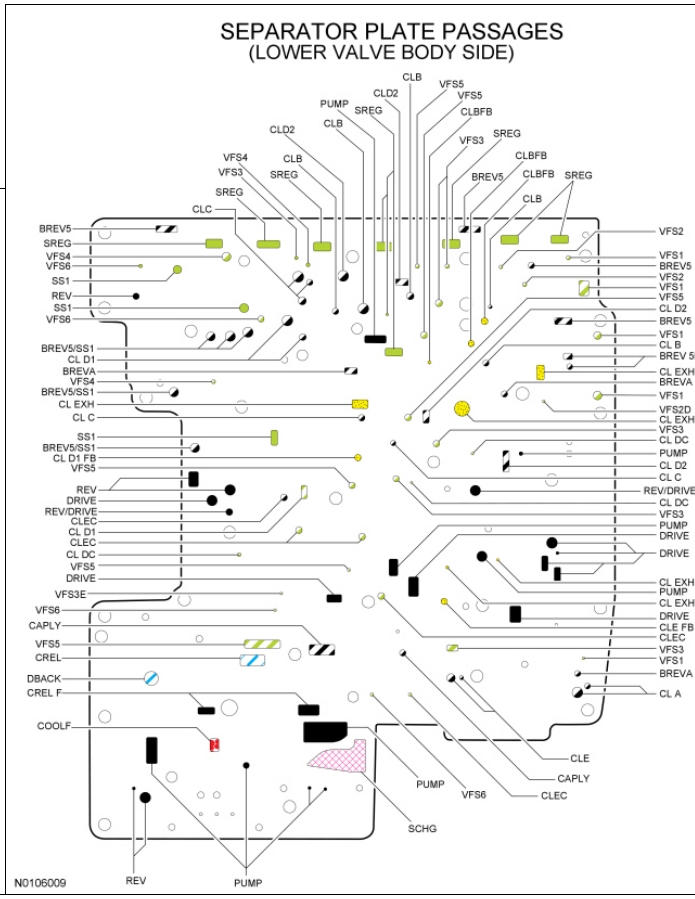
Circuit Name	Description
BREVA	BREV5 pressure from the drive enable valve to the clutch A regulator valve.
BREV5	BREV 5F pressure from the clutch A latch valve to the drive enable valve and the No. 2 shuttle ball.
BREV 5F	Regulated line pressure from the CL B circuit directed to the A clutch latch valve by the B clutch latch valve.
BREV5/SS1	BREV5 or SS1 pressure from the No. 2 shuttle ball to the solenoid multiplex valve.
CAPLY	Apply circuit to the torque converter, also the return circuit during Torque Converter Clutch (TCC) release.
CAPLY EX	TCC release pressure from the bypass clutch control regulator valve to the converter release regulator valve.
CAPLY F	Line pressure from the PUMP circuit directed to the bypass clutch control regulator valve by the main regulator valve.
CL A	Regulated line pressure from the clutch A regulator valve to the clutch A latch valve and the forward (A) clutch to apply the clutch.
CLA FB	Regulated line pressure from the clutch A latch valve that feeds back to the clutch A regulator valve.
CL B	Regulated line pressure from the clutch B regulator valve to the clutch B latch valve and the direct (B) clutch to apply the clutch.
CLB FB	Regulated line pressure from the clutch B latch valve that feeds back to the clutch B regulator valve.
CL C	Regulated line pressure from the clutch C regulator valve to the intermediate (C) clutch to apply the clutch.
CL D1	

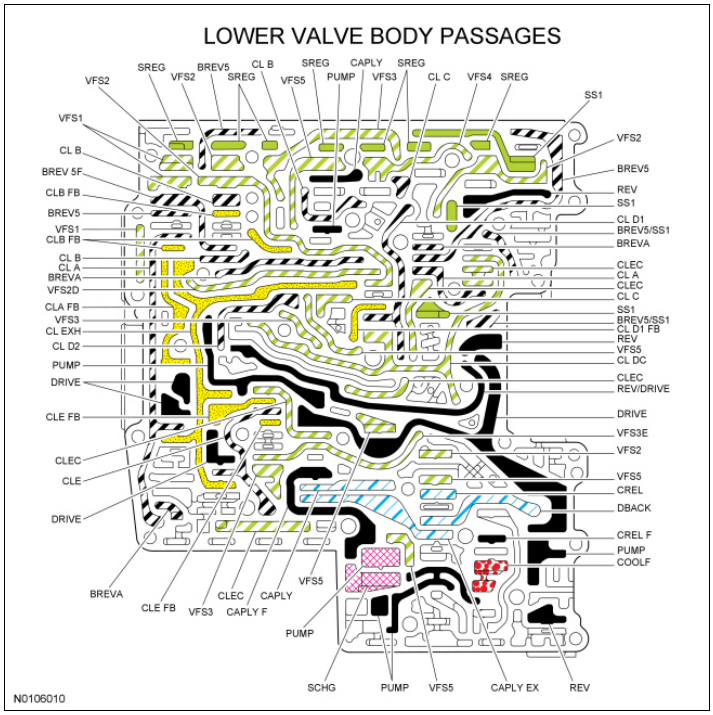
	Regulated line pressure from the clutch D1 regulator valve to the clutch D1 latch valve and the low/reverse (D) clutch to apply the clutch.
CL D1 FB	Regulated line pressure from the clutch D1 latch valve that feeds back to the clutch D1 regulator valve.
CL D2	Regulated line pressure from the clutch D2 regulator valve to the low/reverse (D) clutch to apply the clutch.
CL DC	Regulated solenoid output pressure from Shift Solenoid D (SSD) directed by the solenoid multiplex valve to the D1 and D2 regulator and latch valves to apply the low/reverse (D) clutch.
CLE	Regulated line pressure from the clutch E regulator valve to the clutch E latch valve and the Overdrive (O/D) (E) clutch to apply the clutch.
CLEC	Regulated solenoid output pressure from the CLEC F circuit directed by the drive enable valve to the clutch E regulator and latch valves to apply the clutch.
CLEC F	Regulated solenoid output pressure from the VFS4 circuit directed to the drive enable valve by the solenoid multiplex valve to move the clutch E regulator and latch valves to apply the O/D (E) clutch.
CLE FB	Regulated line pressure from the clutch E latch valve that feeds back to the clutch E regulator valve.
CL EXH	Line pressure regulated to approximately 21 kPa (3 psi) by the D2 latch valve that supplies exhaust pressure to the A, B, C, D1 and E clutch when the clutches are released.
COOLF	Pressure from the lubrication control valve to the oil cooler or the thermal bypass valve that feeds the lubrication circuit.
CREL	Pressure supplied to the torque converter by the converter release regulator valve to release the TCC .
CREL F	Line pressure from the main regulator valve that supplies the converter release regulator valve and the lubrication control valve.
DBACK	CAPLY EX pressure directed to the drain back valve by the converter release regulator valve.
DRIVE	Line pressure directed by the manual valve to the A, C and E clutch regulator valves and the No. 1 shuttle ball.
LUBE	Transmission lubrication circuit supplied by the COOLF circuit after the fluid circulates the transmission fluid cooler or is returned by the cooler bypass valve.
PUMP	Line pressure supplied by the pump to the manual valve, solenoid pressure regulator valve, main regulator valve, clutch D1 regulator valve, clutch D2 regulator valve and clutch D2 latch valve.
REV	Line pressure from the manual valve to the No. 1 shuttle ball and the solenoid multiplex valve.
REV/DRIVE	REV or DRIVE pressure from the No. 1 shuttle ball to the clutch B regulator valve.
SCHG	Line pressure from the main regulator valve to the pump suction port.
SREG	Line pressure from the solenoid regulator valve that supplies pressure to the 7 solenoids (Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), SSD , Shift Solenoid E (SSE), TCC solenoid and Line Pressure Control (LPC) solenoid).
SS1	Solenoid output pressure from SSE to the drive enable valve and to shuttle ball No. 2. to direct SSD output pressure to clutch E regulator and latch valves to apply the O/D (E) clutch.
VFS1	Solenoid output pressure from SSA to the A clutch regulator and latch valve to apply the forward (A) clutch.
VFS2	Solenoid output pressure from SSB to the B clutch regulator and latch valve to apply the direct (B) clutch and is also routed to the D1 latch valve.
VFS2D	SSB output pressure from the VFS2 circuit directed to the clutch B regulator valve by the D1 latch valve.

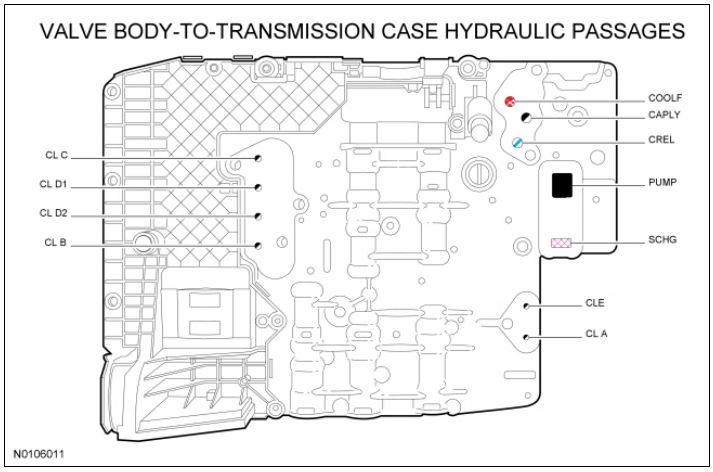
VFS3	Solenoid output pressure from SSC to the C clutch regulator valve to apply the intermediate (C) clutch and is also routed to the clutch E latch valve.
VFS3E	SSC output pressure from the VFS3 circuit directed to the clutch C regulator valve by the clutch E latch valve.
VFS4	Solenoid output pressure from SSD to the solenoid multiplex valve to apply either the D or E clutch.
VFS5	Solenoid output pressure from the LPC solenoid to the main regulator valve to control line pressure.
VFS6	Solenoid output pressure from the TCC solenoid to the bypass clutch control regulator valve and the converter release regulator valve to control the TCC .

Main Control Hydraulic Passage Identification







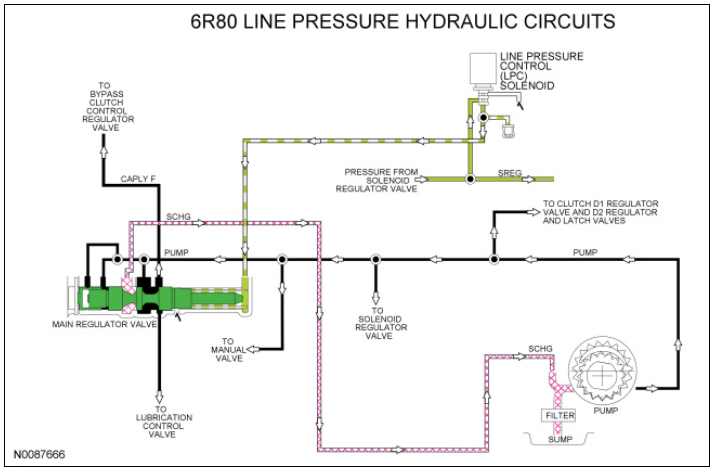


Line Pressure Hydraulic Circuits

The Transmission Control Module (TCM) controls line pressure with the Line Pressure Control (LPC) solenoid. Varying pressure from the LPC solenoid effects shift feel while allowing sufficient pressure for clutch application.

When the engine is running, the pump supplies pressure to the main regulator valve through the PUMP circuit. The position of the main regulator valve controls line pressure (in the PUMP circuit). Pressure from the LPC solenoid through the VFS5 circuit controls the position of the main regulator valve.

The main regulator valve varies pressure in the SCHG circuit. The higher the pressure in the SCHG circuit, the lower the line pressure (PUMP circuit) is. As SCHG pressure decreases, line pressure (PUMP circuit) increases.

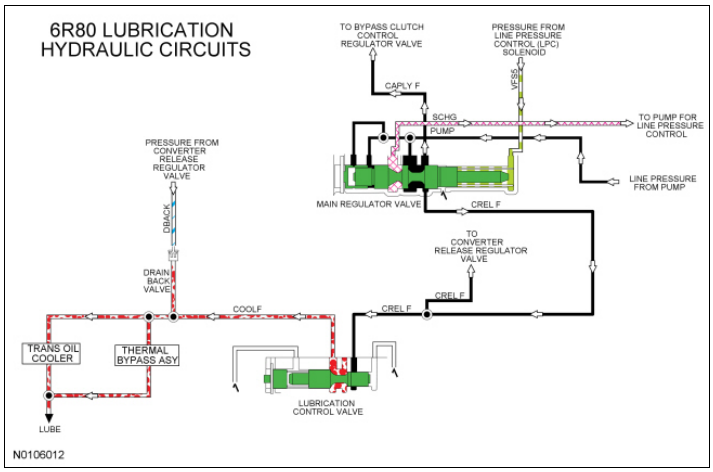


Lubrication Hydraulic Circuits

The main regulator valve supplies pressure to the lubrication control valve through the CREL F circuit. When the Torque Converter Clutch (TCC) is applied, the lubrication control valve supplies the transmission lubrication through the COOLF circuit to the LUBE circuit.

When the TCC is released, return fluid from the torque converter is supplied to the LUBE circuit through the CAPLY, CAPLY EX and DBACK circuits.

Pressure in the LUBE circuit either circulates through the thermal bypass valve when Transmission Fluid Temperature (TFT) is below operating temperature or through the transmission fluid cooler when the transmission fluid is at or above operating temperature. Return fluid from the thermal bypass valve or the transmission fluid cooler enters the input shaft through the pump assembly and flows through passages in the input shaft, intermediate shaft and output shaft to provide lubrication for the transmission.

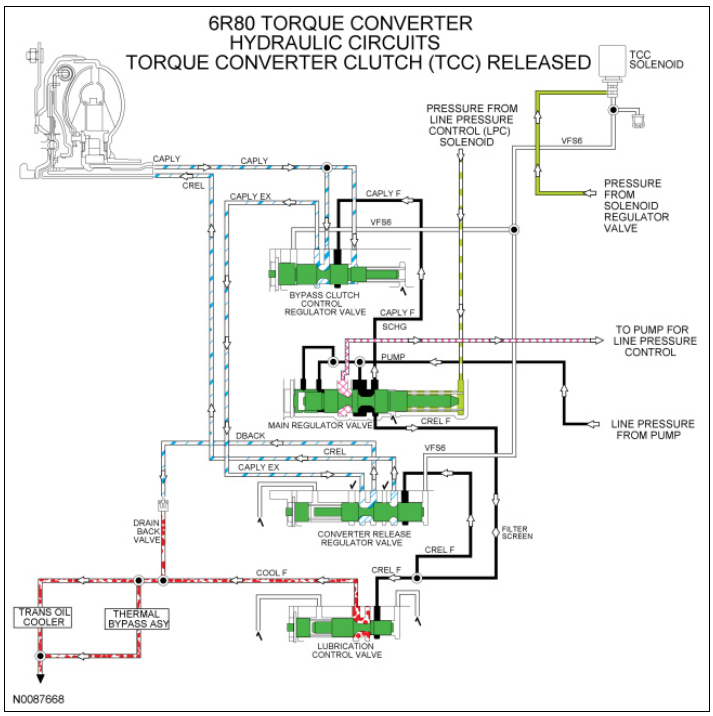


Torque Converter Hydraulic Circuits

When the TCC is released, line pressure is supplied to the converter release regulator valve from the lubrication control valve through the CREL F circuit. The converter release regulator valve supplies pressure to the torque converter through the CREL circuit to release the torque converter.

CREL pressure exits the torque converter through the CAPLY circuit and goes to the bypass clutch control regulator valve. The bypass clutch control regulator valve directs the fluid back to the converter release regulator valve through the CAPLY EX circuit. The converter release regulator valve directs the fluid to the

DBACK circuit where it supplies lubrication in the LUBE circuit.

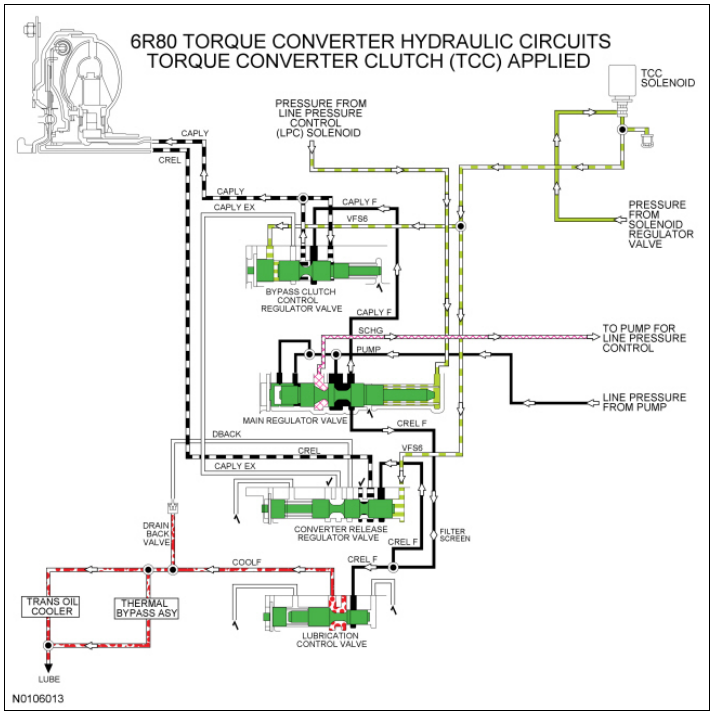


When the TCC is applied, the TCC solenoid applies hydraulic pressure to the bypass clutch control regulator valve and the converter release regulator valve through the VFS6 circuit to position the valves to apply the TCC .

Line pressure is supplied to the bypass clutch control regulator valve from the main regulator valve. The bypass clutch control regulator valve directs regulated line pressure to the TCC through the CAPLY circuit to apply the TCC .

CAPLY pressure exits the torque converter through the CREL circuit and goes to the converter release regulator valve.

For torque converter description and function, refer to Torque Converter Contamination Inspection in this section.



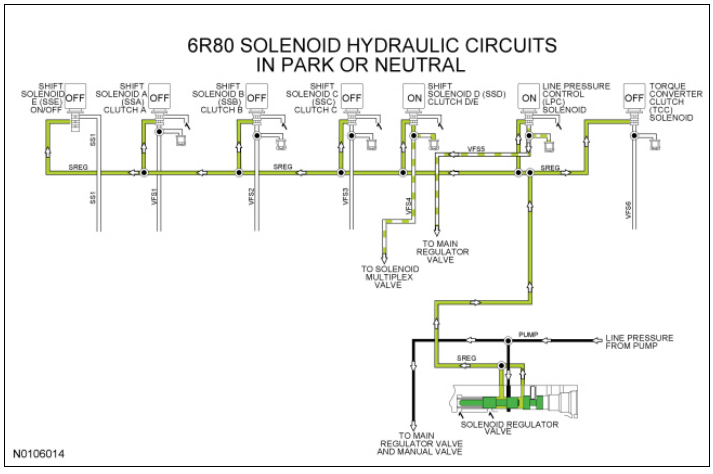
Solenoid Hydraulic Circuits

LINE pressure from the pump is directed to the individual shift, TCC and LPC solenoids by the solenoid regulator valve through the SREG circuit. The solenoids, controlled by the TCM , direct full or regulated SREG pressure to the valves that they control.

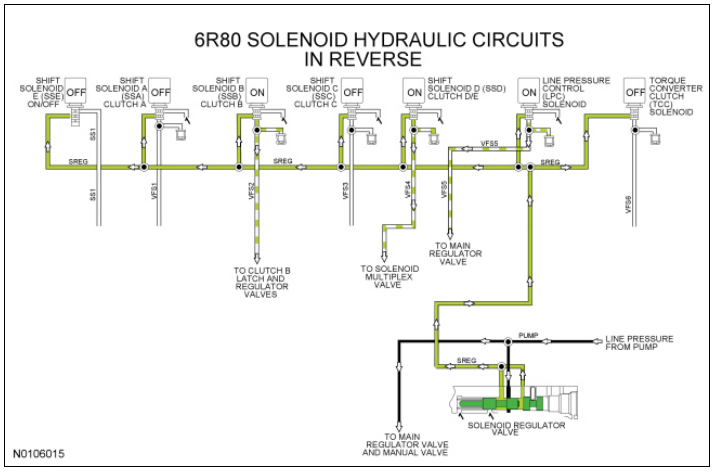
For electrical operation of the solenoids, refer to Transmission Electronic Control System in this section.

The LPC solenoid sends varying pressure to the main regulator valve to control line pressure.

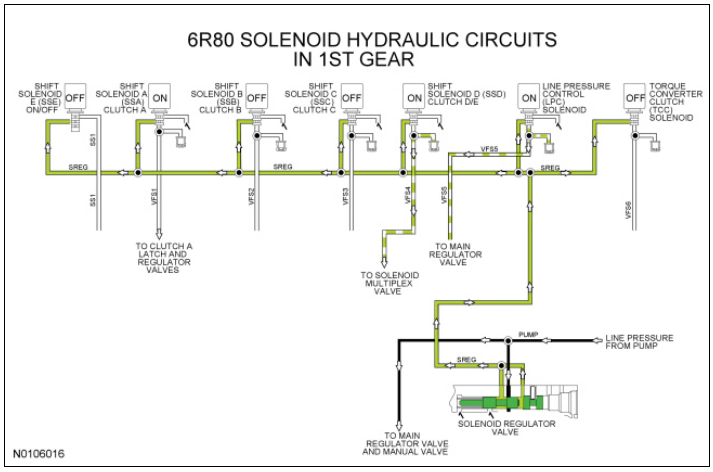
In the PARK and NEUTRAL position, the TCM supplies low amperage to Shift Solenoid D (SSD) to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 and D2 regulator and latch valves to apply the low/reverse clutch (D).



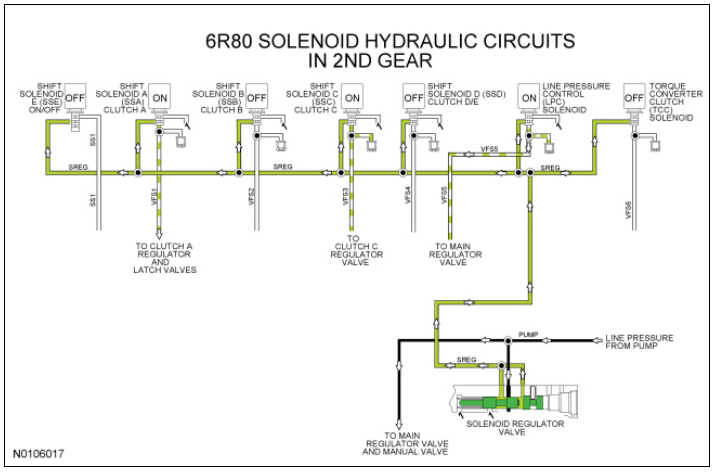
In the REVERSE position, the TCM supplies low amperage to Shift Solenoid B (SSB) to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B). The TCM also supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 and D2 regulator and latch valves to apply the low/reverse clutch (D).



In 1st gear, the TCM supplies high amperage to Shift Solenoid A (SSA) to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 and D2 regulator and latch valves to apply the low/reverse clutch (D).

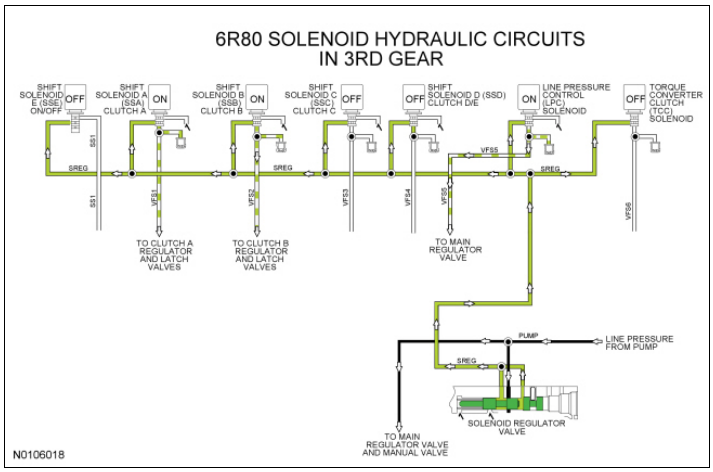


In 2nd gear, the TCM supplies high amperage to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies high amperage to Shift Solenoid C (SSC) to apply high-regulated pressure to the clutch C regulator valve to apply the intermediate clutch (C).

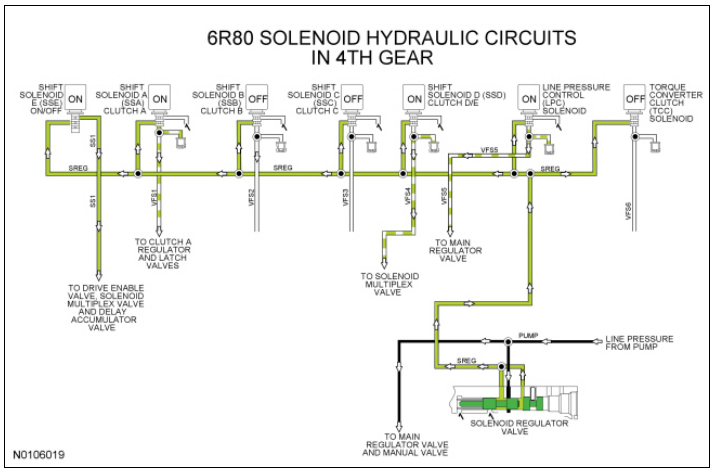


In 3rd gear, the TCM supplies high amperage to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies low amperage to Shift

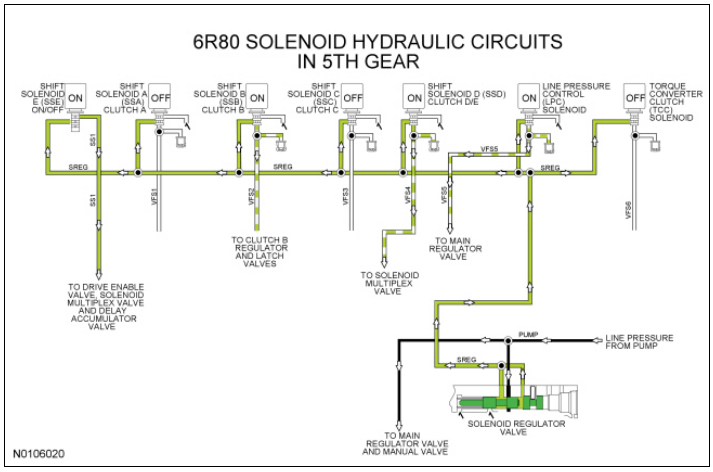
Solenoid B (SSB) to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B).



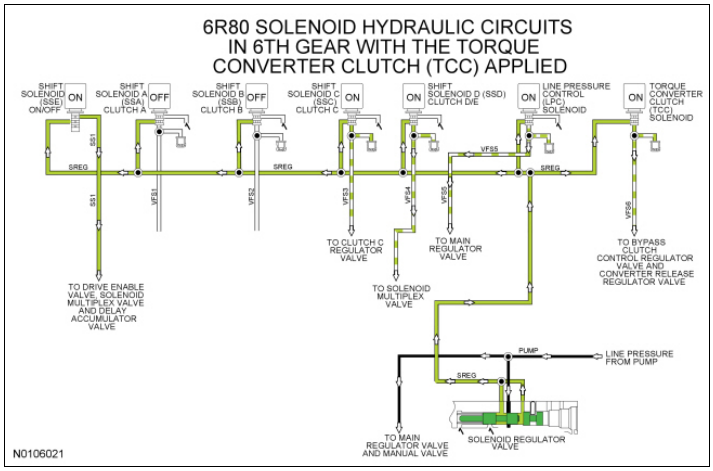
In 4th gear, the TCM supplies high amperage to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the Overdrive (O/D) clutch (E). The TCM turns on Shift Solenoid E (SSE) to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves.



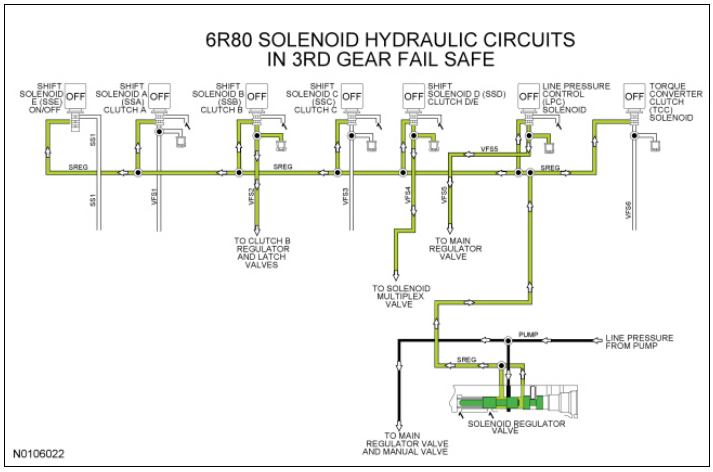
In 5th gear, the TCM supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the O/D clutch (E). The TCM turns on SSE to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves. The TCM also supplies low amperage to SSB to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B).



In 6th gear, the TCM supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the O/D clutch (E). The TCM turns on SSE to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves. The TCM also supplies high amperage to SSC to apply high-regulated pressure to the clutch C regulator valve to apply the intermediate clutch (C). To apply the TCC , the TCM supplies high amperage to the TCC solenoid to apply high-regulated pressure to the converter release regulator valve and the bypass clutch control regulator valve to apply the TCC .



In 3rd gear fail safe, all solenoids are off. SSB , in the off position, applies high pressure to the clutch B regulator and latch valves to apply the direct clutch (B). The forward clutch (A) is hydraulically applied in 3rd gear fail safe. The LPC solenoid provides maximum solenoid pressure to the main regulator valve for maximum line pressure. Also, SSD is on which applies high pressure to the solenoid multiplex valve which is directed to the drive enable valve where it is blocked.

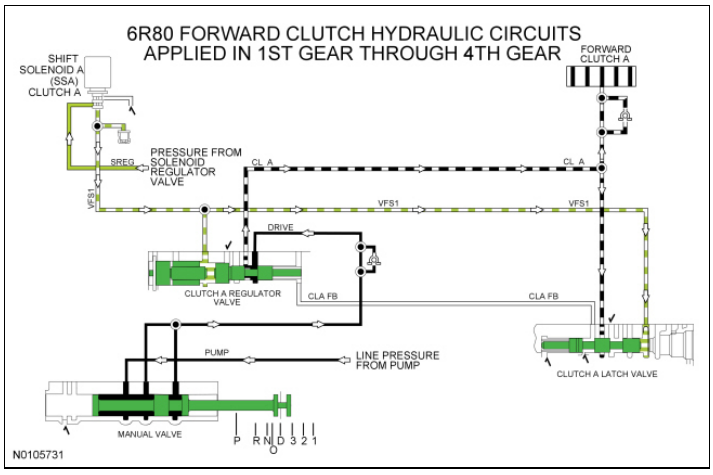


Forward Clutch (A) Hydraulic Circuits

To apply the forward clutch (A), the manual valve must be in the DRIVE, 3, 2 or 1 position to provide line pressure to the clutch A regulator valve through the DRIVE circuit.

For the forward clutch (A) to apply, SSA provides regulated solenoid pressure from the SREG circuit to the clutch A regulator and latch valves through the VFS1 circuit to position the valves to apply the forward clutch (A). As the forward clutch is applied, SSA increases pressure to the clutch A regulator and latch valves.

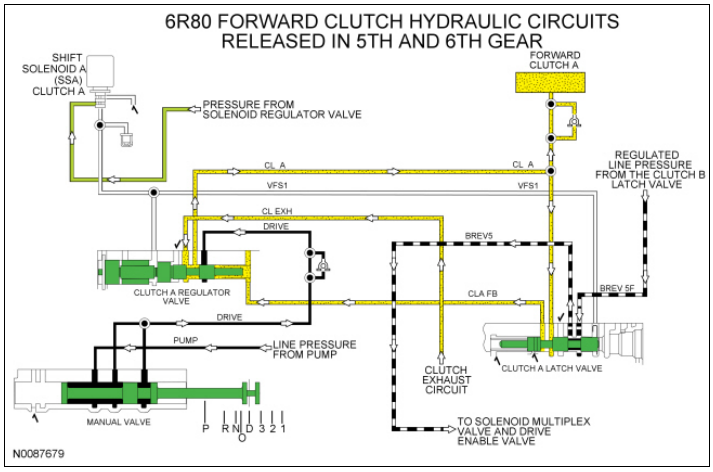
The clutch A regulator valve provides regulated line pressure to the CL A circuit to apply the forward clutch (A).



The forward clutch (A) is released when the manual valve is in the NEUTRAL, REVERSE or PARK position or the when the manual valve is in the DRIVE position with the transmission in 5th or 6th gear.

SSA lowers pressure to the clutch A regulator and latch valve to position the valves to lower the regulated line pressure in the CL A circuit to release the clutch.

When the forward clutch (A) is released, the clutch A regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL A circuit to fill the circuit and the forward clutch (A) with fluid at low pressure, approximately 21 kPa (3 psi).

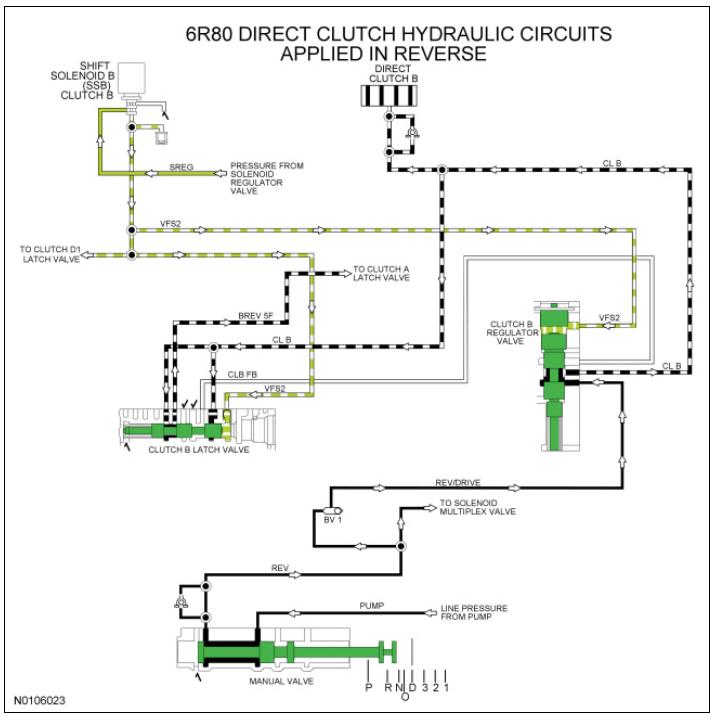


Direct Clutch (B) Hydraulic Circuits

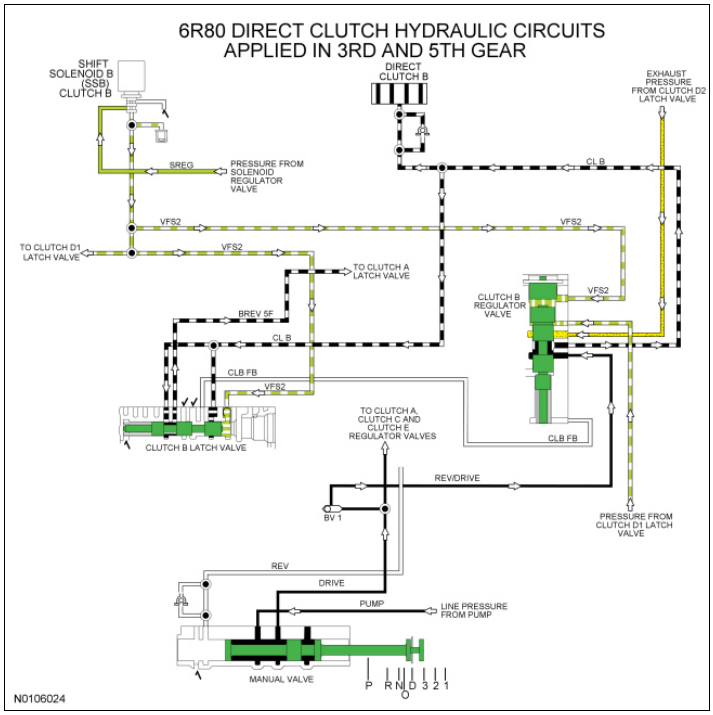
To apply the direct clutch (B), the manual valve can be in the REVERSE, DRIVE, 3, 2 or 1 position to provide line pressure to the clutch B regulator valve through the REV/DRIVE circuit.

For the direct clutch (B) to apply in reverse, SSB provides regulated solenoid pressure from the SREG circuit to the clutch B regulator and latch valves through the VFS2 circuit to position the valves to apply the direct clutch (B). As the direct clutch is applied, SSB increases pressure to the clutch B regulator and latch valves.

The clutch B regulator valve provides regulated line pressure to the CL B circuit to apply the direct clutch (B).

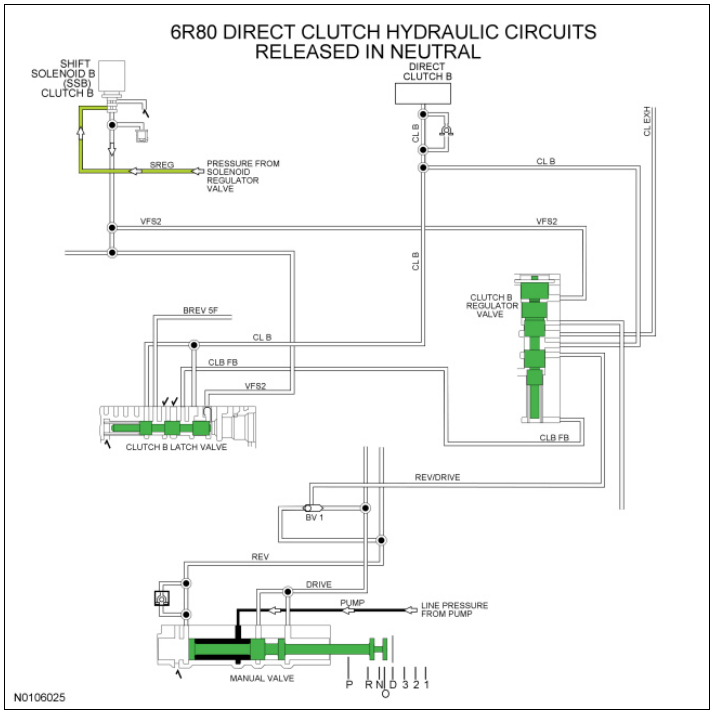


When the direct clutch (B) is applied in 3rd and 5th gear, regulated solenoid pressure from the D1 latch valve is supplied to the clutch B regulator valve through the VFS2D circuit and opposes pressure from the VFS2 circuit for clutch B valve positioning.



The direct clutch (B) is released when the manual valve is in the PARK or NEUTRAL position or when the manual valve is in the DRIVE position with the transmission in 1st, 2nd, 4th or 6th gear.

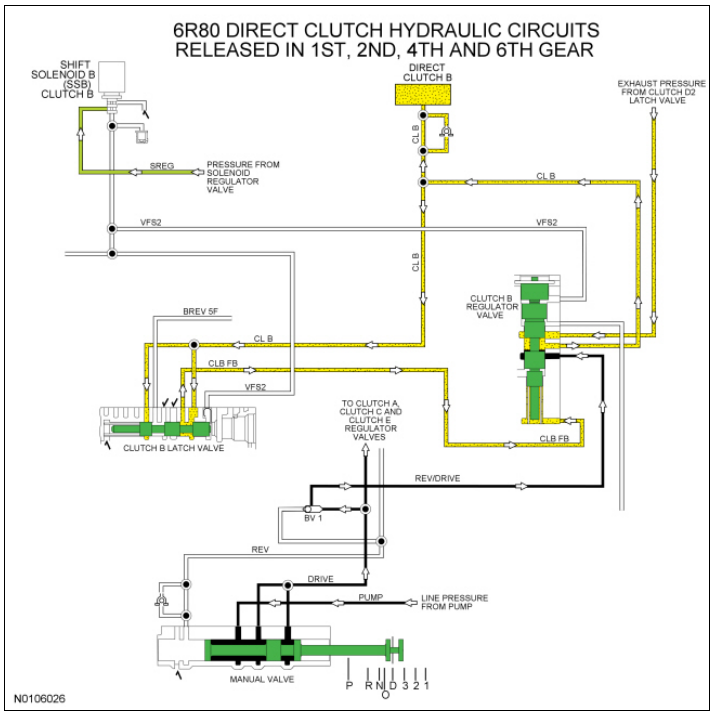
In NEUTRAL or PARK, the manual valve does not supply line pressure to the clutch B regulator valve. SSB lowers pressure to the clutch B regulator and latch valve to position the valves to lower the regulated line pressure in the CL B circuit to release the clutch.



In 1st, 2nd, 4th or 6th gear, the manual valve supplies line pressure to the clutch B regulator valve. SSB lowers pressure to the clutch B regulator and latch valve to position the valves to lower the regulated line pressure in the CL B circuit to release the clutch.

When the direct clutch (B) is released in 1st, 2nd, 4th or 6th gear, the clutch (B) regulator valve directs

exhaust circuit pressure from the CL EXH circuit to the CL B circuit to fill the circuit and the direct clutch (B) with fluid at low pressure, approximately 21 kPa (3 psi).



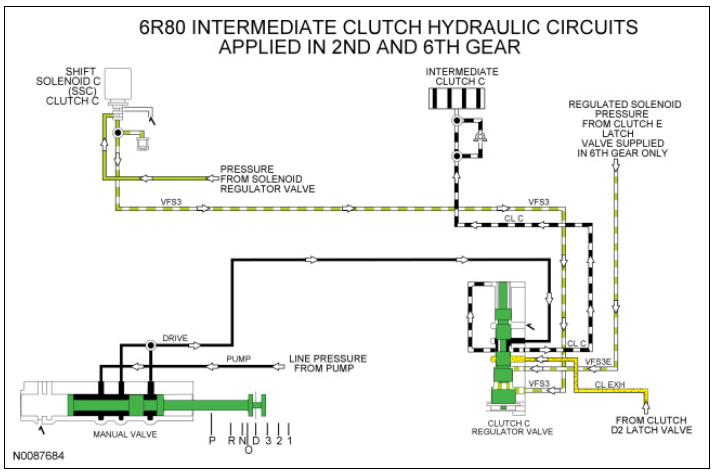
Intermediate Clutch (C) Hydraulic Circuits

To apply the intermediate clutch (C), the manual valve can be in the DRIVE, 3, 2 or 1 position to provide line pressure to the clutch C regulator valve through the DRIVE circuit.

SSC provides regulated solenoid pressure from the SREG circuit to the clutch C regulator valve through the VFS3 circuit to position the valve to apply the intermediate clutch (C). As the intermediate clutch (C) is applied, SSC increases pressure to the clutch C regulator valve.

The clutch C regulator valve provides regulated line pressure to the CL C circuit to apply the intermediate clutch (C).

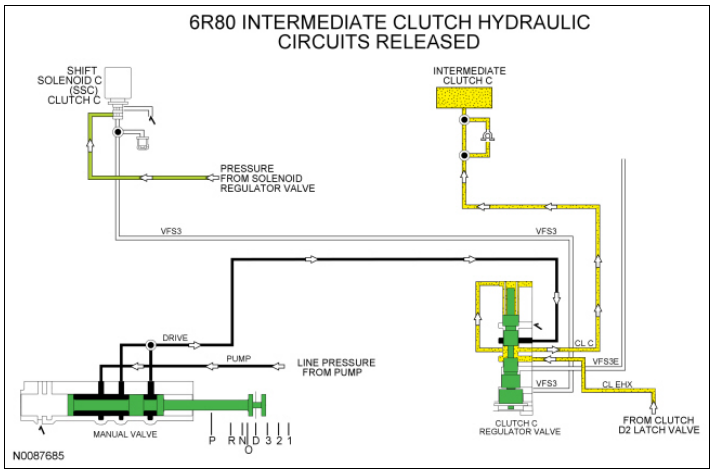
Regulated solenoid pressure from the clutch E latch valve is supplied to the clutch C regulator valve through the VFS3E circuit and opposes VFS3 pressure for clutch C regulator valve positioning in 6th gear only.



To release the intermediate clutch (C) when the manual valve is in the DRIVE, 3, 2 or 1 position SSC lowers pressure to the clutch C regulator valve to position the valve to lower the regulated line pressure in the CL C circuit to release the clutch.

When the intermediate clutch (C) is released, the clutch C regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL C circuit to fill the CL C circuit and the intermediate clutch (C) with fluid at low pressure, approximately 21 kPa (3 psi).

In PARK, REVERSE or NEUTRAL, the manual valve does not supply line pressure to the clutch C regulator valve.

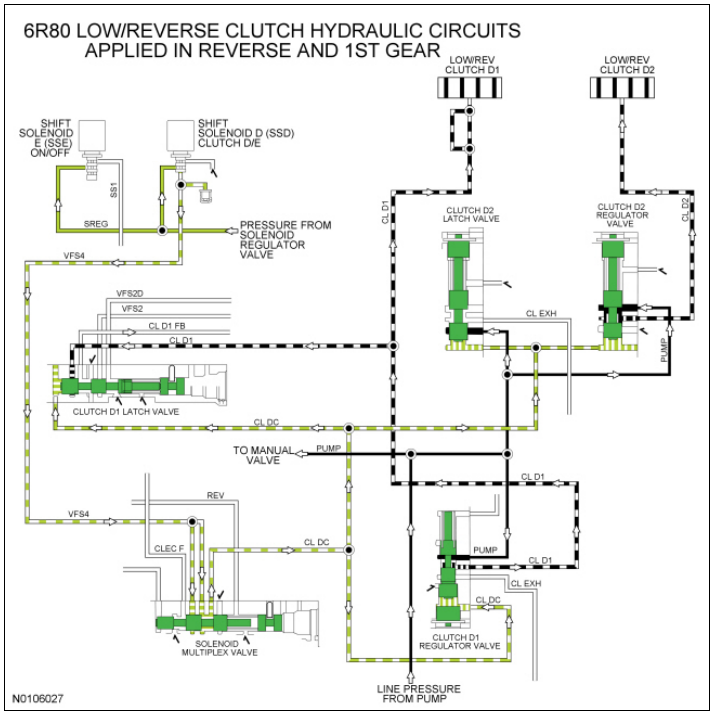


Low/Reverse Clutch (D) Hydraulic Circuits

To apply the low/reverse clutch (D), the manual valve can be in any position. Line pressure is supplied to the D1 and D2 regulator and latch valves by the pump through the PUMP circuit.

SSD provides regulated solenoid pressure from the SREG circuit to the solenoid multiplex valve through the VFS4 circuit where it is directed to the D1 and D2 regulator and latch valves through the CL DC circuit to position the valves to apply the low/reverse clutch (D). As the low/reverse clutch (D) is applied, SSD increases pressure to the D1 and D2 clutch regulator and latch valves.

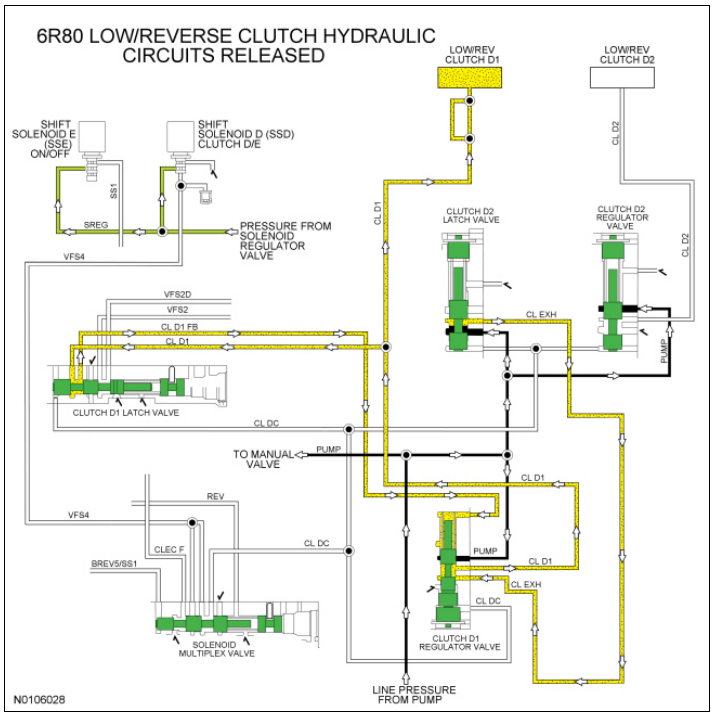
The clutch D1 and D2 regulator valves provide regulated line pressure from the PUMP circuit to the CL D1 and CL D2 circuits to apply the low/reverse clutch (D).



To release the low/reverse clutch (D), the manual valve can be in the DRIVE, 3 or 2 position. SSD lowers pressure to the VFS4 circuit which lowers pressure in the CL DC circuit to position the D1 and D2 regulator and latch valves to lower pressure in the CL D1 and CL D2 circuits and release the low/reverse clutch (D).

When the low/reverse clutch (D) is released, the clutch D2 latch valve directs line pressure regulated to approximately 21 kPa (3 psi) to the CL EXH circuit which fills the volume of the unused clutches and circuits.

When the low/reverse clutch (D) is released, the CL EXH circuit supplies the D1 regulator valve which fills the CL D1 circuit and the low/reverse (D) clutch.

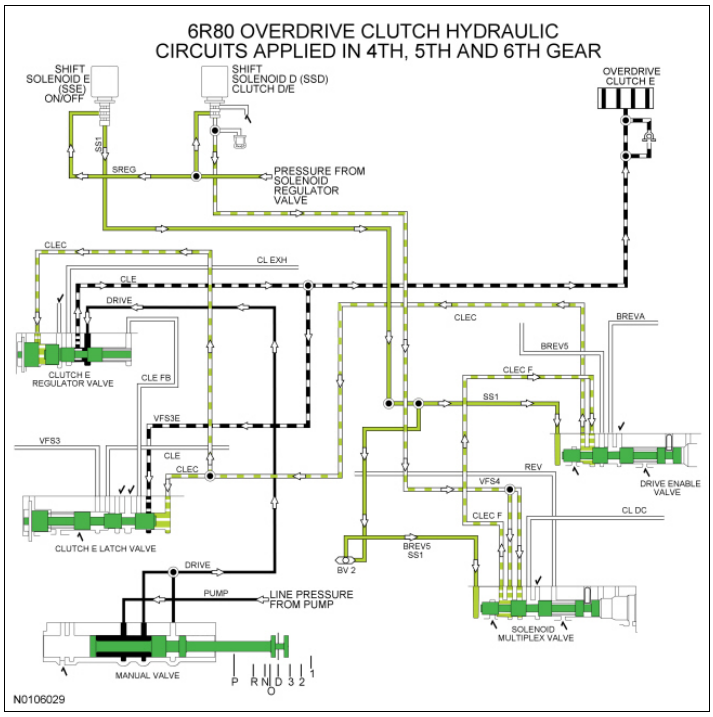


Overdrive (O/D) Clutch (E) Hydraulic Circuits

To apply the O/D clutch (E), the manual valve must be in the DRIVE position. Line pressure is supplied to the clutch E regulator valve.

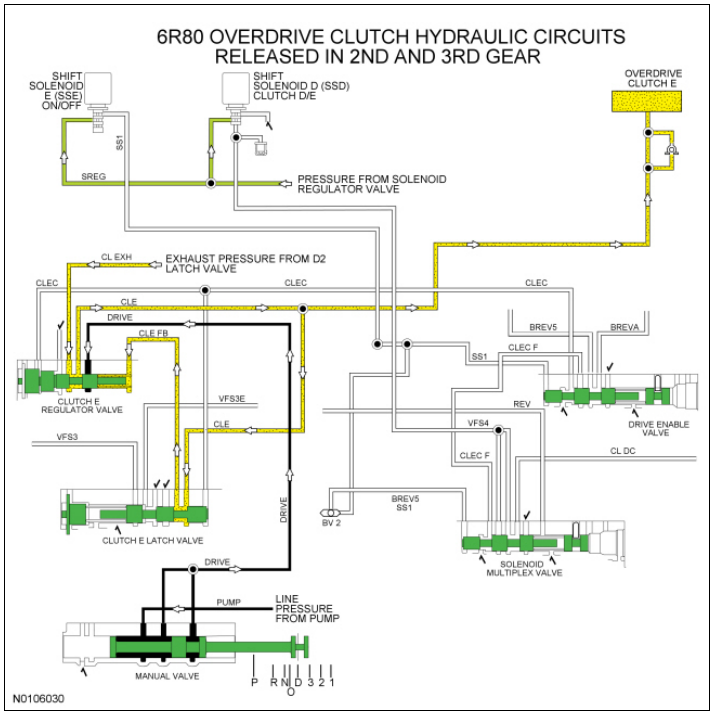
SSD provides regulated solenoid pressure from the SREG circuit to the solenoid multiplex valve through the VFS4 circuit. SSE supplies pressure to the solenoid multiplex valve and the drive enable valve to position the valves to direct pressure from the VFS4 circuit to the CLEC F and CLEC circuits to position the clutch E regulator and latch valves to apply the O/D clutch (E). As the O/D clutch (E) is applied, SSD increases pressure to the clutch E regulator and latch valve.

The clutch E regulator valve provides regulated line pressure from the DRIVE circuit to the CLE circuit to apply the O/D clutch (E).



To release the O/D clutch (E), the manual valve can be in any position. SSD lowers pressure to the VFS4 circuit which lowers pressure in the CLEC and CLEC F circuits and releases the O/D clutch (E). SSE blocks SREG pressure to the solenoid multiplex valve and the drive enable valve to allow SSD to control low/reverse clutch (D) operation.

When the O/D clutch (E) is released, the clutch E regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL E circuit to fill the circuit and the clutch with fluid at low pressure, approximately 21 kPa (3 psi).


6R80 OVERDRIVE CLUTCH HYDRAULIC CIRCUITS
RELEASED IN 2ND AND 3RD GEAR
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID D (SSD) CLUTCH D/E
OVERDRIVE CLUTCH E
SS1
SREG
PRESSURE FROM SOLENOID REGULATOR VALVE
CL EXH
EXHAUST PRESSURE FROM D2 LATCH VALVE
CLEC
CLEC
CLEC
CLE
DRIVE
CLE FB
BREV5
BREVA
CLEC F
SS1
CLUTCH E REGULATOR VALVE
VFS3E
REV
DRIVE ENABLE VALVE
VFS4
VFS3
CLE
CLEC F
CL DC
DRIVE
BREV5
SS1
BV 2
CLUTCH E LATCH VALVE
SOLENOID MULTIPLEX VALVE
DRIVE
PUMP
LINE PRESSURE FROM PUMP
MANUAL VALVE
P R N D 3 2 1
O
N0106030

Transmission Electronic Control System

Transmission Control Module (TCM)

The Transmission Control Module (TCM) controls the functions of this transmission. The TCM is part of a molded plastic leadframe module that is bolted to the mechatronic assembly. The leadframe module also has the Turbine Shaft Speed (TSS) sensor, Output Shaft Speed (OSS) sensor, Transmission Range (TR) sensor and Transmission Fluid Temperature (TFT) sensor integrated into it.

The TCM responds to inputs from the sensors and from the vehicle Controller Area Network (CAN) signal. The TCM uses the inputs to control the line pressure, shift and TCC solenoids. The TCM also provides power and ground for the reverse lamp relay coil and provides a PARK/NEUTRAL start enable signal.

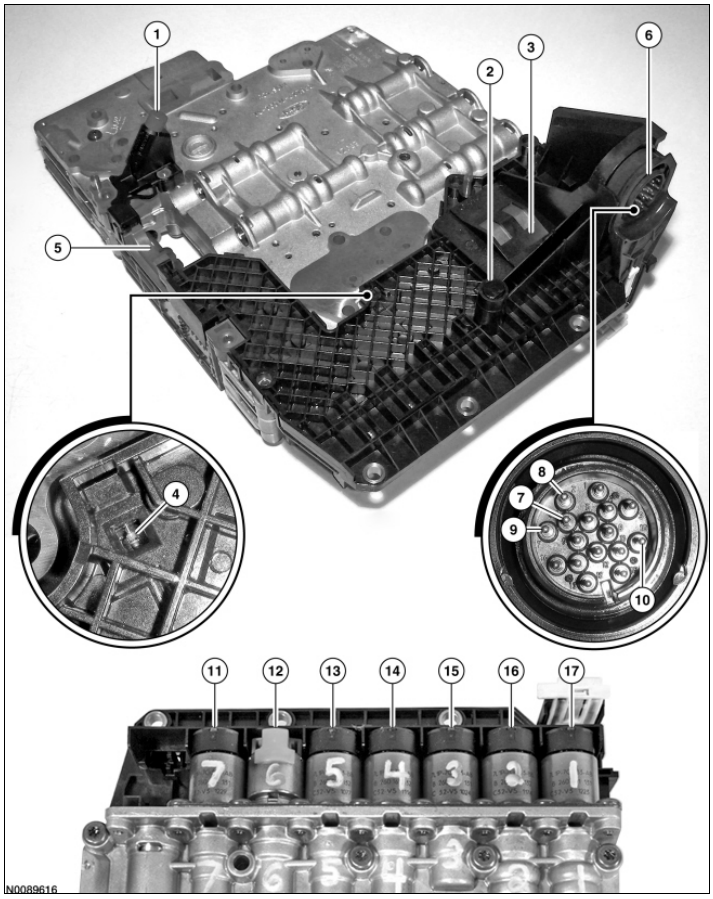
The TCM uses the following input from the vehicle CAN signal:

- Engine speed
- Engine torque
- Engine Coolant Temperature (ECT)
- Engine Oil Temperature (EOT)
- Throttle Position (TP)
- Accelerator Pedal Position (APP)
- Brake Pedal Position (BPP)
- ABS wheel speed
- Automatic Traction Control (ATC) status
- Four-Wheel Drive (4WD) status

The TCM also:

- monitors inputs and outputs for the presence of faults.
- stores DTCs related to detected faults.
- supplies output to the vehicle CAN for TR position, OSS , TSS , TFT , current gear and A/C inhibit.
- provides On-Board Diagnostic (OBD) information using the CAN signal to illuminate the Malfunction Indicator Lamp (MIL) or Transmission Control Indicator Lamp (TCIL).
- displays diagnostic information to a scan tool through the Data Link Connector (DLC).

Transmission Control Module (TCM)



Item	Part Number	Description
1	-	Turbine Shaft Speed (TSS) sensor
2	-	Output Shaft Speed (OSS) sensor
3	-	Transmission Control Module (TCM)
4	-	Transmission Fluid Temperature (TFT) sensor
5	-	Transmission Range (TR) sensor
6	-	TCM transmission vehicle harness connector
7	-	Controller Area Network (CAN) + terminal
8	-	CAN - terminal
9	-	Reverse lamp relay power
10	-	PARK/NEUTRAL start enable signal terminal
11	7G383	Torque Converter Clutch (TCC) Variable Force Solenoid (VFS)
12	7G484	Shift Solenoid E (SSE) (ON/OFF)
13	7G383	Shift Solenoid D (SSD) VFS
14	7G383	Line Pressure Control (LPC) solenoid
15	7G383	Shift Solenoid C (SSC) VFS
16	7G383	Shift Solenoid B (SSB) VFS
17	7G383	Shift Solenoid A (SSA) VFS

If the TCM detects a fault, it uses Failure Management and Effects Mode strategies to substitute a value or signal.

The TCM also uses Failure Management and Effects Mode strategies to compensate for detected solenoid or apply component faults that result in alternate shift patterns.

If the transmission loses complete electronic control, it will operate in a failsafe mode with:

- Maximum line pressure in all transmission ranges
- Functional PARK, REVERSE and NEUTRAL positions
- Operation in 3rd or 5th gear (depending on the failure conditions) when the selector lever is in the DRIVE, 3, 2 or 1 position
- TCC is released in all transmission ranges and gears

Solenoid Application Chart

Gear	SS A (VFS1) Proportional	SS B (VFS2) Inversely Proportional	SS C (VFS3) Proportional	SS D (VFS4) Inversely Proportional	PC A (VFS5) Inversely Proportional	TCC (VFS6) Proportional	SS E (SS1) ON/ OFF
Park				X	[a]		
Reverse		X		X	[a]		
Neutral				X	[a]		
1st Gear Manual	X			X	[a]	[a]	
2nd Gear Manual	X		X		[a]	[a]	
3rd Gear Manual	X	X			[a]	[a]	
1st Gear D	X			X	[a]	[a]	
2nd Gear D	X		X		[a]	[a]	
3rd Gear D	X	X			[a]	[a]	
4th Gear D	X			X	[a]	[a]	X
5th Gear D		X		X	[a]	[a]	X
6th Gear D			X	X	[a]	[a]	X

[a] Transmission control module (TCM) controlled

Line Pressure Control (LPC) Solenoid

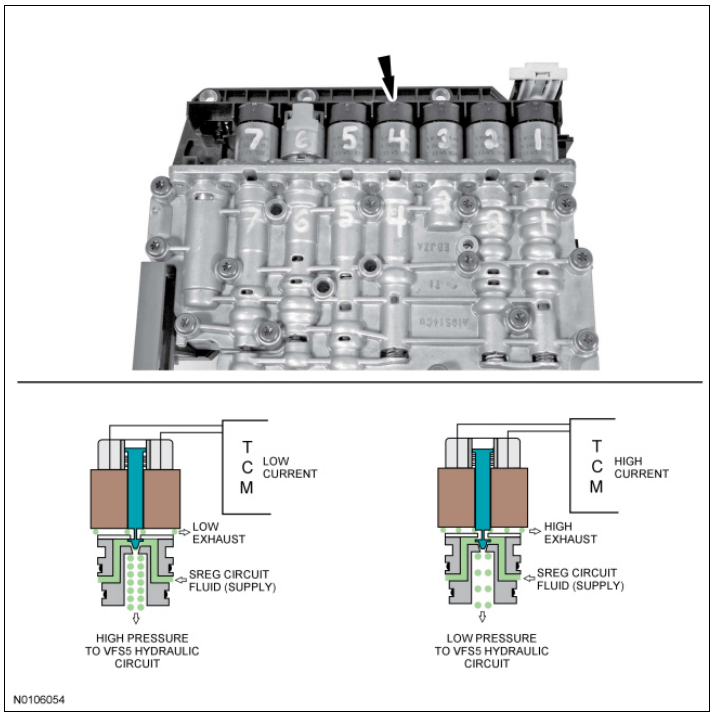
The Line Pressure Control (LPC) solenoid is a Variable Force Solenoid (VFS) that varies hydraulic pressure by actuating a hydraulic valve.

The TCM applies variable current to the LPC solenoid which varies pressure in the VFS5 hydraulic circuit to the Main Regulator Valve. Refer to Hydraulic Circuits in this section for information.

The LPC solenoid uses inversely proportional operation. As the current from the TCM decreases, the pressure from the solenoid increases. As the current from the TCM increases, the pressure from the solenoid decreases. The LPC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the LPC solenoid fully opens the hydraulic valve which applies the maximum amount of hydraulic pressure to the Main Regulator Valve through the VFS5 hydraulic circuit and applies maximum line pressure in the PUMP hydraulic circuit. With maximum current to the solenoid, the hydraulic valve fully closes the outlet port for minimum pressure to the VFS5 hydraulic circuit to lower the line pressure in the PUMP hydraulic circuit.

Line Pressure Control (LPC) Inversely Proportional Variable Force Solenoid (VFS)



Torque Converter Clutch (TCC) Solenoid

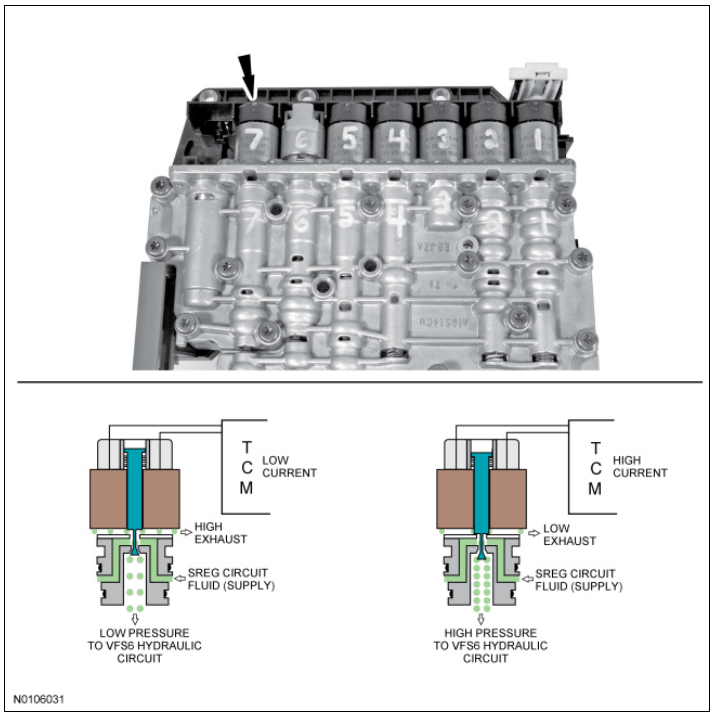
The TCC solenoid is a VFS that varies hydraulic pressure by actuating a hydraulic valve.

The TCM applies variable current to the TCC solenoid which varies pressure in the VFS6 hydraulic circuit to the Converter Release Regulator Valve and the Bypass Clutch Control Regulator Valve. Refer to Hydraulic Circuits in this section.

The TCC solenoid uses proportional operation. As the current from the TCM decreases, the pressure from the solenoid decreases. As the current from the TCM increases, the pressure from the solenoid increases. The TCC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the TCC solenoid fully closes the hydraulic valve which applies the minimum amount of hydraulic pressure to the Converter Release Regulator Valve and the Bypass Clutch Control Regulator Valve through the VFS6 hydraulic circuit and releases the TCC . With maximum current to the solenoid, the hydraulic valve fully opens the outlet port for maximum pressure to the VFS6 hydraulic circuit to apply the TCC .

Torque Converter Clutch (TCC) Proportional Variable Force Solenoid (VFS)



Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC) and Shift Solenoid D (SSD)

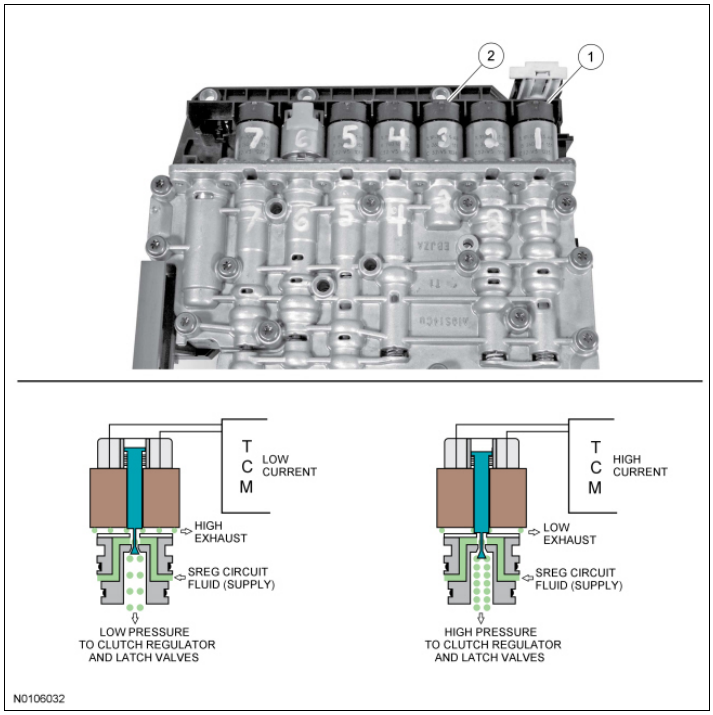
Shift solenoids A through D are variable force type solenoids that vary hydraulic pressure by actuating a hydraulic valve.

The TCM applies variable current to the shift solenoids which varies pressure in the hydraulic circuit to the regulator and latch valves of the clutch that it controls. Refer to Hydraulic Circuits in this section.

Shift Solenoid A (SSA) and Shift Solenoid C (SSC) use proportional operation. As the current from the TCM decreases, the pressure from the solenoid decreases. As the current from the TCM increases, the pressure from the solenoid increases. SSA and SSC are supplied hydraulic pressure from the SREG circuit.

With zero current, SSA and SSC fully close the hydraulic valves which applies zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch. With maximum current to the solenoids, the hydraulic valves fully open for maximum pressure to the regulator and latch valves to apply the clutch.

Shift Solenoid A (SSA) and Shift Solenoid C (SSC) Proportional Variable Force Type Solenoids

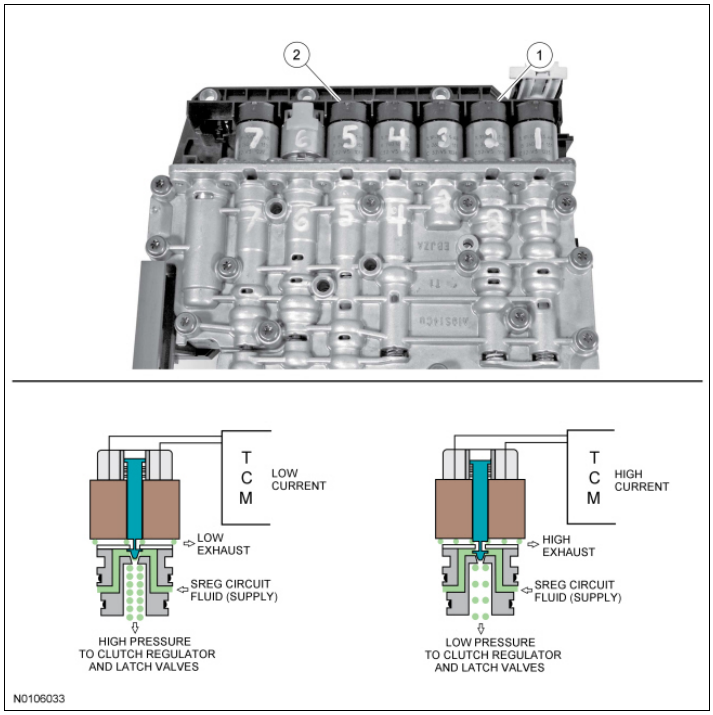


Item	Part Number	Description
1	7G383	Shift Solenoid A (SSA) Variable Force Solenoid (VFS)
2	7G383	Shift Solenoid C (SSC) VFS

Shift Solenoid B (SSB) and Shift Solenoid D (SSD) use inverse proportional operation. As the current from the TCM decreases, the pressure from the solenoid increases. As the current from the TCM increases, the pressure from the solenoid decreases. SSB and SSD are supplied hydraulic pressure from the SREG circuit.

With zero current, SSB and SSD fully open the hydraulic valves which applies maximum hydraulic pressure to the regulator and latch valves to apply the clutch that it controls. With maximum current to the solenoids, the hydraulic valve fully closes to apply zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch.

Shift Solenoid B (SSB) and Shift Solenoid D (SSD) Inverse Proportional Variable Force Type Solenoids



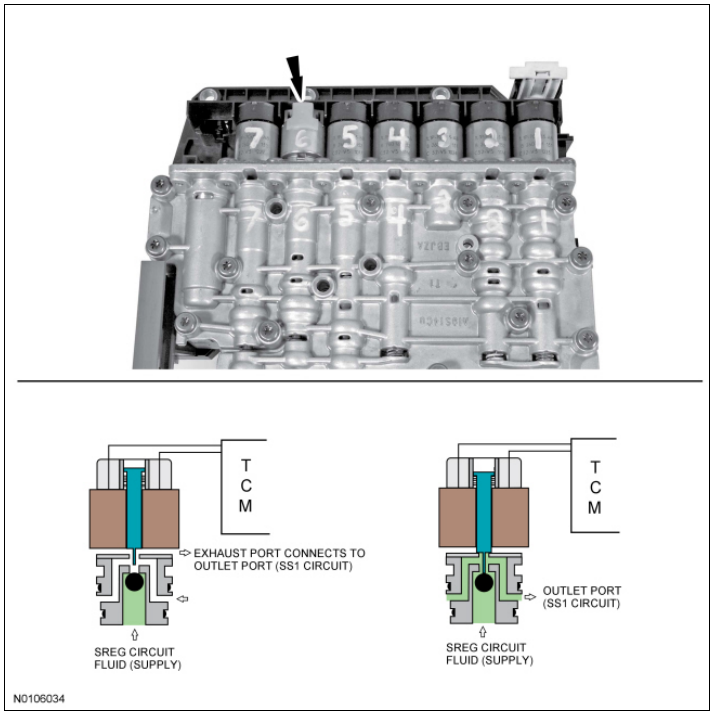
Item	Part Number	Description
1	7G383	Shift Solenoid B (SSB) Variable Force Solenoid (VFS)
2	7G383	Shift Solenoid D (SSD) VFS

Shift Solenoid E (SSE)

Shift Solenoid E (SSE) is an ON/OFF solenoid. When SSE is in the OFF position, SSD controls the regulator and latch valves to apply the low/reverse clutch. When SSE is in the ON position, SSD controls the regulator and latch valves to apply the Overdrive (O/D) (456) clutch. Refer to Hydraulic Circuits in this section.

SSE is supplied hydraulic pressure from the SREG circuit. When SSE is OFF, the solenoid supply is blocked and the outlet port (SS1 circuit) is connected to the exhaust port. When SSE is ON, the exhaust port is blocked and the solenoid supply is connected to the outlet port (SS1 circuit).

Shift Solenoid E (SSE) ON/OFF Solenoid



Turbine Shaft Speed (TSS) Sensor

The TSS sensor connects to the TCM through wiring inside the leadframe module assembly.

The TSS sensor is a Hall-effect type sensor that provides a signal to the TCM that changes in frequency as the rotating speed of the forward (1234) clutch cylinder varies.

The TCM compares the TSS sensor signal with the engine speed information to determine the amount of slip occurring in the torque converter.

The TCM also compares the TSS sensor signal with the OSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The TCM uses the TSS sensor signal as an input for its strategies for shifts and TCC operation. The TCM also uses the TSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TSS sensor.

Output Shaft Speed (OSS) Sensor

The OSS sensor connects to the TCM through wiring inside the leadframe module assembly.

The OSS sensor is a Hall-effect type sensor that provides a signal to the TCM that changes in frequency as the rotating speed of the output shaft ring gear varies.

The TCM also compares the OSS sensor signal with the TSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The TCM uses the OSS sensor signal as an input for its strategies for shifts and TCC operation. The TCM also uses the OSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the OSS sensor.

Transmission Fluid Temperature (TFT) Sensor

The TFT sensor connects to the TCM through wiring inside the leadframe module assembly.

The TFT sensor is a temperature dependent resistor that is in contact with transmission fluid in the transmission sump area.

The TCM monitors the voltage across the TFT sensor, which changes as TFT varies.

The TCM uses the TFT sensor signal as an input for its strategy for shifting and TCC operation. The TCM also uses the TFT sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TFT sensor.

Transmission Range (TR) Sensor

The TR sensor connects to the TCM through wiring inside the leadframe module assembly.

The TR sensor has a set of Hall-effect sensors that have a pattern of ON/OFF states which are dependant on the PARK, REVERSE, NEUTRAL, DRIVE, 3, 2 or 1 position of the manual valve.

The TR sensor also provides signals for the starting system and the reverse lights.

The TCM uses the TR sensor signal as an input for its strategy for shifting and TCC operation. The TCM also uses the TR sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TR sensor.

Transmission Operation

Transmission Operation Overview

Torque Converter

This transmission uses a torque converter with the following elements:

- Impeller
- Turbine
- Reactor
- Torque Converter Clutch (TCC)

For component information, refer to Torque Converter Contamination Inspection in this section.

Planetary Gearsets

Operation of this transmission involves the use of 2 planetary gearsets that have the following components:

- Front (single planetary gearset)
  - One sun gear
  - One planetary carrier with 4 gears
  - One ring gear
- Rear (ravigenaux planetary gearset)
  - Two sun gears of different sizes
  - Three short planetary gear pinions meshing with the sun gears
  - Three long planetary gear pinions meshing with the sun gears
  - One planetary carrier
  - One ring gear

Apply Clutches

NOTE: Friction and steel plate quantity will vary based on engine displacement. Refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

This transmission uses the following clutches to operate the 2 planetary gearsets:

- Forward clutch (A)
- Direct clutch (B)
- Intermediate clutch (C)
- Low/reverse clutch (D)
- Overdrive clutch (E)

For information about planetary gearsets or the apply clutches, refer to Mechanical Components and Functions in this section.

Hydraulic System

The hydraulic operation of this transmission includes the following components:

- Main control (mechatronic) assembly with integrated Transmission Control Module (TCM)
- Pump assembly with filter
- Torque converter
- Apply components (clutches)

For component information, refer to Hydraulic System in this section.

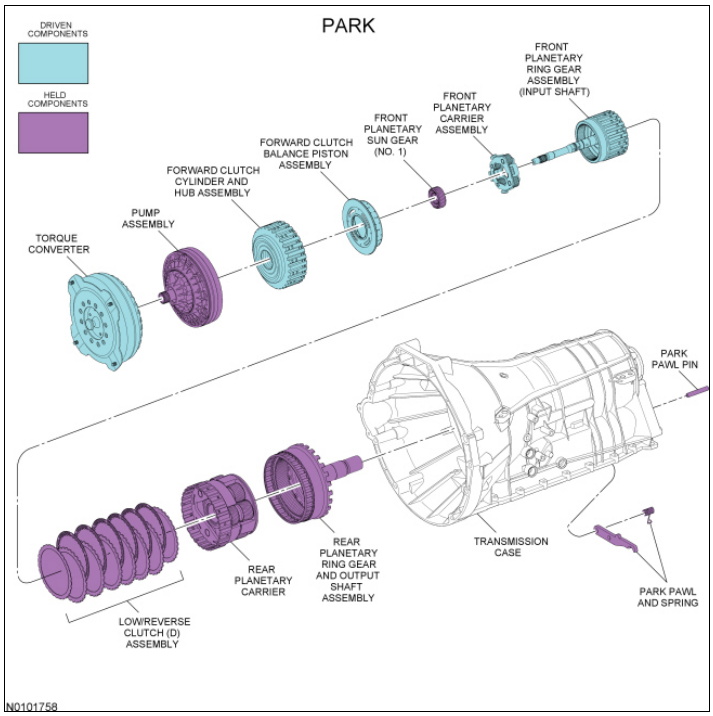
Electronic Operation

The TCM controls the operation of this transmission with the following solenoids:

- Line Pressure Control (LPC) solenoid
- Shift Solenoid A (SSA) Variable Force Solenoid (VFS)
- Shift Solenoid B (SSB) VFS
- Shift Solenoid C (SSC) VFS
- Shift Solenoid D (SSD) VFS
- Shift Solenoid E (SSE) ON/OFF solenoid
- TCC solenoid VFS

For solenoid information, refer to Transmission Electronic Control System in this section.

Park Position



Mechanical Operation

Apply components:

- Park pawl engaged holding the park gear (output shaft) stationary
- Low/reverse clutch (D) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- None

Rear planetary gearset driven components:

- None

Rear planetary gearset held components:

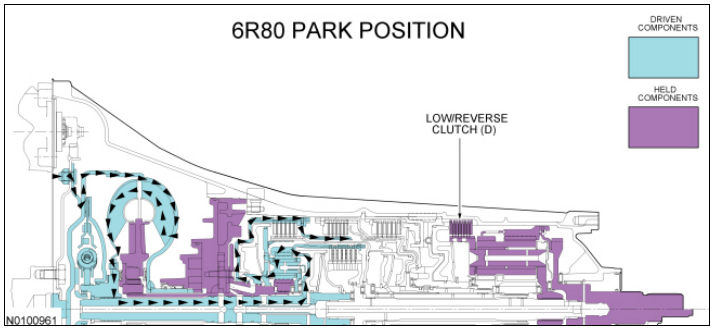
- Planetary carrier
- Ring gear (output shaft)

Park Position Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
PARK				X	

For component information, refer to Mechanical Components and Functions in this section.

Park Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CL DC circuit to position the valves for low/reverse clutch (D) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 and D2 latch and regulator valves.
- Regulated line pressure from the D1 and D2 regulator valves is supplied to the low/reverse clutch (D) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

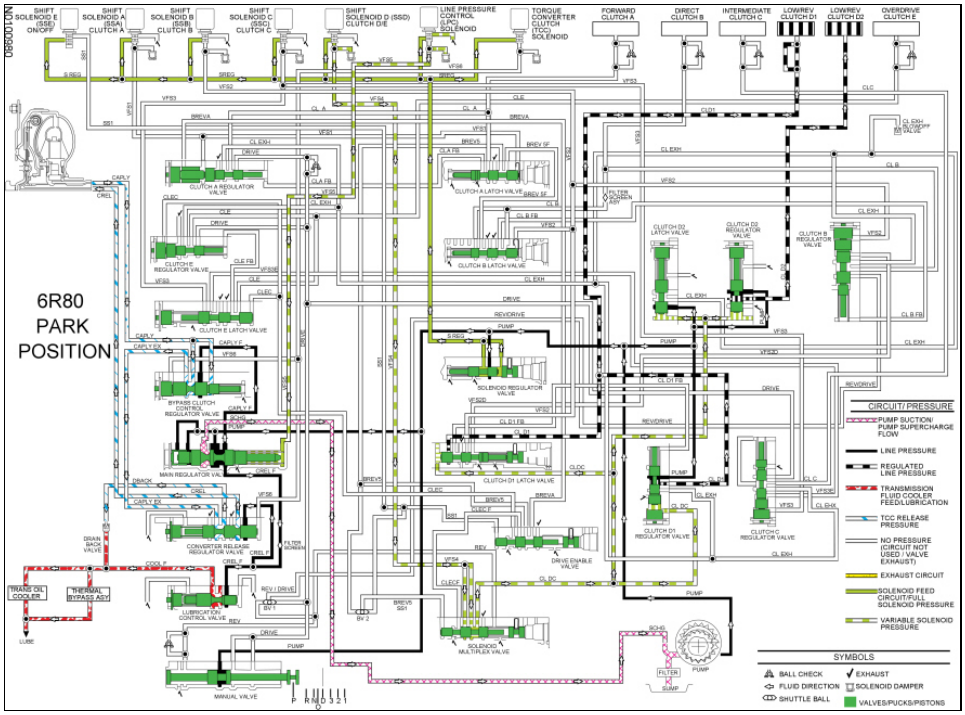
Solenoid operation:

Park Position Solenoid Operation Chart

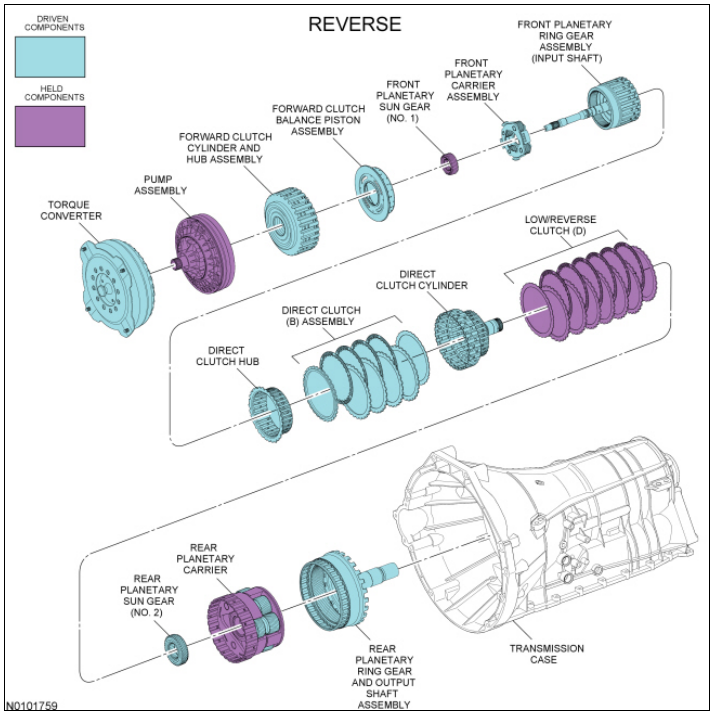
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
Park				X		X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



Reverse Position



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied
- Direct clutch (B) applied (quantity model dependant)

Direct Clutch (B) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- Sun gear No. 2

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

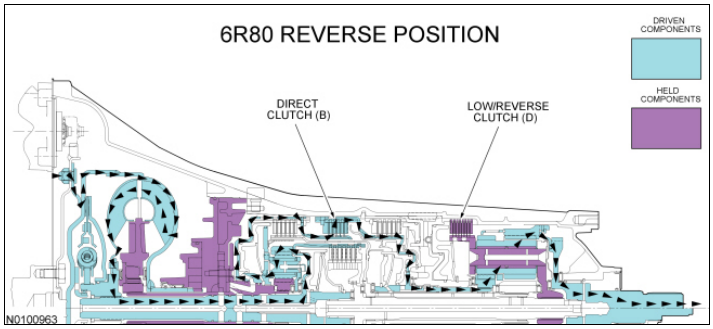
- Planetary carrier

Reverse Position Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
Reverse		X		X	

For component information, refer to Mechanical Components and Functions in this section.

Reverse Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 and D2 latch and regulator valves.
- In reverse, the manual valve directs line pressure to the No. 1 shuttle valve and the solenoid multiplex valve through the REV circuit.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSB supplies pressure to the clutch B regulator and latch valves to position the valves for direct clutch (B) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 and D2 latch and regulator valves.
- Regulated line pressure from the D1 and D2 regulator valves is supplied to the low/reverse clutch (D) to apply the clutch.
- Line pressure is supplied by the manual valve to the clutch B latch and regulator valves.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

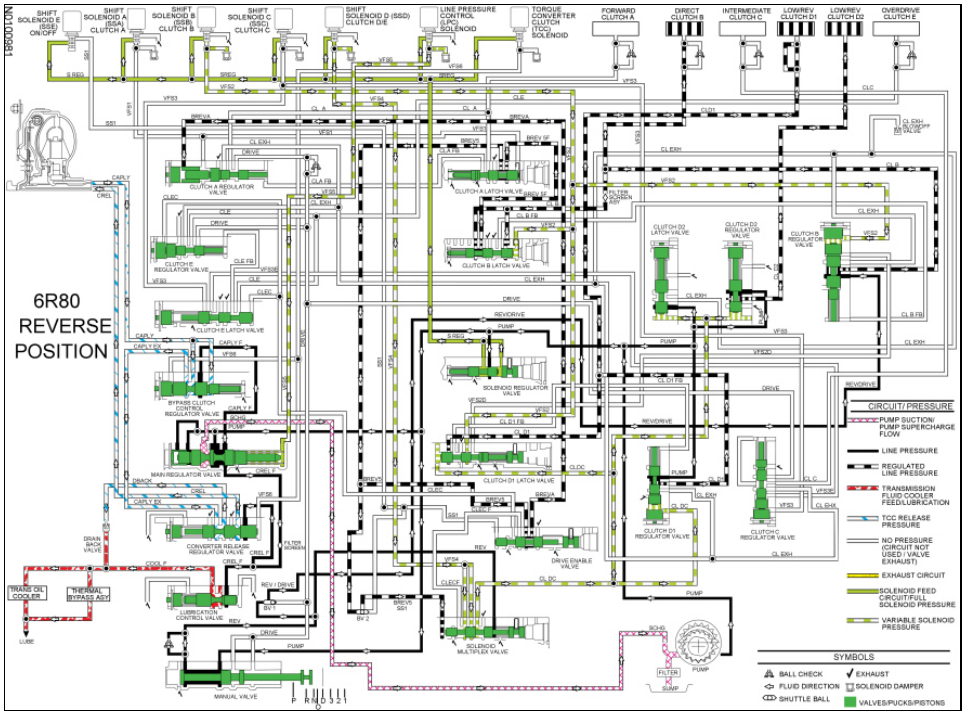
Reverse Position Solenoid Operation Chart

Gear	SSA (VFS)	SSB (VFS)	SSC (VFS)	SSD (VFS)	SSE	LPC (VFS)	TCC (VFS)

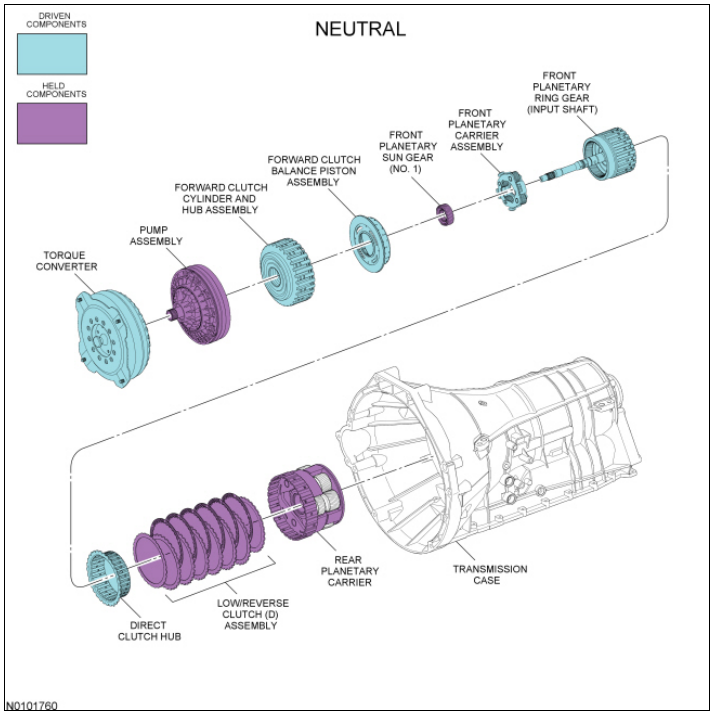
	Proportional	Inversely Proportional	Proportional	Inversely Proportional	(ON/OFF)	Inversely Proportional	Proportional
Reverse		X		X		X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



Neutral Position



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- None

Rear planetary gearset driven components:

- None

Rear planetary gearset held components:

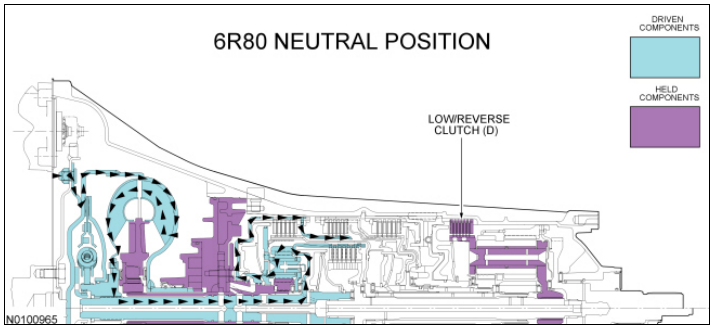
- Planetary carrier

Neutral Position Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
Neutral				X	

For component information, refer to Mechanical Components and Functions in this section.

Neutral Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
    - ♦ manual valve.
    - ♦ lubrication control valve.
    - ♦ converter release regulator valve.
    - ♦ bypass clutch control regulator valve.
    - ♦ solenoid pressure regulator valve.
    - ♦ D1 and D2 latch and regulator valves.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CL DC circuit to position the valves for

low/reverse clutch (D) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 and D2 latch and regulator valves.
- Regulated line pressure from the D1 and D2 regulator valves is supplied to the low/reverse clutch (D) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

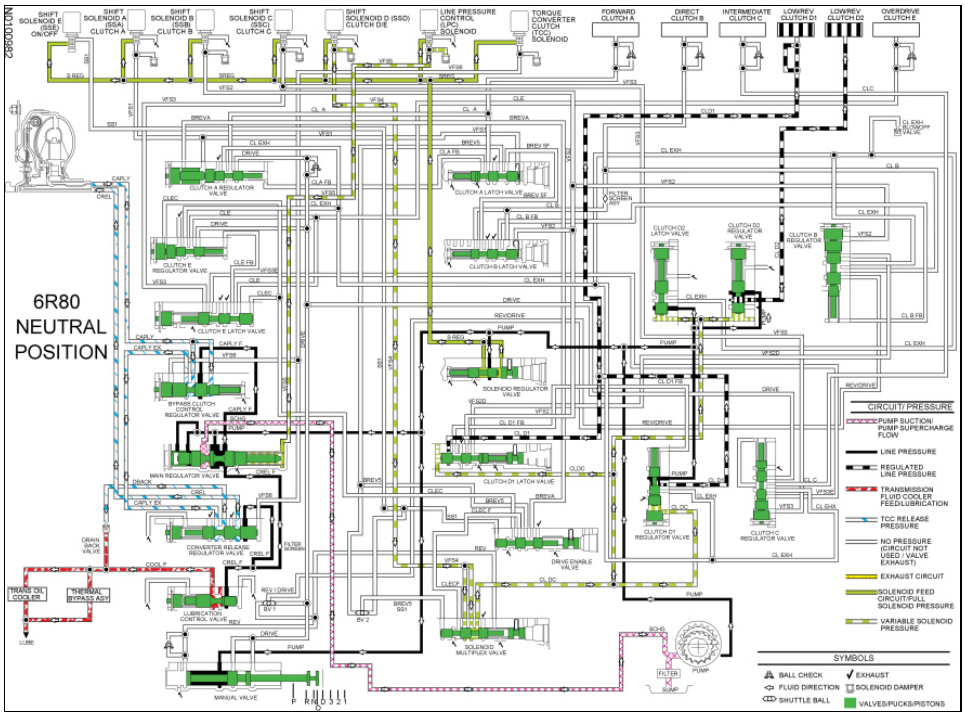
Solenoid operation:

Neutral Position Solenoid Operation Chart

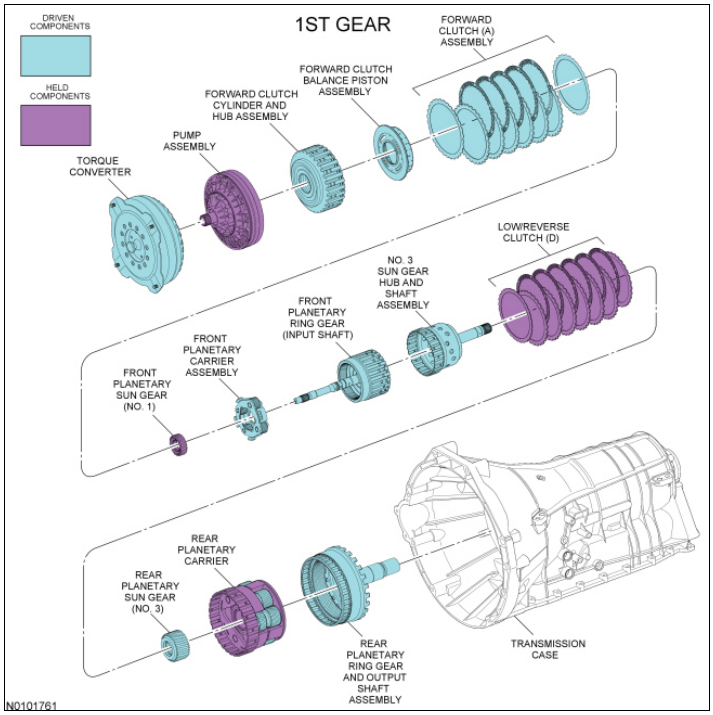
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
Neutral				X		X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



1st Gear



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied
- Forward clutch (A) applied (quantity model dependant)

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5
5.4L	Expedition, Navigator, F-150	5	6

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

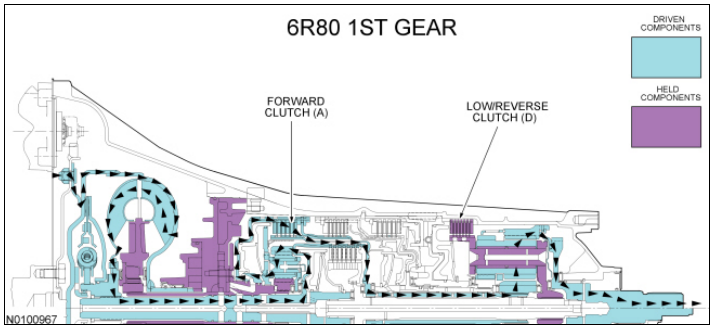
- Planetary carrier

1st Gear Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
1st Gear	X			X	

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 and D2 latch and regulator valves.
- Regulated line pressure from the D1 and D2 regulator valves is supplied to the low/reverse clutch (D) to apply the clutch.
- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

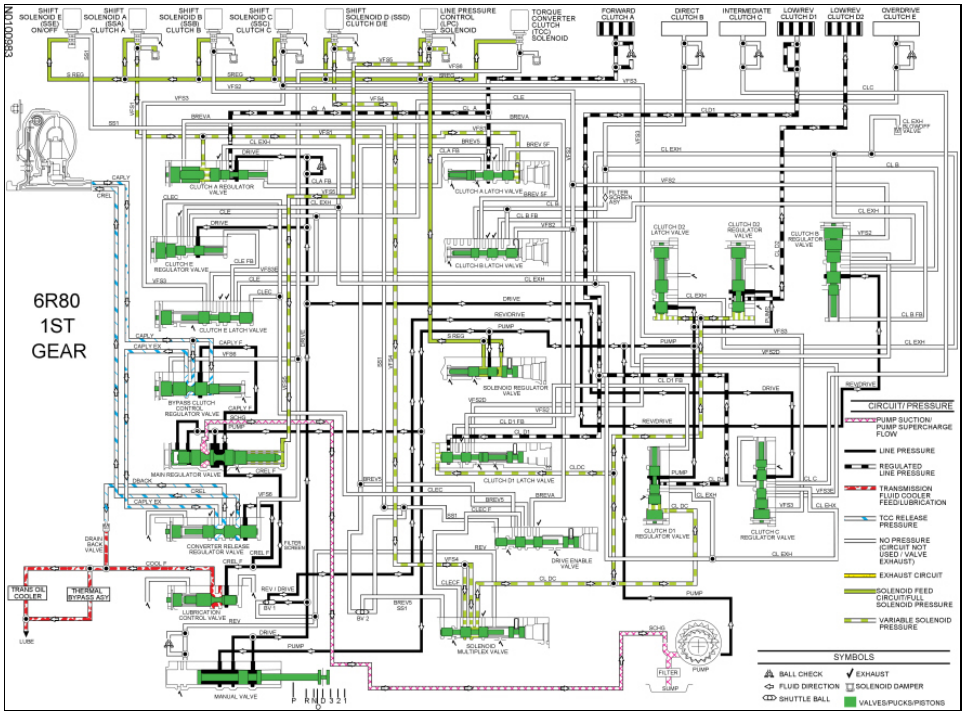
1st Gear Solenoid Operation Chart

Gear	SSA (VFS) Proportional	SSB (VFS) Inversely	SSC (VFS) Proportional	SSD (VFS) Inversely	SSE (ON/OFF)	LPC (VFS) Inversely	TCC (VFS) Proportional

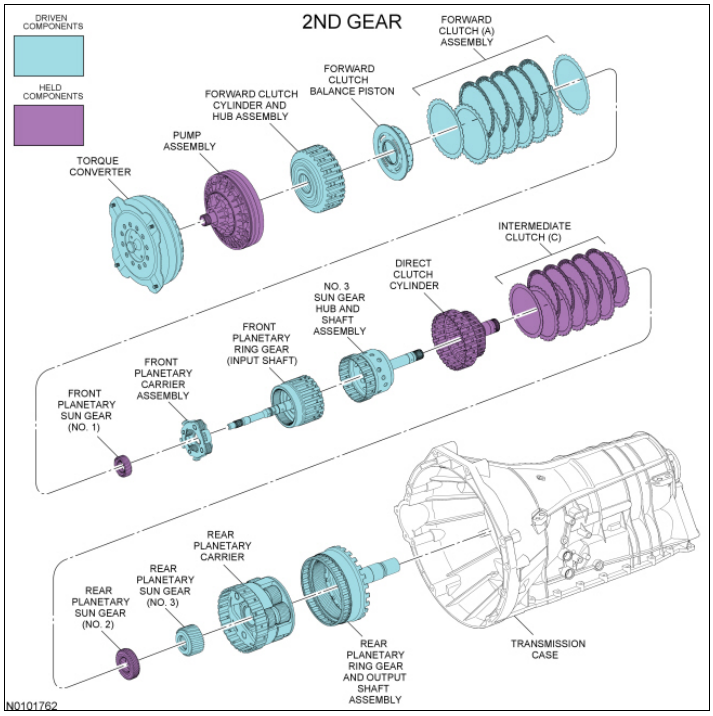
		Proportional		**Proportional**		**Proportional**	
1st Gear	X			X		X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



2nd Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied (quantity model dependant)
- Intermediate clutch (C) applied (quantity model dependant)

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5
5.4L	Expedition, Navigator, F-150	5	6

Intermediate Clutch (C) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear

Rear planetary gearset driven components:

- Planetary carrier

- Ring gear (output shaft)

Rear planetary gearset held components:

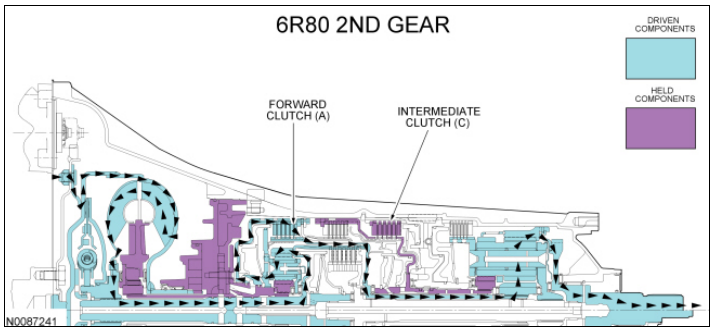
- No. 2 sun gear

2nd Gear Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
2nd Gear	X		X		

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .

- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSC supplies pressure to the clutch C regulator valve to position the valve for intermediate clutch (C) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch C regulator valve is supplied to the intermediate clutch (C) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

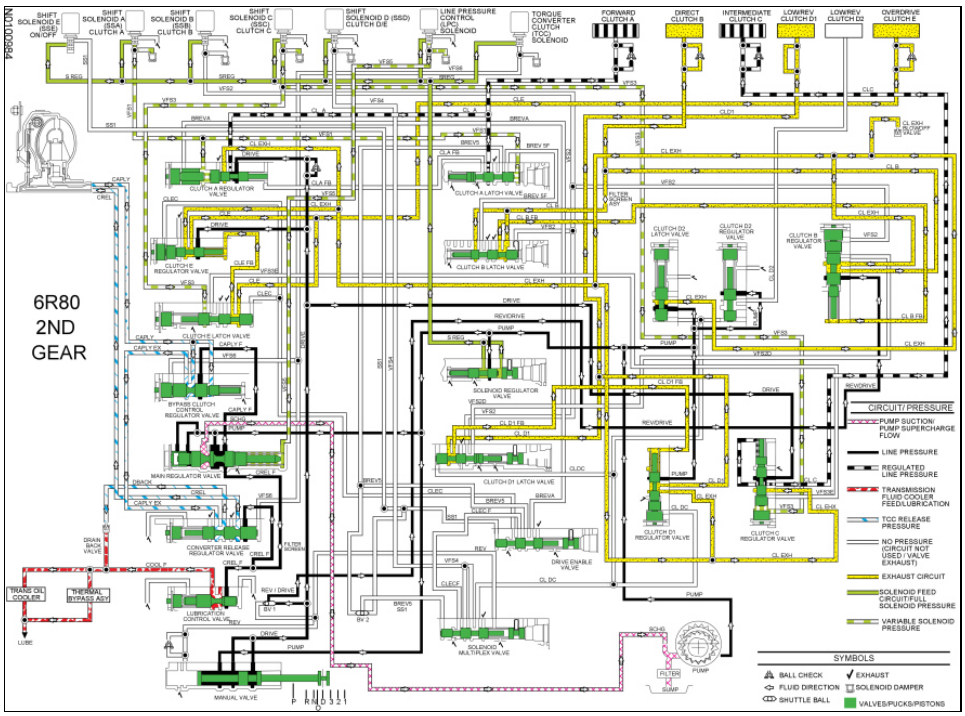
Solenoid operation:

2nd Gear Solenoid Operation Chart

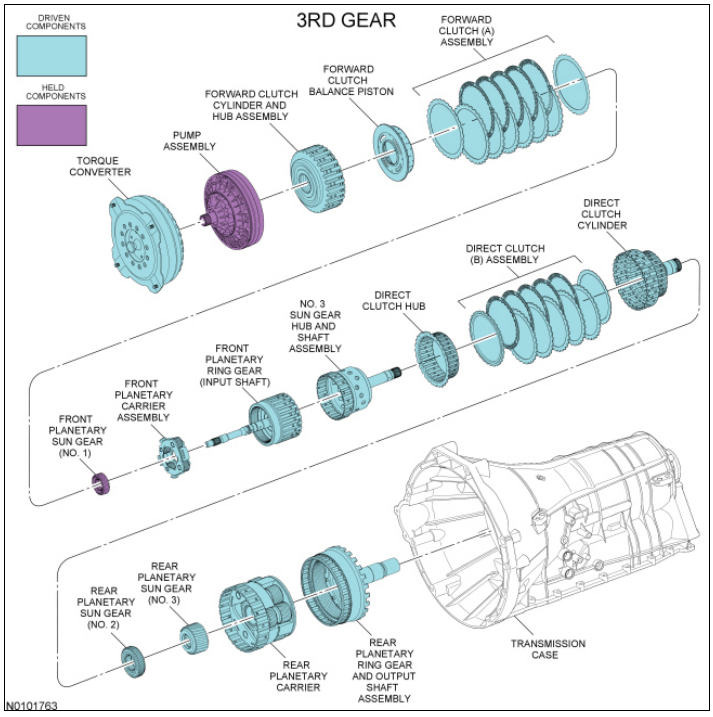
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
2nd Gear	X		X			X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



3rd Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied (quantity model dependant)
- Direct clutch (B) applied (quantity model dependant)

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5
5.4L	Expedition, Navigator, F-150	5	6

Direct Clutch (B) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear
- No. 2 sun gear

Rear planetary gearset driven components:

- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:

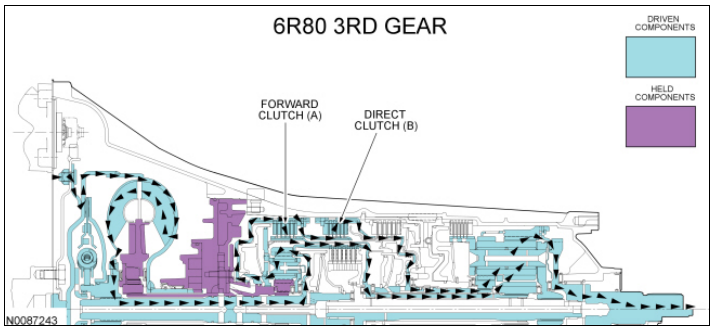
- None

3rd Gear Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
3rd Gear	X	X			

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSB supplies pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

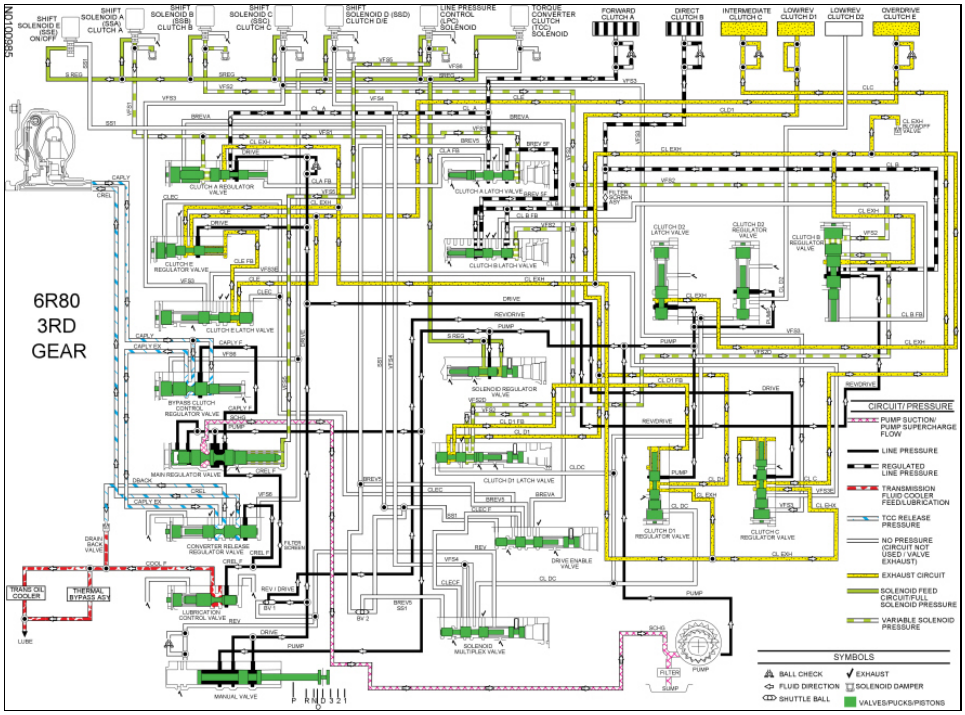
Solenoid operation:

3rd Gear Solenoid Operation Chart

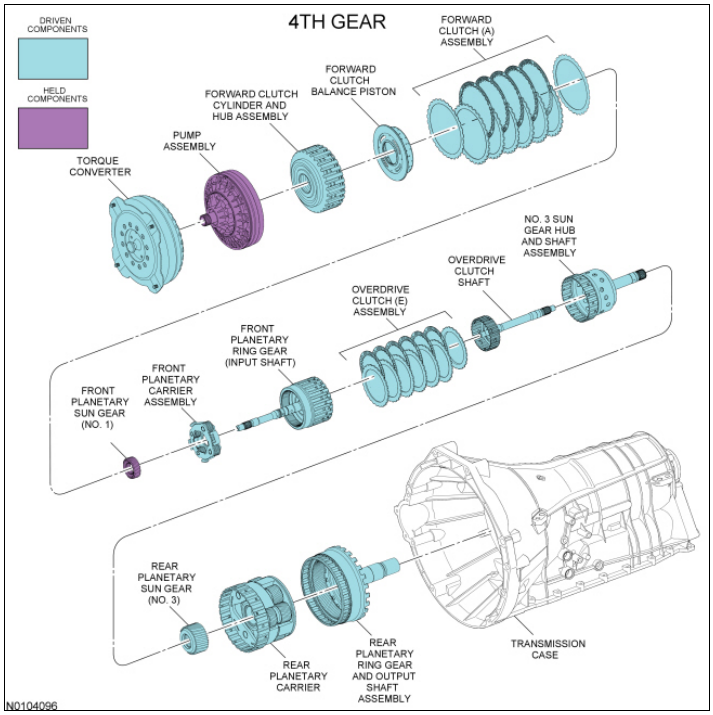
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
3rd Gear	X	X				X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



4th Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied (quantity model dependant)
- Overdrive (O/D) clutch (E) applied

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5
5.4L	Expedition, Navigator, F-150	5	6

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear
- Planetary carrier

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

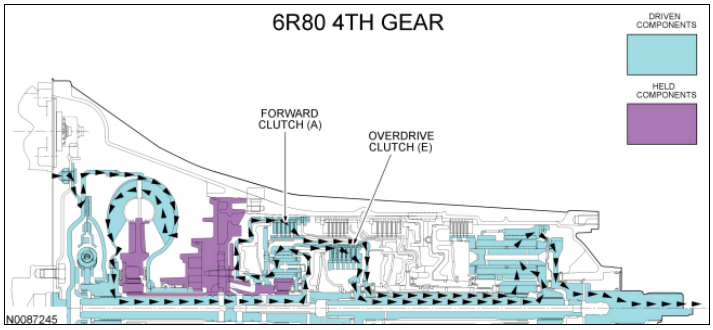
- None

4th Gear Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
4th Gear	X				X

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.

- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for O/D clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the O/D clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

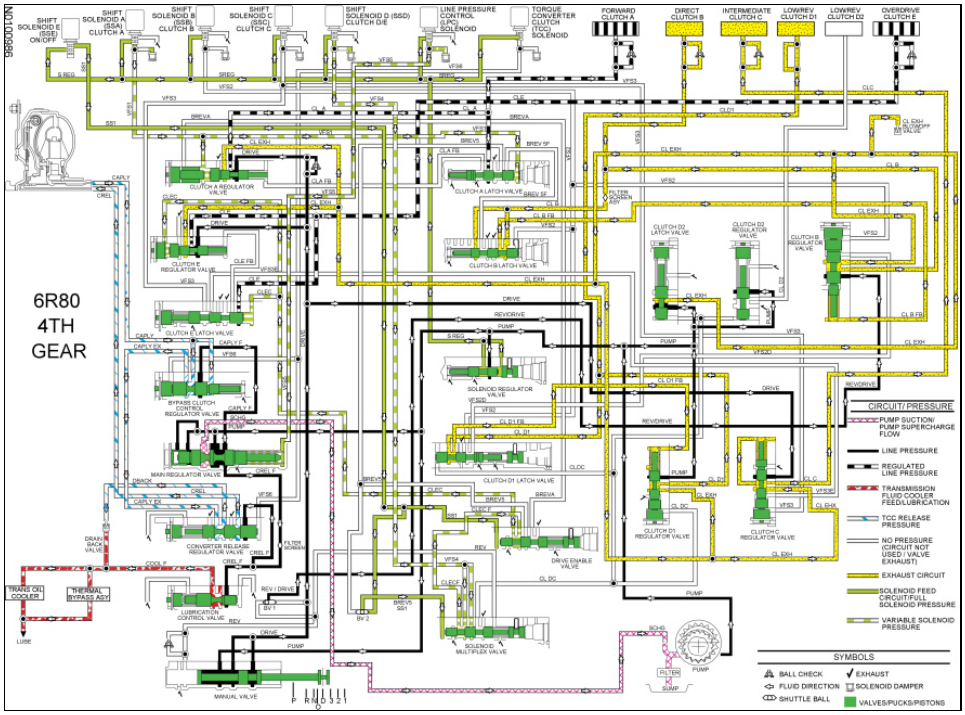
Solenoid operation:

4th Gear Solenoid Operation Chart

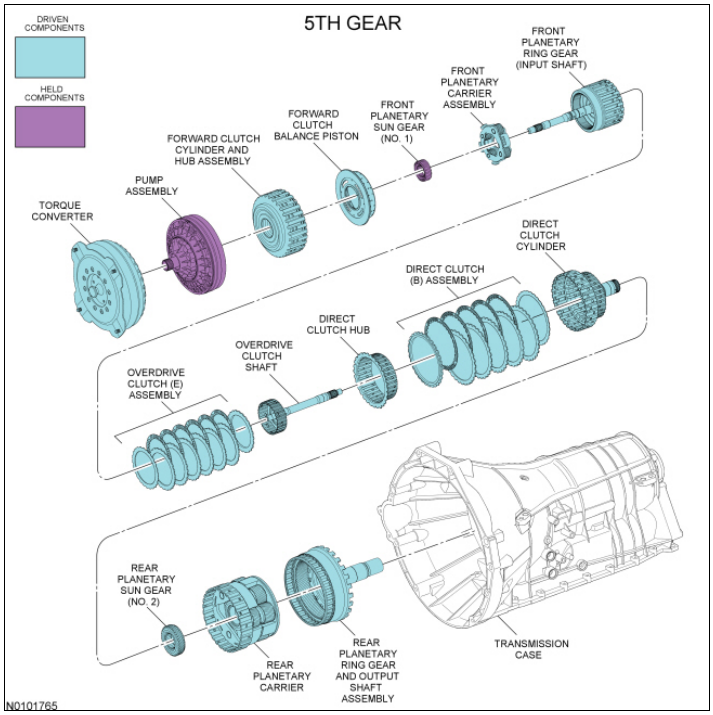
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
4th Gear	X			X	X	X	

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



5th Gear



Mechanical Operation

Apply components:

- O/D clutch (E) applied
- Direct clutch (B) applied (quantity model dependant)

Direct Clutch (B) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 2 sun gear
- Planetary carrier

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

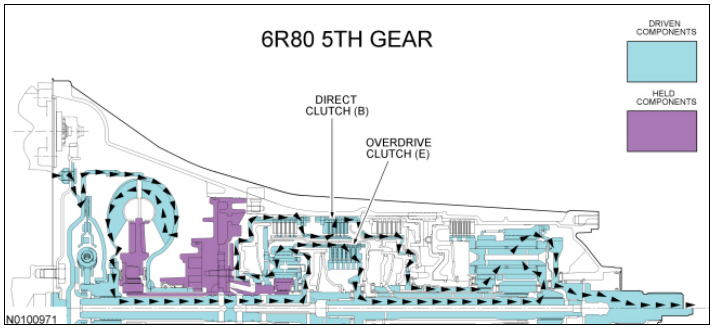
- None

5th Gear Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
5th Gear		X			X

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.

- SSB supplies pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for O/D clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the O/D clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

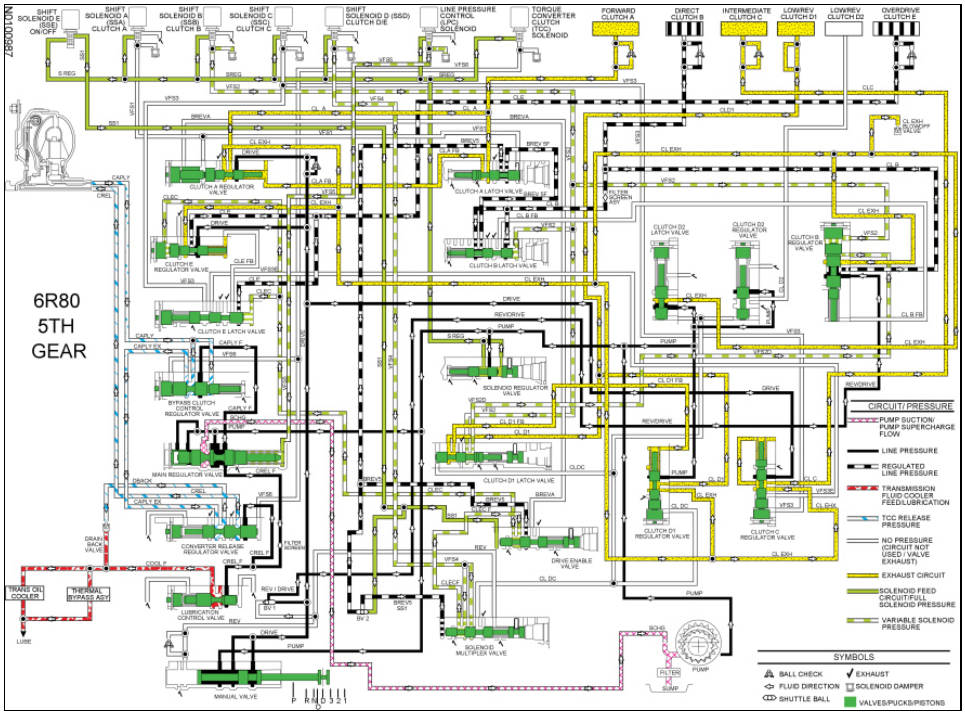
Solenoid operation:

5th Gear Solenoid Operation Chart

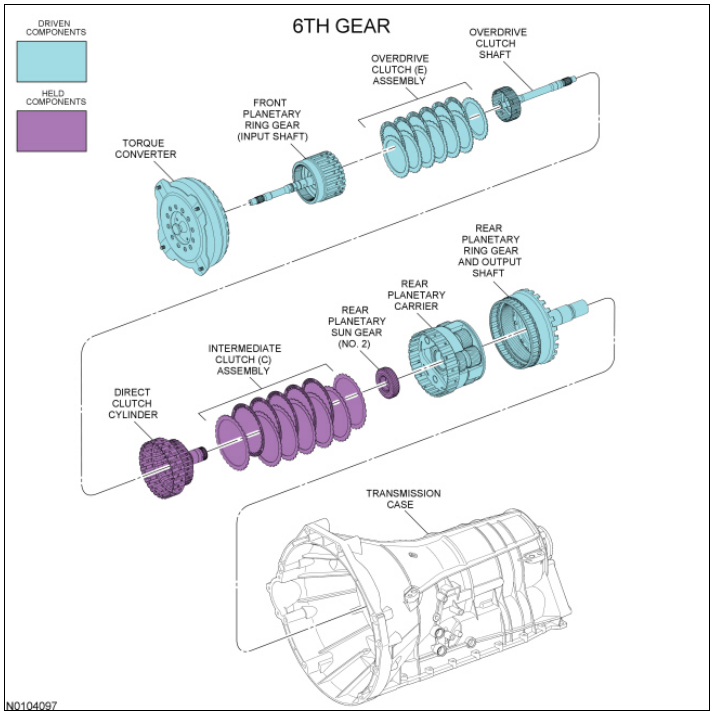
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
5th Gear		X		X	X	X	

For solenoid information, refer to Transmission Electronic Control System in this section.

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6th Gear Torque Converter Clutch (TCC) Applied



Mechanical Operation

Apply components:

- O/D clutch (E) applied
- Intermediate clutch (C) applied (quantity model dependant)

Intermediate Clutch (C) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier (does not contribute to power flow)

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- Planetary carrier

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

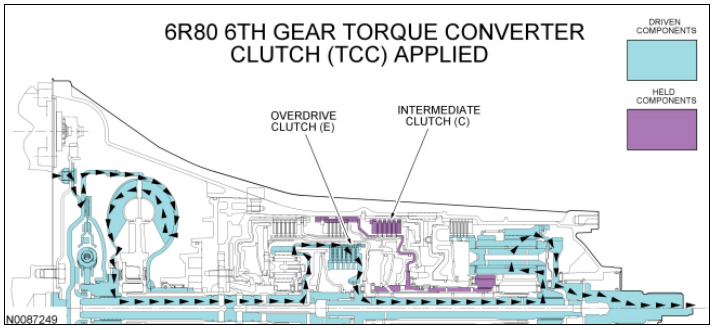
- No. 2 sun gear

6th Gear Torque Converter Clutch (TCC) Applied Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)	TCC
6th Gear			X		X	X

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is applied, the bypass clutch control regulator valve applies pressure to the torque converter through the CAPLY circuit to apply the TCC .
- CAPLY pressure exits the torque converter through the CREL circuit to the converter release regulator valve.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- The TCC solenoid supplies pressure to the converter release regulator valve and the bypass clutch control regulator valve to move the position of the valves for TCC application.
- SSC supplies pressure to the clutch C regulator valve to position the valve for intermediate clutch (C) application.

- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for O/D clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch C regulator valve is supplied to the intermediate clutch (C) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the O/D clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

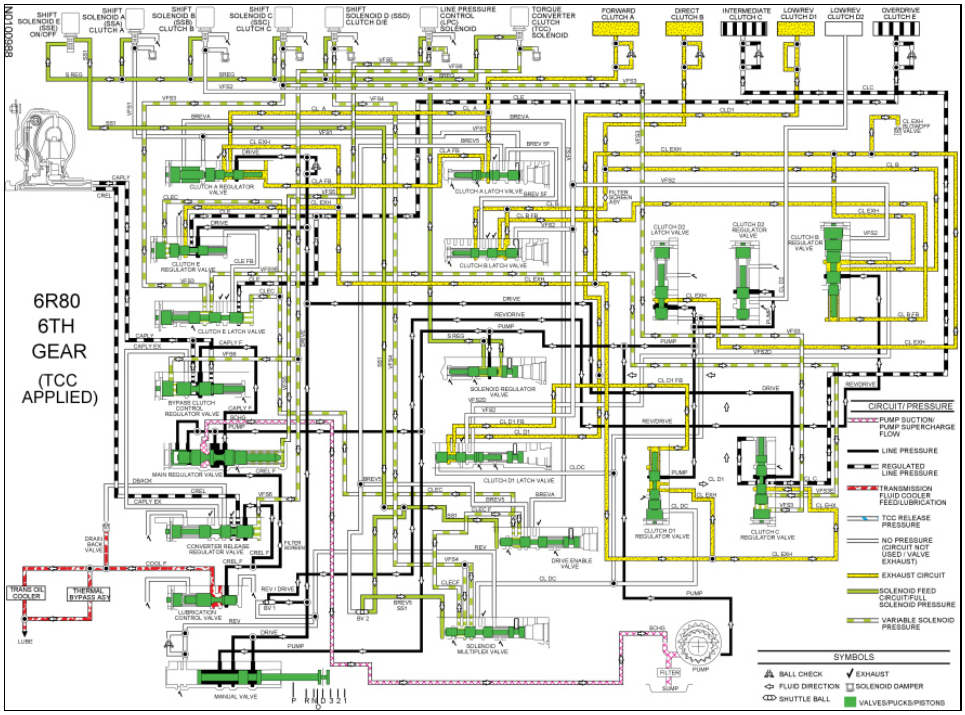
Solenoid operation:

6th Gear Torque Converter Clutch (TCC) Applied Solenoid Operation Chart

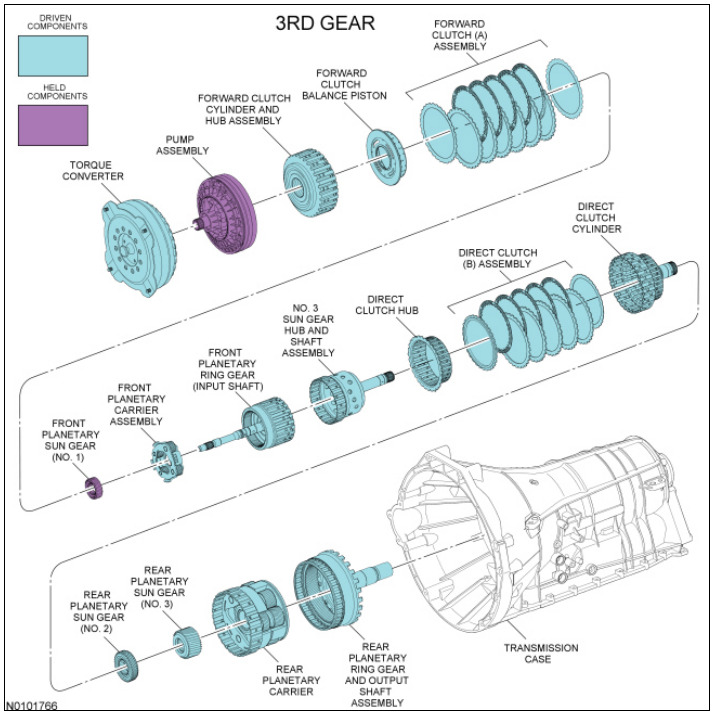
Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
6th Gear			X	X	X	X	X

For solenoid information, refer to Transmission Electronic Control System in this section.

Printable / zoomable view of this graphic



3rd Gear Fail Safe



Mechanical Operation

Apply components:

- Forward clutch (A) applied (quantity model dependant)
- Direct clutch (B) applied (quantity model dependant)

Forward Clutch (A) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	5
5.4L	Expedition, Navigator, F-150	5	6

Direct Clutch (B) Plate Quantity

NOTE: The number of clutch plates are model dependant based on engine displacement.

Engine	Vehicle	Friction Plates	Steel Plates
4.6L	Explorer, Mountaineer, Sport Trac, F-150	4	4
5.4L	Expedition, Navigator, F-150	5	5

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear
- No. 2 sun gear

Rear planetary gearset driven components:

- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:

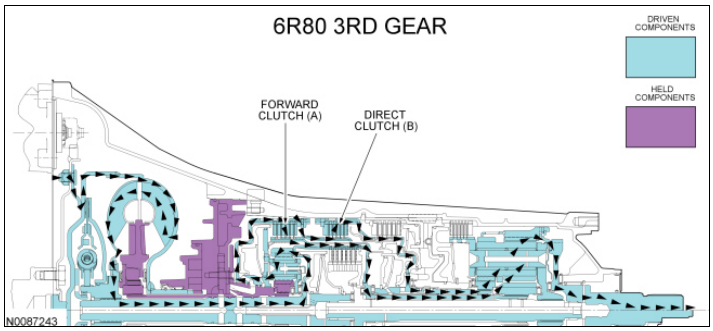
- None

3rd Gear Fail Safe Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)
3rd Gear	X	X			

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - ♦ manual valve.
  - ♦ lubrication control valve.
  - ♦ converter release regulator valve.
  - ♦ bypass clutch control regulator valve.
  - ♦ solenoid pressure regulator valve.
  - ♦ D1 and D2 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC .
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies full solenoid output pressure to the main regulator valve through the VFS5 hydraulic circuit. With full solenoid output pressure, the main regulator valve provides maximum line pressure during fail safe.
- SSB supplies maximum solenoid output pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to, apply the clutch. Regulated line pressure from the clutch B regulator valve is also supplied to the clutch A latch valve from the clutch B latch valve through the BREV 5F circuit.
- The clutch A latch valve directs the regulated line pressure to the drive enable valve through the BREV5 circuit.
- The drive enable valve directs the BREV5 pressure to the BREVA circuit which supplies the clutch A regulator valve to position the valve to apply the forward clutch (A) with 81% of line pressure.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

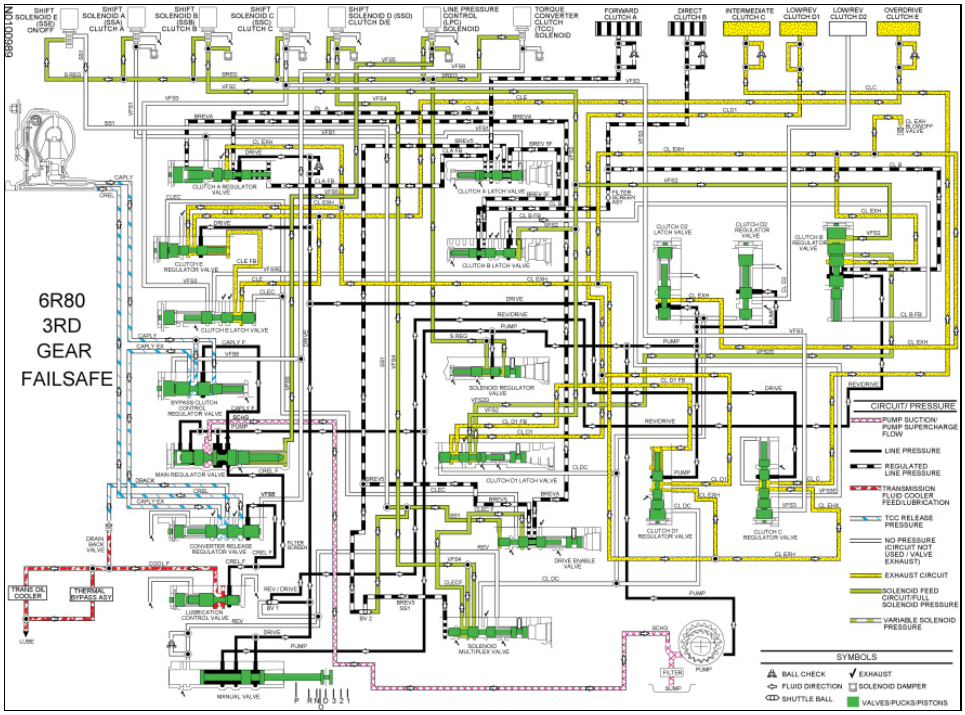
Solenoid operation:

3rd Gear Fail Safe Solenoid Operation Chart

Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
3rd Gear	-	-	-	-	-	-	-

For solenoid information, refer to Transmission Electronic Control System in this section.

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6R80
3RD
GEAR
FAILSAFE
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
EXHAUST
FLUID DIRECTION
SOLENOID DAMPER
SHUTTLE BALL
VALVES/PUCKS/PISTONS

Diagnostic Strategy

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take short cuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- Powertrain Control/Emissions Diagnosis (PC/ED) manual
- On-Line Automotive Service Information System (OASIS)
- TSBs
- Wiring Diagrams manual

These publications provide the information required when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer concern.
- Verify the concern by operating the vehicle.
- Check the transmission fluid level and condition.
- Check for non-factory add-on items.
- Check selector lever cable for correct adjustment.
- Check TSBs regarding the concern.

Diagnostics

- Carry out On-Board Diagnostic (OBD) procedures, Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).
- Record all DTCs.
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Clear all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only codes that have passed are obtained, refer to Diagnosis By Symptom in this section for additional information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Diagnostic Flow Chart

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Prior to carrying out the flow test, the following items should be checked:

- Know and understand the customer concerns.
- Verify the concern by operating the vehicle.
- Check the transmission fluid level and condition.
- Check for non-factory-installed items and verify correct installation.
- Check the selector lever cable adjustments.
- Check TSBs for vehicle concerns.
- Carry out Self Test both Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).
- Record all DTCs.
- Verify the vehicles PCM and Transmission Control Module (TCM) is programmed to the latest calibration level.

Diagnostic Flow Chart		
1) Were any DTCs recorded?	Yes	• REPAIR all DTCs. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, then this workshop manual, GO to Step 2.
	No	• REFER to Diagnosis By Symptom in this section, GO to Step 5.
2) Are any continuous test memory codes present?	Yes	• CLEAR codes and CARRY OUT drive cycle test, GO to Step 3.
	No	• GO to Step 4.
3) Did the continuous test memory codes reappear?	Yes	• REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, then this workshop manual, GO to Step 4.
	No	• GO to Step 4.
4) Is the concern repaired?	Yes	• CARRY OUT the final self-test to verify that no DTCs are present. CLEAR the DTCs.
	No	

		• REFER to Diagnosis By Symptom in this section to diagnose and repair the concern, GO to Step 5.
5) Are there any electrical concerns?	Yes	• INSTALL the scan tool and CARRY OUT the output state control test, GO to Step 6.
	No	• REFER to the hydraulic and mechanical routine to DIAGNOSE and REPAIR the concern, GO to Step 7.
6) Was the transmission concern corrected when the scan tool was installed?	Yes	• REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, intermittent fault diagnosis section and use the scan tool to diagnose cause of concern in the processor, vehicle harness of external inputs (sensors or switches).
	No	• REFER to the hydraulic and mechanical routine to DIAGNOSE and REPAIR the concern, GO to Step 7.
7) Is the concern repaired?	Yes	• CARRY OUT the final self-test and verify that no DTCs are present. CLEAR the DTCs.
	No	• Concern should have been repaired. RETURN to the Diagnostic Flow Chart and REVIEW other components that may have contributed to the concern. CHECK and DIAGNOSE those components.

Preliminary Inspection

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer concern or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions, including when the concern occurs. For example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to Verification of Condition.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

The following procedures must be used when verifying customer concerns for the transmission.

Determine Customer Concern

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperature
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshifting
- Downshifting
- Coasting
- Engagement
- Noise/vibration - check for engine rpm, vehicle speed, shift, gear, range or temperature dependencies.

Check Transmission Fluid Level and Condition

Transmission Fluid Level Check

NOTICE: **The vehicle should not be driven if the transmission fluid level is low as internal transmission failure could result.**

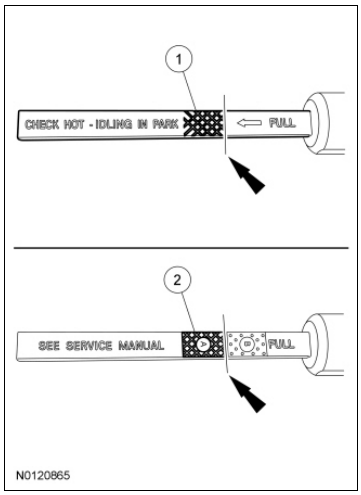
NOTICE: **The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.**

NOTE: If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the transmission fluid must cool down to obtain an accurate reading.

NOTE: If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

This transmission is equipped with an internal thermal bypass located in the case. This internal thermal bypass valve will shut off transmission fluid flowing to the transmission fluid cooler if the transmission fluid temperature falls below normal operating temperature. Refer to Transmission Fluid Level Check in this section.

The transmission can have 2 types of transmission fluid level indicators, the original or the replacement. The original transmission fluid level indicator has a single crosshatch area for the fluid level. The replacement has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the crosshatched area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.



1	Original transmission fluid level indicator
2	Replacement transmission fluid level indicator

High Transmission Fluid Level

NOTICE: **A transmission fluid level that is too high can cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transmission failure.**

If an overfill reading is indicated, remove any excessive transmission fluid. Refer to Transmission Fluid Level Check in this section.

Low Transmission Fluid Level

Low transmission fluid level can result in poor transmission engagement, slipping or failure. This may also indicate a leak in one of the transmission seals or gaskets.

Adding Transmission Fluid

NOTICE: **The use of any type of transmission fluid other than specified can result in transmission failure.**

NOTICE: **The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.**

NOTICE: **The vehicle should not be driven if the transmission fluid level is low as internal failure could result.**

Add transmission fluid using the refill procedure. Refer to Transmission Fluid Drain and Refill in this section.

Transmission Fluid Condition Check

1. Check the transmission fluid level.
2. Remove the transmission fluid fill plug and transmission fluid level indicator allowing the transmission fluid to drip onto a facial tissue and examine the stain.
3. Observe the color and the odor.
4. If evidence of solid material is found, remove the transmission fluid pan for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transmission. Inspect the engine cooling system at this time.
6. If transmission fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, disassemble and completely clean the transmission. This includes the torque converter and transmission fluid cooler tubes. Install a new auxiliary transmission fluid cooler.

Water in Transmission Fluid

To correctly repair an automatic transmission that had water or coolant introduced into the system, completely disassemble, clean and replace the following parts:

- All internal and external seals
- All friction material
- Torque converter
- All parts with bonded seals
- All solenoids
- All transmission fluid filters

Prior to installing the transmission, the transmission fluid cooler(s), transmission fluid cooler tubes and hoses need to be flushed and cleaned.

Shift Point Road Test

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

This test verifies the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate vehicle with the selector lever in Overdrive (O/D) position.
3. Apply minimum throttle and observe speeds at which upshift occurs and the torque converter engages. Refer to the Shift Speeds chart in this section.
4. With the selector lever in O/D , move the selector lever into the manual 3 position. The transmission should downshift to 4th gear. Release the accelerator pedal; engine braking should occur.
5. Press the accelerator pedal to floor, Wide Open Throttle (WOT). Transmission should shift from 4th to 3rd, depending on vehicle speed. The torque converter should disengage and then reapply.
6. With the selector lever in the Overdrive (O/D) position and vehicle speed above 80 km/h (50 mph) and less than half throttle, move the selector lever from the O/D position to manual 2 position and release the accelerator pedal. The transmission should downshift into 2nd gear. With the transmission remaining in the manual 2 position, move the selector lever into the manual 1 position and release the accelerator pedal. The transmission should downshift into 1st gear at speeds below approximately 45-56 km/h (28-35 mph).
7. If the transmission fails to upshift/downshift or the torque converter does not apply and release, refer to Diagnosis By Symptom in this section.

Shift Speeds

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet. Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	Km/H	MPH
Light Throttle	1-2	13-21	8-13
Throttle Position (TP) Sensor	2-3	26-34	16-21
Voltage @ 1.25 Volts	3-4	35-43	22-27
	4-5	56-64	35-40
	5-6	71-79	44-49

Closed Throttle	6-5	56-64	35-40
	5-4	40-48	25-30
	4-3	13-21	8-13
	3-2	3-11	2-7
	2-1	2-6	1-4
Wide Open Throttle (WOT)	1-2	45-53	28-33
	2-3	87-95	54-59
	3-4	140-148	87-92

Road Test - Adaptive Drive Cycle

1. Connect the scan tool to the Data Link Connector (DLC).
2. **NOTE:** Disconnecting the battery will not clear the Keep Alive Memory (KAM).

   NOTE: Do not clear the PCM KAM .

   Using the scan tool, clear the Transmission Control Module (TCM) KAM and the adaptive table before conducting an adaptive drive cycle test.
3. Using the scan tool verify the transmission fluid is at normal operating temperature, between 80°C-82°C (176°F-180°F). If the transmission fluid is not at operating temperature, drive the vehicle approximately 5 km (3.1 mi) to reach operating temperature.
4. **NOTE:** The transmission fluid must be at operating temperature before proceeding to this step.

   Drive the vehicle to perform adaptive shift strategy learn on a level road surface.

   1. Accelerate from a stop with light throttle to 24 km/h (15 mph) and then release the accelerator pedal.
   2. Gently brake and bring the vehicle to a stop and hold the brake for 6 seconds.
   3. Repeat Substeps 1 and 2 an additional 5 times.
   4. Accelerate from a stop with light throttle so the 1-2, 2-3 and 3-4 shifts occur with engine speeds between 1,700-2,000 rpm.
   5. Continue accelerating until either the vehicle speed reaches 80 km/h (50 mph) or the 5-6 upshift is reached.
   6. Gently brake and bring the vehicle to a stop and hold the brake for 10 seconds.
   7. Repeat Substeps 4, 5 and 6 an additional 3 times.

Torque Converter Diagnosis

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of good torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary inspection.

2. Know and understand the customer concern.

3. Verify the condition - carry out the Torque Converter Operation Test.

4. Perform diagnostic procedures.

- Perform On-Board Diagnostic (OBD) test. Refer to Diagnostics in this section.
  - ♦ Repair all non-transmission related DTCs first.
  - ♦ Repair all transmission-related DTCs.
  - ♦ Rerun OBD test to verify repair.
- Perform Stall Speed Test. Refer to Special Testing Procedures in this section.
- Perform Diagnostic Routines. Refer to Diagnosis By Symptom in this section.
  - ♦ Use the Diagnosis by Symptom to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and repair as required before changing the torque converter.

Torque Converter Operation Test

The Torque Converter Operation Test verifies the Torque Converter Clutch (TCC) control system and the torque converter are operating correctly.

1. Perform a self-test with the scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Check for DTCs.

2. Connect a scan tool to the vehicle.

3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds with the selector lever in the Overdrive (O/D) position.

4. After normal operating temperature is reached, maintain a constant speed of about 56 km/h (35 mph) in 5th gear for 10 seconds.

5. Release the accelerator pedal and monitor the scan tool Throttle Position (TP) voltage to approximately 1.25 volts or 25% throttle.

6. Monitor the TCC and RPM TCM PIDs. The torque converter should release and engine rpms should increase before the 5-4 shift occurs.

NOTE: The following is a list of common vehicle concerns that have been misdiagnosed as torque converter shudder. For diagnosis of the following items, refer to the appropriate sections of the workshop manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

- Spark plugs - check for cracks, high resistance or broken insulators
- Ignition coil-on-plug - misfire
- Fuel injector - filter may be plugged
- Fuel contamination - engine driveability concerns
- EGR valve - valve may let in too much exhaust gas and cause engine to run lean
- Vacuum leak - engine will not get correct air/fuel mixture
- Manifold Absolute Pressure (MAP) and Mass Air Flow (MAF) sensor - incorrect air/fuel mixture
- Heated Oxygen Sensor (HO2S) - too rich/lean air/fuel mixture
- Fuel pressure - may be too low
- Engine mounts - loose/damaged mounts can cause vibration concerns
- Axle joints - check for vibration

Visual Inspection

A visual inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - A/C
  - generator (alternator)
  - engine turbo
  - cellular telephone
  - cruise control
  - CB radio
  - linear booster
  - backup alarm signal
  - computer
- Vehicle modification:

These items, if not installed correctly, will affect the PCM or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size or axle ratio changes.

- Leaks; refer to Leakage Inspection in this section.
- Correct selector lever adjustments; refer to Section 307-05 .

Selector Lever Check

Check for a misadjustment in the selector lever by matching the detents in the Transmission Range (TR) selector lever with those of the manual control lever in the transmission.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-05 for selector lever cable adjustment.

Check TSBs and On-Line Automotive Service Information System (OASIS)

Refer to all TSB and On-Line Automotive Service Information System (OASIS) messages that pertain to the transmission concern and follow the procedure as described.

Carry Out On-Board Diagnostic (OBD) Key ON Engine OFF (KOEO), Key ON Engine Running (KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, perform a self-test using the scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Diagnostics

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. The most important things to remember is there is a definite procedure to follow. Do not take shortcuts or assume that critical checks or adjustments have already been made. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostic (OBD) with Scan Tool

These self-tests should be used to diagnose the PCM and should be carried out in order.

NOTE: Make sure the latest software version is loaded on the scan tool.

1. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC to the VCM .

2. If the scan tool does not communicate with the VCM :
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No power to the scan tool.

3. If the scan tool does not communicate with the vehicle:
   - verify the ignition is in the RUN position.
   - verify scan tool operation with a known good vehicle.
   - refer to Section 418-00 , The PCM does not respond to the scan tool.

4. Carry out the network test:
   - If the scan tool responds with no communication from one or more modules, refer to Section 418-00 , No High Speed Controller Area Network (CAN) communication, all modules are not responding.
   - If the network test passes, retrieve and record the continuous memory DTCs.

5. Clear the continuous DTCs and carry out the PCM self-test.

6. If DTCs retrieved are related to the concern, GO to the DTC Chart.

7. If no DTCs related to the concern are retrieved, REFER to Diagnosis By Symptom in this section.

Output State Control (OSC) Mode

On-Board Diagnostic (OBD)

Output state control allows the technician to take control of certain parameters to function the transmission.

Output state control allows the technician to shift the transmission when commanding a gear change.

Another example of the output state control features is, the technician can command the torque converter ON or OFF to check operation.

This transmission output state control has one mode of operation; DRIVE. This mode has a unique set of operating requirements that the technician must meet before allowed to operate the torque converter or select gears.

Diagnostic Parameters Identification (PID) Chart

The following is a list of output state control parameters and their corresponding PIDs:

Diagnostic PID Chart

PID Name	PID Description	Units
APP_R	Accelerator Pedal Position (APP) Relative	0% - 100%
AST	Time Since Start	Time
CLRDIST	Distance Since Diagnostic Trouble Codes Cleared	Miles
DRIVE	Gear Lever Position - Drive	Yes/No
DTC TCM	Continuous Codes	Number
ECT TCM	Engine Coolant Temperature (ECT) Transmission Control Module	Degrees
ENGLOAD	Engine Load	0% - 100%
GEAR	Gear Commanded by Module	1, 2, 3, 4, 5
GEAR_OSC#	Gear Commanded by Output State Control	1, 2, 3, 4, 5
GEAR_RAT_CMD	Gear Ratio Commanded	Ratio 0-5:1
GEAR_RAT_MES	Gear Ratio Measured	Ratio 0-5:1
MIL_DIS	The Distance Traveled Since the MIL was Activated	Miles
NEUTRAL	Gear Lever Position - Neutral	Yes/No
OSS	Output Shaft Speed (OSS)	rpm
OSS_SRC	Unfiltered OSS	rpm
PCA AMP	PCA Amp	Current
PVT	Pressure Vacuum Transducer	Pressure
PVT	Pressure Vacuum Transducer	Vacuum
REVERSE	Gear Lever Position - Reverse	Yes/No
RPM TCM	Engine Revolutions Per Minute	rpm
SHIFT_TYPE	Shifter Position	Mode
SSA_AMP	Shift Solenoid Pressure Control A (SSPCA)	Current
SSB_AMP	Shift Solenoid Pressure Control B (SSPCB)	Current
SSC_AMP	Shift Solenoid Pressure Control C (SSPCC)	Current
SSD_AMP	Shift Solenoid Pressure Control D (SSPCD)	Current
SSE	Shift Solenoid Pressure Control E (SSPCE)	0% - 100%
TCC AMP	Torque Converter Clutch (TCC) Solenoid Pressure Control	Current
TCC_OSC#	TCC Output State Control	Locked/Unlocked
TC_SLIPACT	Torque Converter Slip Actual	rpm
TC_SLIP_ABSL	Absolute Value of Torque Converter Slip	rpm
TFT	Transmission Fluid Temperature (TFT)	Temp
TORQUE	Net Engine Torque	Torque Nm

TP	Throttle Position (TP) Sensor	0% - 100%
TR	Transmission Range (TR) Sensor	Mode
TSS	Turbine Shaft Speed (TSS)	rpm
TSS_SRC	Unfiltered TSS Sensor	rpm
VPWR TCM	Module Supply Voltage	Voltage
VSS	Vehicle Speed Sensor (VSS)	mph 0-80
WARMUPS	Number of Warm-Ups Since DTCs Cleared	Number

Transmission Drive Cycle Test

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Malfunctions must occur 4 times consecutively for a shift error DTC to set, and 5 times consecutively for continuous Torque Converter Clutch (TCC) DTCs to set.

NOTE: Refer to the Solenoid Application Chart for solenoid operation while performing the Transmission Drive Cycle Test.

After performing the self-test, follow the transmission drive cycle test for checking codes.

1. Record then clear the DTCs.

2. Warm the engine to normal operating temperature.

3. Make sure the transmission fluid level is correct.

4. With the selector lever in Overdrive (O/D), moderately accelerate from stop to 80 km/h (50 mph) allowing the transmission to shift into 6th gear. Keep vehicle speed and throttle steady for a minimum of 15 seconds.

5. With the transmission in 6th gear and maintaining steady speed and throttle, lightly apply and release the brake pedal to operate the stop lamps. Then, hold vehicle speed and throttle steady for a minimum of 5 seconds.

6. Brake to a stop and remain stopped for a minimum of 20 seconds.

7. Repeat steps 4 through 6 at least 5 times.

8. Perform a self-test and record DTCs.
    - If DTCs are present, refer to the DTC Chart. Repair all non-transmission DTCs first as they can directly affect the operation of the transmission. Repeat the self-test and the road test to

verify the correction. Clear the DTCs. Perform the transmission drive cycle test and repeat the self-test after completing the repair.
- If the tests pass and a concern is present, refer to Diagnosis By Symptom in this section, OASIS messages and TSBs for concerns.

After On-Board Diagnostic (OBD)

NOTE: The vehicle wiring harness, PCM and non-transmission sensors may affect transmission operations. Repair these concerns first.

Repair all DTCs after the On-Board Diagnostic (OBD) test procedures are completed.

Begin with non-transmission related DTCs, then repair transmission related DTCs. Use the DTC Chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Diagnosis the vehicle wiring harness and the PCM as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual aids in diagnosing non-transmission electronic components.

Diagnostic Trouble Code (DTC) Charts

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Using a scan tool to retrieve DTCs, begin with and repair all non-transmission related DTCs. Start with the U-DTC codes (communication link codes) then repair any transmission-related DTCs.

Limp-home mode is a default condition to protect the engine and transmission when a fault occurs. Limp-home mode depends on the actual gear the vehicle was in when the fault has occurred.

- For gears 1-3, the limp-home default will be 3rd gear.
- For gears 4-6, the limp-home default will be 5th gear.

The limp-home gear will be held until the vehicle is placed in R, P or the vehicle has been restarted. After these action(s) the vehicle will default to the limp-home mode of 3rd gear.

DTC Chart

DTC	Component	Description	Condition	Symptom	Action
P0218	Transmission Fluid Temperature (TFT)	TFT condition	Transmission Control Module (TCM) has detected a TFT that has exceeded a set temperature.	• Aggressive lockup schedule	PERFORM normal diagnostic for an overheating condition. REFER to Diagnosis By Symptom in this section.
P0562	Battery	System voltage low	TCM has detected a voltage level below minimum voltage to operate solenoids. Maintains current solenoid state.	• Malfunction Indicator Lamp (MIL) ON • Transmission Control Indicator Lamp (TCIL) ON • No adaptive	CONNECT the scan tool and monitor the VPWR TCM PID and verify module supply voltage to the TCM . REFER to Diagnostic Parameters Identification (PID) Chart in this section.

				strategy • No self learning strategy • Default to 3rd or 5th gear • Battery voltage below 9 volts	
P0563	Battery	System voltage high	TCM has detected a voltage level above maximum voltage.	• No adaptive strategy • No self learning strategy • MIL may turn ON • Default to 3rd or 5th gear • Battery voltage above 16 volts • Will turn on TCIL	CONNECT the scan tool and monitor the VPWR TCM PID and verify module supply voltage to the TCM . REFER to the Diagnostic Parameters Identification (PID) Chart and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0605	TCM	The TCM Read-Only Memory (ROM) has been corrupted	TCM has detected an internal software concern with ROM .	• MIL ON • TCIL ON • Default to 3rd or 5th gear	REPROGRAM the original mechatronic to the latest calibration. CLEAR the DTCs. TEST the system for normal operation. If DTCs return, INSTALL a new mechatronic assembly. After installing the new mechatronic assembly, it must be programmed with the latest calibration. PERFORM the Road Test - Adaptive Drive Cycle. REFER to Shift Point Road Test in this section.
P0613	TCM	TCM processor	TCM has detected an internal software issue.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	INSTALL a new mechatronic assembly. After installing the new mechatronic assembly, it must be programmed with the latest calibration.
P0634	TCM	TCM module temperature	Internal temperature	• MIL ON	CONNECT the scan tool and monitor the TFT PID to

			within TCM too high. Possible restriction in cooling circuit.	• Default to 3rd or 5th gear	verify that a high temperature is present. INSPECT the transmission fluid cooler tubes for possible restrictions (kinked or bent cooler tube). VERIFY correct operation/orientation of the thermal bypass valve. INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0641	TCM	TCM module sensor voltage failed	Sensor reference voltage A circuit open, voltage too high or too low.	• MIL ON • TCIL ON • Default to 3rd or 5th gear • Low battery voltage under 9 volts. May also cause P0562	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0657	TCM	Actuator supply voltage A circuit open	Power supply actuators open circuit.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0658	TCM	Actuator supply voltage A circuit low	Power supply actuators short circuit to ground.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.

P0659	TCM	Actuator supply voltage A circuit high	Actuator power supply short circuit to power before key ON.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0667	TCM	PCM/ECM/ TCM internal temperature sensor range/performance	Substrate temperature sensor.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0701	Transmission control system	Transmission control system range/performance	TCM has detected a concern with the operational strategy.	• TCIL ON • One or more DTCs set causing transmission to default to a hydraulic limp-home mode • Default to 3rd or 5th gear	Multiple DTC failure with conflicting failure mode actions. If other DTCs are present, REPAIR them first. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. REPROGRAM the TCM first. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0705					

	Transmission Range (TR) sensor	TR sensor circuit error	TCM has detected a TR signal (P, R, N, D, 3, 2 or 1) is out of range.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the appropriate PID to validate that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0711	TFT sensor	TFT sensor circuit range/performance	TCM has detected no TFT change during operation.	• MIL ON • TCIL ON • Default to 3rd or 5th gear • No TCC	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0712	TFT sensor	TFT sensor A circuit low	TCM has detected a voltage drop across the TFT sensor exceeds scale set for temperature (grounded circuit).	• MIL ON • TCIL ON • No TCC	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0713	TFT sensor	TFT sensor A circuit high	TCM has detected a voltage drop across the TFT sensor; exceeds scale set for temperature.	• MIL ON • TCIL ON • No TCC	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0714	TFT sensor	TFT sensor A circuit intermittent	TCM has detected no TFT intermittent operation.	• MIL ON • TCIL ON • No TCC	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0715	Turbine Shaft Speed (TSS) sensor	TSS sensor A circuit	TSS has detected a short circuit to power.	• MIL ON • TCIL ON • No TCC engagement • Maximum line	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.

				pressure • No adaptive learning strategy • Default to 3rd gear	
P0716	TSS sensor	TSS sensor A circuit range/performance	TCM has detected a loss or noisy TSS signal during operation.	• MIL ON • TCIL ON • No TCC • Maximum line pressure • No adaptive learning strategy • Default to 3rd gear	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0717	TSS sensor	No TSS sensor A circuit no signal	TCM has not detected a TSS signal. No TSS signal when Output Shaft Speed (OSS) signal is present.	• MIL ON • TCIL ON • No TCC • Maximum line pressure • No adaptive learning strategy • Default to 3rd gear	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0720	OSS sensor	No OSS sensor circuit	TCM has detected an OSS short circuit to power.	MIL ON	INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0721	OSS sensor	OSS sensor circuit range/performance	TCM has detected a loss or noisy OSS signal during operation.	MIL ON	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the

					DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0722	OSS sensor	No OSS sensor no signal	TCM has not detected a OSS signal. No OSS signal when OSS signal is present.	MIL ON	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0723	OSS sensor	No OSS sensor circuit intermittent	TCM has detected an intermittent signal.	• MIL ON • TCIL ON • No TCC • Hold in gear currently selected • Maximum line pressure • No adaptive learning strategy	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0729	Transmission	Gear 6 incorrect ratio	No 6th gear ratio detected by the TCM .	• MIL ON • TCIL ON • No 6th gear • No TCC • No adaptive learning strategy • Maximum line pressure • Default to 5th gear	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 272. REFER to Diagnosis By Symptom in this section.

P0731	Transmission	Gear 1 incorrect ratio	No 1st gear ratio detected by the TCM .	• MIL ON • TCIL ON • No 1st gear • No TCC • No adaptive learning strategy • Default to 3rd gear • Maximum line pressure	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 215. REFER to Diagnosis By Symptom in this section.
P0732	Transmission	Gear 2 incorrect ratio	No 2nd gear ratio detected by the TCM .	• MIL ON • TCIL ON • No TCC engagement • No adaptive learning strategy • Default to 3rd gear • Maximum line pressure	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 220, 224 and 217. REFER to Diagnosis By Symptom in this section.
P0733	Transmission	Gear 3 incorrect ratio	No 3rd gear ratio detected by the TCM .	• MIL ON • TCIL ON • No TCC • No adaptive learning strategy • Default to 4th gear • Maximum line pressure	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 221 or 223. REFER to Diagnosis By Symptom in this section.
P0734	Transmission	Gear 4 incorrect ratio	No 4th gear ratio detected by the TCM .	• MIL ON • TCIL ON • No TCC • No adaptive	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification

				learning strategy • Default to 3rd gear • Maximum line pressure	(PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 222 or 271. REFER to Diagnosis By Symptom in this section.
P0735	Transmission	Gear 5 incorrect ratio	No 5th gear ratio detected by the TCM .	• MIL ON • TCIL ON • No TCC • No adaptive learning strategy • Default to 3rd gear • Maximum line pressure	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 270 or 273. REFER to Diagnosis By Symptom in this section.
P0736	Transmission	Reverse incorrect ratio	No reverse gear ratio detected by the TCM .	• MIL ON • No TCC • No adaptive learning strategy • Default to 4th gear • Maximum line pressure	FOLLOW preliminary diagnostics. CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 202 or 205. REFER to Diagnosis By Symptom in this section.
P0740	TCC solenoid	TCC solenoid circuit open	TCC solenoid VFS 6 circuit fails. Circuit open.	• MIL ON • TCIL ON • No adaptive learning strategy • Default to 3rd or 5th gear • No TCC	CONNECT the scan tool and monitor the TCC PID to verify TCC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit.

					CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0741	TCC	TCC solenoid circuit performance or stuck off	TCC solenoid VFS 6, clutch or circuit open.	• MIL ON • TCIL ON • No TCC	PERFORM normal diagnostics for TCC . FOLLOW diagnostic Routines 240, 241 and 242. REFER to Diagnosis By Symptom in this section.
P0742	TCC Solenoid	TCC solenoid circuit stuck on	The TCM has detected a TCC solenoid control circuit shorted to ground.	• MIL ON • TCC is disabled • Poor launch performance • Maximum line pressure • Default to 5th gear • DTC P0743 may be set	CONNECT the scan tool and monitor the TCC PID to verify TCC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0743	TCC Solenoid	TCC solenoid circuit electrical	The TCM has detected a TCC solenoid circuit open, shorted to ground or an intermittent.	• TCIL ON • TCC is disabled • Maximum line pressure • Poor launch performance	CONNECT the scan tool and monitor the TCC PID to verify TCC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid

				• Default to 5th gear • DTCs P0740, P0742 or P0744 may be set	terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0744	TCC Solenoid	TCC solenoid circuit intermittent	The TCM has detected the TCC solenoid control circuit shorted to power.	• MIL ON • TCC is disabled • DTC P0743 may be set	CONNECT the scan tool and monitor the TCC PID to verify TCC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0748	Pressure Control Solenoid A (PCA)	PCA electrical	The TCM will set this DTC along with one or more specific electrical DTCs.	• TCIL ON • Maximum line pressure • Default to 5th gear • DTCs P0960, P0962 or P0963 may be	CONNECT the scan tool and monitor the PCA PID to verify PCA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination.

				set	REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0750	Shift Solenoid A (SSA)	SSA	The TCM has detected that the SSA circuit failed open or shorted to power.	• MIL ON • 5th and 6th gear only • Poor launch performance • DTC P0753 may be set	CONNECT the scan tool and monitor the SSA PID to verify SSA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0751	SSA	SSA performance/stuck off	The TCM commanded SSA ON but detected a ratio error (mechanical failure).	• MIL ON • 5th or 6th gear only • Harsh reverse engagement • Neutral or flair condition on downshift • Poor launch performance	DTC P0751 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.

				• DTC P2700 may be set	
P0752	SSA	SSA stuck on	The TCM commanded SSA OFF but detected a ratio error (mechanical failure).	• MIL ON • Disable 5th and 6th gear • Erratic shifts • Stuck in 4th gear • DTC P2700 may be set	DTC P0752 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P0753	SSA	SSA electrical	The TCM will set this DTC along with one or more specific electrical DTCs.	• TCIL ON • 5th and 6th gear only • DTCs P0750, P0973 or P0974 may be set	CONNECT the scan tool and monitor the SSA PID to verify SSA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0754	SSA	SSA intermittent	The TCM will set this DTC when an intermittent condition (open, short to power or ground) occurs three times for less than 5 seconds with each occurrence.	• MIL ON • Unexpected upshifts, downshifts, flairs or neutral conditions	CONNECT the scan tool and monitor the SSA PID to verify SSA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT

					and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0755	Shift Solenoid B (SSB)	SSB	The TCM has detected that the SSB circuit has failed open or shorted to power.	• MIL ON • 3rd and 5th gear only • Harsh 1-3 shift • DTC P0758 may be set	CONNECT the scan tool and monitor the SSB PID to verify SSB electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0756	SSB	SSB performance/stuck off	The TCM commanded SSB ON but detected a ratio error (mechanical failure).	• MIL ON • Disable 3rd and 5th gear • Neutral or flair condition • Transmission hangs in 2nd on acceleration	DTC P0756 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.

				• DTC P2701 may be set	
P0757	SSB	SSB stuck on	The TCM commanded SSB OFF but detected a ratio error (mechanical failure).	• MIL ON • Disable 3rd and 5th gear • Neutral or flair condition • Erratic shifts • DTC P2701 may set	DTC P0757 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P0758	SSB	SSB electrical	The TCM will set this DTC along with one or more specific electrical DTCs.	• TCIL ON • Default to 3rd or 5th gear depending on the DTC • Minimum or maximum line pressure depending on the DTC (failed voltage high or voltage low) • DTCs P0755, P0976 or P0977 may be set	CONNECT the scan tool and monitor the SSB PID to verify SSB electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0759	SSB	SSB intermittent	The TCM will set this DTC when an intermittent condition (open, short to power or ground) occurs three times for less than 5	• MIL ON • Unexpected upshifts, downshifts, flairs or neutral conditions	CONNECT the scan tool and monitor the SSB PID to verify SSB electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the

			seconds with each occurrence.		DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0760	Shift Solenoid C (SSC)	SSC	The TCM detected that he SSC circuit failed open.	• MIL ON • Disable 2nd and 6th gear • Erratic or harsh 1-3 shift • DTC P0763 may be set	CONNECT the scan tool and monitor the SSC PID to verify SSC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0761	SSC	SSC performance/stuck off	The TCM commanded SSC ON but detected a ratio error (mechanical failure).	• MIL ON • Disable 2nd and 6th gear • Neutral or flair condition • DTC P2702 may be	DTC P0761 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.

				set	
P0762	SSC	SSC stuck on	The TCM commanded SSC OFF but detected a ratio error (mechanical failure).	• MIL ON • 2nd and 6th gear only • Harsh reverse engagement • Erratic shift or stuck in 6th • DTC P2702 may be set	DTC P0762 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P0763	SSC	SSC electrical	The TCM will set this DTC along with one or more specific electrical DTCs.	• TCIL ON • Default to 2nd and 6th gear or 1st and 3rd depending on the DTC • Minimum or maximum line pressure depending on the DTC (failed voltage high or voltage low) • DTCs P0760, P0979 or P0980 may be set	CONNECT the scan tool and monitor the SSC PID to verify SSC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0764	SSC	SSC intermittent	The TCM will set this DTC when an intermittent condition (open, short to power or	• MIL ON • Unexpected upshifts, downshifts, flairs or	CONNECT the scan tool and monitor the SSC PID to verify SSC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in

			ground) occurs three times for less than 5 seconds with each occurrence.	neutral conditions	this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0765	Shift Solenoid D (SSD)	SSD	The TCM detected that the SSD circuit failed open.	• MIL ON • TCIL ON • Disable 1st gear • DTC P0768 may be set	CONNECT the scan tool and monitor the SSD PID to verify SSD electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0766	SSD	SSD performance/stuck off	The TCM commanded SSD ON but detected a ratio error (mechanical failure).	• MIL ON • 2nd and 3rd gear only • Delayed or no reverse	DTC P0766 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.

				engagement • DTC P2703 and/or DTC P2704 may be set	
P0767	SSD	SSD stuck on	The TCM commanded SSD OFF but detected a ratio error (mechanical failure).	• MIL ON • 4th gear only • DTC P2704 may be set	DTC P0767 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P0768	SSD	SSD electrical	The TCM will set this DTC along with one or more specific electrical DTCs.	• TCIL ON • Disable 1st gear or 3rd gear only depending on the DTC • Minimum or maximum line pressure depending on the DTC (failed voltage high or voltage low) • DTCs P0765, P0982 or P0983 may be set	CONNECT the scan tool and monitor the SSD PID to verify SSD electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0769	SSD	SSD intermittent	The TCM will set this DTC when an intermittent condition (open, short to power or ground) occurs three times for less than 5	• MIL ON • Unexpected upshifts, downshifts, flairs or neutral conditions	CONNECT the scan tool and monitor the SSD PID to verify SSD electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the

			seconds with each occurrence.		DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0770	Shift Solenoid E (SSE)	SSE	SSE circuit or solenoid failure.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSE PID to verify SSE electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. MEASURE the resistance of SSE . If the value is not between 9.5 to 10.5 ohms, INSTALL a new SSE , REFER to Mechatronic Assembly in this section. If the value is between 9.5 to 10.5 ohms, REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0771	SSE	SSE performance/stuck off	The TCM commanded SSE ON but detected a ratio error	• MIL ON • 1st, 2nd and 3rd	DTC P0771 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the

			(mechanical failure).	gear only • Erratic shifting, flairs or neutral condition • DTC P0984 may be set	DTC returns, REFER to Diagnosis By Symptom in this section.
P0772	SSE	SSE stuck on	The TCM commanded SSE OFF but detected a ratio error (mechanical failure).	• MIL ON • Disable 1st, 2nd and 3rd gear • 4th gear launch • DTC P0984 may be set	DTC P0772 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P0773	SSE	SSE electrical	The TCM will set this DTC along with one or more specific electrical DTCs.	• MIL ON • TCIL ON • Default to 3rd or 5th gear • DTC P0770 may be set	CONNECT the scan tool and monitor the SSE PID to verify SSE electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. MEASURE the resistance of SSE . If the value is not between 9.5 to 10.5 ohms, INSTALL a new SSE , REFER to Mechatronic Assembly in this section. If the value is between 9.5 to 10.5 ohms, REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest

					calibration.
P0774	SSE	SSE intermittent	The TCM will set this DTC when an intermittent condition (open, short to power or ground) occurs three times for less than 5 seconds with each occurrence.	• TCIL ON • Hangs In 1st gear • Default to 3rd or 5th gear • DTC P0770 may be set	CONNECT the scan tool and monitor the SSE PID to verify SSE electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. MEASURE the resistance of SSE . If the value is not between 9.5 to 10.5 ohms, INSTALL a new SSE , REFER to Mechatronic Assembly in this section. If the value is between 9.5 to 10.5 ohms, REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P07A8	Friction Element D	Friction element D performance/stuck off	The Low/Reverse clutch failed off, ratio error (mechanical failure)	• Disable 1st gear • Delayed or no reverse engagement	DTC P07A8 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P07A9	Friction Element D	Friction element D stuck on	The Low/Reverse clutch failed on, ratio error (mechanical failure)	• 1st gear only • High engine rpm	DTC P07A9 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to Diagnosis By Symptom in this section.
P07AA	Friction Element E	Friction element E performance/stuck off	Clutch 4, 5, 6 failed off, ratio error (mechanical failure)	• Disable 4th, 5th and 6th gear	DTC P07AA is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to

				• Erratic shifts, neutral conditions, flair or high engine rpm	Diagnosis By Symptom in this section.
P0781	Transmission	1-2 or 2-1 shift error	Incorrect ratio calculated during shift 1-2 or 2-1.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • MIL ON • TCIL ON • No TCC • No adaptive learning strategy • Hold in 3rd, 2nd or 4th gear	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 220 or 225. REFER to Diagnosis By Symptom in this section.
P0782	Transmission	2-3 or 3-2 shift error	Incorrect ratio calculated during shift 2-3.	• Incorrect gear selection depending on failure or mode and manual lever	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic

				position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • MIL ON • TCIL ON • No TCC • No adaptive learning strategy • Hold in 4th, 3rd or 2nd gear	Routine 221 or 224. REFER to Diagnosis By Symptom in this section.
P0783	Transmission	3-4 or 4-3 shift error	Incorrect ratio calculated during shift 3-4 or 4-3.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • MIL ON • TCIL ON • No TCC	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 222 or 223. REFER to Diagnosis By Symptom in this section.

				• No adaptive learning strategy • Default to 3rd or 4th gear	
P0784	Transmission	4-5 or 5-4 shift error	Incorrect ratio calculated during shift 4-5 or 5-4.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • MIL ON • TCIL ON • No TCC • No adaptive learning strategy • Default to 4th or 5th gear	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 270 or 271. REFER to Diagnosis By Symptom in this section.
P0829	Transmission	5-6 or 6-5 shift error	Incorrect ratio calculated during shift 5-6 or 6-5.	• Incorrect gear selection depending on failure or mode and manual lever position. Shift	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, see diagnostic Routine 272 or 273. REFER to Diagnosis By Symptom

				errors may also be due to other internal transmission concerns (stuck valves, damaged friction material) • MIL ON • TCIL ON • No TCC • Default to 2nd or 3rd gear	in this section.
P0960	Pressure Control Solenoid A (PCA)	PCA control circuit open	PCA circuit failed during operation.	• MIL ON • TCIL ON • No adaptive strategy • Maximum line pressure	CONNECT the scan tool and monitor the PCA PID to verify PCA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0962	PCA	PCA control circuit low	Voltage through PCA was not detected when the solenoid was commanded on.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the PCA PID to verify PCA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the

					DTC returns, REMOVE the mechatronic unit. INSPECT and clean the solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0963	PCA	PCA circuit high	Voltage through PCA was not detected when the solenoid was commanded on.	• MIL ON • TCIL ON • Maximum line pressure • No adaptive strategy	CONNECT the scan tool and monitor the PCA PID to verify PCA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0972	Shift Solenoid A (SSA)	SSA control circuit range/performance	SSA control circuit or solenoid failure.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSA PID to verify SSA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT

					and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0973	SSA	SSA control circuit low	Voltage through SSA was not detected when the solenoid was commanded off. Short to ground detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSA PID to verify SSA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0974	SSA	SSA control circuit high	Voltage through SSA was not detected when the solenoid was commanded on. Open or short to power detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSA PID to verify SSA electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe

					for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0975	Shift Solenoid B (SSB)	SSB control circuit range/performance	SSB control circuit or solenoid failure.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSB PID to verify SSB electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0976	SSB	SSB circuit low	Voltage through SSB was not detected when the solenoid was commanded off. Short to ground detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSB PID to verify SSB electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the

					mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0977	SSB	SSB circuit high	Voltage through SSB was not detected when the solenoid was commanded on. Open or short to power detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSB PID to verify SSB electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0978	Shift Solenoid C (SSC)	SSC control circuit range/performance	SSC control circuit or solenoid failure.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSC PID to verify SSC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool

					and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0979	SSC	SSC control circuit low	Voltage through SSC was not detected when the solenoid was commanded off. Short to ground detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSC PID to verify SSC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0980	SSC	SSC control circuit high	Voltage through SSC was not detected when the solenoid was commanded on. Open or short to power detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSC PID to verify SSC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and

					check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0981	Shift Solenoid D (SSD)	SSD control circuit range/performance	SSD control circuit or solenoid failure.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSD PID to verify SSD electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0982	SSD	SSD control circuit low	Voltage through SSD was not detected when the solenoid was commanded off. Short to ground detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSD PID to verify SSD electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new

					mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0983	SSD	SSD control circuit high	Voltage through SSD was not detected when the solenoid was commanded on. Open or short to power detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSD PID to verify SSD electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0985	SSE	SSE control circuit low	Voltage through SSE was not detected when the solenoid was commanded off. Short to ground detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSE PID to verify SSE electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. MEASURE the resistance of SSE . If the value is not between 9.5 to 10.5 ohms, INSTALL a new SSE , REFER to Mechatronic Assembly in this section. If the value is between 9.5 to 10.5 ohms, REINSTALL the mechatronic unit.

					CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P0986	SSE	SSE control circuit high	Voltage through SSE was not detected when the solenoid was commanded on. Open or short to power detected.	• MIL ON • TCIL ON • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the SSE PID to verify SSE electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the shift solenoid terminals at the leadframe for metallic contamination. MEASURE the resistance of SSE . If the value is not between 9.5 to 10.5 ohms, INSTALL a new SSE , REFER to Mechatronic Assembly in this section. If the value is between 9.5 to 10.5 ohms, REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P1705	TR sensor	TR circuit not indicating park/neutral during self-test	TR circuit not indicating park/neutral during Key ON Engine OFF (KOEO) or Key ON Engine Running (KOER) self-test.	-	VERIFY the selector lever is in PARK or NEUTRAL. CLEAR the DTC. RERUN the KOEO and/or KOER self-test. TEST the system for normal operation.
P1707	Transmission				

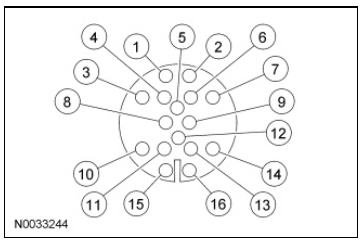
		Park/Neutral (P/N) switch circuit failure	Circuit or sensor failure high. Circuit or sensor failure low.	• Engine will not crank in P or N or engine will crank in all gears • TCIL ON	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. CHECK the shift linkage. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P1910	Reverse lamp circuit	Reverse lamp control circuit open	Control circuit or sensor failure.	• Park lock or interlock switched OFF • Reverse lamps may be on at all times • Reverse may not come on	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST system for normal operation. If DTC returns, REFER to Section 417-01 .
P1911	Reverse lamp circuit	Reverse lamp control circuit shorted to ground. Circuit low	Circuit or sensor failure.	-	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST system for normal operation. If DTC returns, REFER to Section 417-01 .
P1912	Reverse lamp circuit	Reverse lamp control circuit shorted to power. Circuit high	Circuit or sensor failure.	• Park lock or interlock switched OFF	CONNECT the scan tool and monitor the appropriate PID to verify that an error is present. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST system for normal operation. If DTC returns, REFER to Section 417-01 .
P2763	TCC				

		TCC pressure control solenoid control circuit high.	Voltage through TCC was not detected when the solenoid was commanded on. Short to power detected.	• MIL ON • TCIL ON • No TCC • No adaptive learning strategy • Default to 3rd or 5th gear	CONNECT the scan tool and monitor the TCC PID to verify TCC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P2764	TCC	TCC pressure control solenoid control circuit low.	TCC was not detected when the solenoid was commanded on. Short to ground detected.	• MIL ON • TCIL ON • No TCC • No adaptive learn strategy	CONNECT the scan tool and monitor the TCC PID to verify TCC electrical operation. REFER to Diagnostic Parameters Identification (PID) Chart in this section. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REMOVE the mechatronic unit. INSPECT and clean the solenoid terminals at the leadframe for metallic contamination. REINSTALL the mechatronic unit. CONNECT the scan tool and CLEAR the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, INSTALL a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
P062F	TCM	Internal control module EEPROM	Internal TCM with Electrically	• MIL ON	CLEAR the DTCs. TEST the system for normal

		error	Erasable Programmable Read-Only Memory (EEPROM) error.	• Mechanical limp-home mode	operation. If the DTC returns, install a new mechatronic unit. After installing the new mechatronic unit, it must be programmed with the latest calibration.
U0073	Controller Area Network (CAN)	Control module communication bus off	CAN communication bus off, short circuit CAN high to CAN low.	• TCIL ON • No TCC • No adaptive learn strategy • Default to 3rd gear • Maximum line pressure	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U0100	CAN	Lost communication with ECM/PCM A	CAN link error detected by TCM , between TCM and PCM.	• TCIL ON • No TCC • No adaptive learn strategy • Default to 3rd gear • Maximum line pressure	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U0155	CAN	Lost communication with Instrument Cluster (IC) control module	CAN link error detected by the TCM and IC .	• No communication with the IC	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Transmission Connector Layouts

Transmission Vehicle Harness - C1575

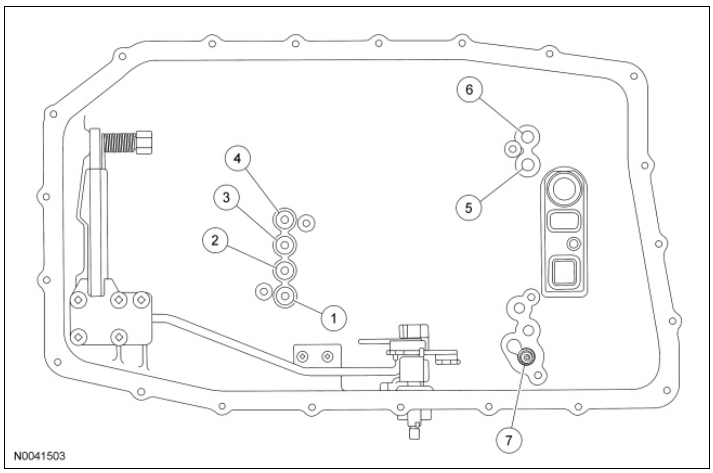


Item	Description
1	NOT USED
2	Controller Area Network (CAN) low
3	NOT USED
4	NOT USED
5	NOT USED
6	CAN high
7	NOT USED
8	NOT USED
9	Ignition voltage
10	Park/Neutral signal
11	NOT USED
12	NOT USED
13	Ground
14	Battery voltage
15	NOT USED
16	Ground

Special Testing Procedures

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transmission.

Air Pressure Test



Item	Description
1	Intermediate clutch (C) port
2	Low/reverse clutch (D1) port
3	Not used
4	Direct clutch (B) port
5	Overdrive clutch (E) port
6	Forward clutch (A) port
7	Thermal bypass valve

A no-drive condition can exist with correct transmission fluid pressure because of inoperative clutches. Refer to the Clutch Application Chart to determine the appropriate elements. A clutch concern can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the concern.

Example: When the selector lever is in a forward gear range, a no-drive condition may be caused by an inoperative clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.

2. Remove the transmission fluid filter, seal assembly and mechatronic unit.

3. Locate the inoperative clutches by applying air pressure into the appropriate clutch port.

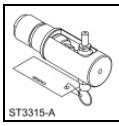
4. Apply air pressure to the appropriate clutch port. A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing sound may be heard.

5. If the clutches fail to operate during the air check:
    - the piston seals are not seated, damaged or installed incorrectly.
    - plugged feed holes for clutch apply in the case and/or clutch cylinder.
    - damaged piston and/or clutch cylinder.

6. Service as required and recheck.

Leakage Inspection

Special Tool(s)

 ST3315-A	Leak Tester, Torque Converter 307-691

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-

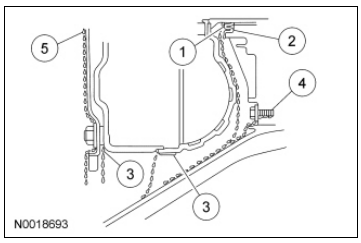
Leak Check Test

NOTE: When diagnosing transmission leaks, the source of the leak must be positively identified prior to repair. If the vehicle is driven extensively between adding the fluorescent additive and performing the leak test, the leaking oil can spread and make identifying the location of the leak difficult.

1. Clean off any transmission fluid from the top and bottom of the torque converter housing, the front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a nonflammable solvent and blow dry with compressed air.

2. Add Dye-Lite® ATF Power Steering Fluid Leak Detection Dye to the transmission fluid. Use one 30 ml (1 fl. oz) of dye solution for every 3.8 L (4 qt) of transmission fluid.

3. Start and run the engine until the transmission reaches its normal operating temperature. Raise the vehicle on a hoist and run the engine occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transmission. Using a black light, observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Run the engine until transmission fluid leakage is evident and the probable source of leakage can be determined.



4. If the source of the leak is obvious, repair as required. Leaks from the torque converter housing can originate from several locations. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 5 steps following correspond with the numbers in the illustration.
    1. Transmission fluid leaking by the converter hub seal lip will tend to move along the drive hub and onto the back of the torque converter. Except in the case of a total seal failure,

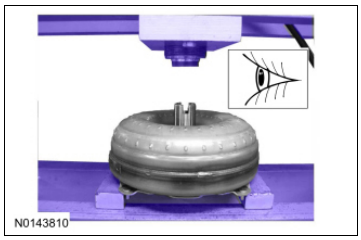
transmission fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing.
2. Transmission fluid leakage by the outside diameter of the converter impeller hub seal and the case will follow the same path that leaks by the ID of the converter hub seal follow.
3. Transmission fluid leakage from the converter cover weld or the converter-to-flexplate stud weld will appear at outside diameter of torque converter on the back face of the flexplate and in the converter housing only near the flexplate. If a converter-to-flexplate lug, lug weld or converter cover weld leak is suspected, remove the converter and pressure check.
4. Transmission fluid leakage from the bolts inside the converter housing will flow down the back of the torque converter housing. Leakage may be from loose or missing bolts.
5. Engine oil leaks from the rear main oil.

5. Remove the torque converter.

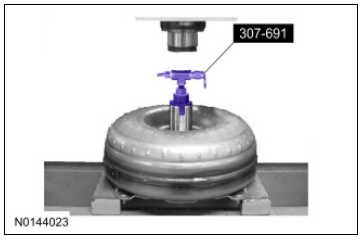
6. Using a black light, observe the torque converter housing. Inspect for evidence of dye from the pump bolts, pump seal, and torque converter hub seal. Repair as required.

7. If the source of the leak is not evident, continue with this procedure to leak test the torque converter.

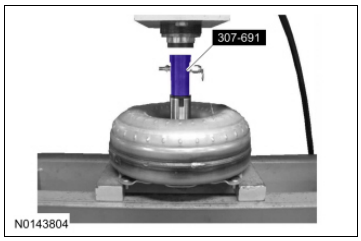
8. Install the torque converter in the arbor press. Support the torque converter on the mounting pads.



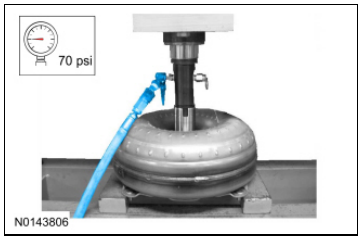
9. Install the Leak Tester, Torque Converter 307-691 into the torque converter hub. Tighten to 25 Nm.



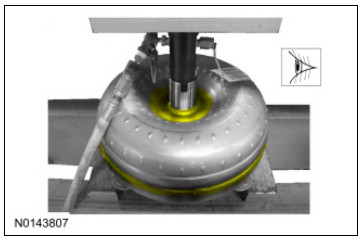
10. Secure the press. Only apply enough force from the press to seal the Leak Tester, Torque Converter 307-691 into the torque converter hub.



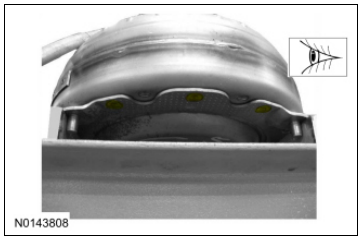
11. Connect a compressed air supply to the Leak Tester, Torque Converter 307-691.



12. With air pressure applied to valve, inspect for leaks at the converter hub weld and seams. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new torque converter.



13. With air pressure applied to valve, inspect for leaks at the stud or mounting pad and balance weight welds. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new torque converter.



14. After leaks are repaired, clean the remaining transmission fluid dye from serviced areas.

Transmission Fluid Cooler

NOTICE: **When a transmission has been disassembled to install new parts, the transmission fluid cooler and/or auxiliary cooler should be replaced and the transmission fluid cooler tubes must be cleaned and backflushed to keep contaminants from entering the transmission, causing internal damage.**

NOTE: Cleaning and backflushing the transmission fluid cooling tubes, along with following all the normal cleaning and inspection procedures during disassembly and reassembly, will keep contaminants from entering the transmission, causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission failure and must be removed from the transmission cooling system before the transmission is put back into use. Install a new transmission fluid cooler and/or auxiliary cooler and backflush the transmission fluid cooler tubes.

Diagnosis By Symptom

The Diagnosis By Symptom gives the technician diagnostic information and direction, and suggests possible components using a symptom as a starting point. All routines start out with any potential electrical components that can cause or contribute to the symptom described. The routines then list all possible hydraulic or mechanical components that can cause or contribute the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Diagnosis by Symptom, select the condition that best describes the condition.

2. Refer to the Routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with:
    1. preliminary inspections.
    2. verifications of condition.
    3. checking the fluid levels.
    4. perform other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a DTC. Be aware that components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.

   NOTE: When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The Transmission Control Module (TCM) must relearn these parameters. During this learning process, slightly firm shifts, delayed or early shifts may occur. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored in the TCM .

   Begin with the ROUTINES, if indicated. Follow the reference or action required statements. Always perform the On-Board Diagnostic (OBD) tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, proceed to the Hydraulic/Mechanical Routine listed.

5. The list contains only possible hydraulic or mechanical components that may cause or contribute to the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure that repairs are complete.

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Diagnostic Routines

Engagement Concerns: No Forward in Drive

Possible Component	Reference/Action

201 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Selector Lever Linkage	
• Selector lever linkage - damage or incorrectly adjusted	• INSPECT and REPAIR as required. VERIFY selector lever cable adjustment. REFER to Section 307-05 . ADJUST selector lever cable as necessary.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and CLEAR the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid A (SSA)	• INSPECT and CLEAN the SSA terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and CLEAR the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective manual valve	• Inspect manual valve linkage.
• Defective clutch A regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Forward clutch (A) friction and steel plate - failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.

• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate - failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
Pump	
• Pump gear - failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Engagement Concerns: No Reverse

Possible Component	Reference/Action
202 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Selector Lever Linkage	
• Selector lever linkage - damage or incorrectly adjusted	• INSPECT and REPAIR as required. VERIFY selector lever cable adjustment. REFER to Section 307-05 . ADJUST selector lever cable as necessary.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section.

Solenoid B (SSB)	CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective direct clutch (B) or low/reverse clutch (D) regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
Pump	
• Pump gear - failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Engagement Concerns: Harsh Reverse

Possible Component		Reference/Action
203 - ROUTINE		
Transmission Fluid		
	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Mechatronics		
	• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
	• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic

		Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
	• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
	• Transmission Control Module (TCM) mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Driveline		
	• Engine driveline looseness in the driveshaft, U-joints or the engine mounts	• INSPECT and REPAIR as required.

Engagement Concerns: Harsh Forward

Possible Component	Reference/Action
204 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid A (SSA)	• INSPECT and CLEAN the SSA terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.

• Defective clutch A regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch A latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• TCM mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Driveline	
• Engine driveline looseness in the driveshaft, U-joints or the engine mounts	• INSPECT and REPAIR as required.

Engagement Concerns: Delayed/Soft Reverse

Possible Component	Reference/Action
205 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.

• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Transmission Control Module (TCM) mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

Engagement Concerns: Delayed/Soft Forward

Possible Component	Reference/Action
206 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid A (SSA)	• INSPECT and CLEAN the SSA terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic

	unit, it must be programmed with the latest calibration.
• Defective clutch A latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Transmission Control Module (TCM) mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

Engagement Concerns: No Forward and No Reverse

Possible Component	Reference/Action
207 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Selector Lever Linkage (Internal/External)	
• Damaged, out of aadjustment	• INSPECT for damage, repair as required.
Transmission Filter and Seal Assembly	
• Not seated, damaged or plugged • Pump adapter Seal	• INSPECT for position, damage and restriction. INSTALL a new filter and seal assembly. . • INSPECT for crack or damage. INSTALL new as required.
Mechatronics	
• Manual Valve • Mounting bolt torque • Solenoid Pressure Regulator Valve	• INSPECT for damage. Replace as required. • INSPECT for loose mechatronic assembly to transmission bolts. Tighten to specification. • INSPECT for valve stuck in spring compressed position or broken spring. CLEAN or REPLACE mechatronic assembly as required. REFER to Mechatronic Assembly .

Pump Assembly	
• Gear	• INSPECT for damage. REPLACE as required.
• Sun gear hub/splines	• INSPECT for damage. REPLACE as required.
Other Possible Components	
• Turbine shaft	• INSPECT for damage. REPAIR as required.
• Front planetary gear set	• INSPECT for damage. REPAIR as required.
• Forward clutch drum	• INSPECT for damage. REPAIR as required.
• Output shaft/ring gear	• INSPECT for damage. REPAIR as required.

Engagement Concerns: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), external vehicle wiring harnesses, solenoids, Transmission Range (TR) sensor, Shift Solenoid A (SSA), Pressure Control Solenoid A (PCA)	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test again.
• Multiple shift missing (more than one gear)	• If some shifts are missing, determine which shifts do not occur. REFER to clutch and solenoid application charts in this section. MONITOR appropriate PIDs as listed in diagnostics.

	REFER to Routine 210.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.

Engagement Concerns: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Mechatronics	
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

Shift Concerns: Some/All Shifts Missing

Possible Component	Reference/Action
210 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.

Selector Lever Linkage Damaged or Incorrectly Adjusted	
• Selector lever cable	• INSPECT and REPAIR as required. VERIFY selector lever cable adjustment. REFER to Section 307-05 . ADJUST selector lever cable as necessary.
Forward Clutch (A) Assembly (No Shifts)	
• Seals, piston - damaged	• INSPECT and REPAIR as required.
• Friction elements - damaged or worn	• INSPECT and REPAIR as required.
• Return springs - damaged	• INSPECT and REPAIR as required.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses, solenoids, Transmission Range (TR) sensor, Shift Solenoid A (SSA), Pressure Control Solenoid A (PCA)	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test again.
• Multiple shift missing (more than one gear)	• If some shifts are missing, determine which shifts do not occur. REFER to the Clutch and Solenoid Application Charts in this section. MONITOR appropriate PIDs as listed in diagnostics.

Shift Concerns: Timing - Early/Late

Possible Component	Reference/Action
211 - ROUTINE	
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test again.
• Engine driveability concerns	• REFER to Section 303-00 .
Mechatronics	
• Bolts not tightened to specification	• TIGHTEN to specification.
• Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve	• INSPECT for damage. If damaged, INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

damaged, stuck or bore damaged	
Incorrect Pressures	
• Application pressures are incorrect	• Incorrect application pressures may be due to non-transmission components, mechatronic assembly or internal transmission damage. REPAIR all non-transmission components then continue with this routine.
Other	
• Tire size change, axle ratio change	• VERIFY the vehicle has the original equipment. REFER to the Vehicle Certification (VC) label. Changes in tire size and axle ratio will affect shift timing.

Shift Concerns: Timing - Erratic/Hunting

Possible Component		Reference/Action
212 - ROUTINE		
Transmission Fluid		
	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
	• Condition	• CARRY OUT Transmission Fluid Condition Check. REFER to Preliminary Inspection in this section.
	• Transmission fluid over temperature condition	• REFER to Transmission Overheating, Routine 257.
Powertrain Control System		
	• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test again.
Torque Converter Concerns		
	• Torque Converter Clutch (TCC)	• REFER to Torque Converter Operation Concerns: Cycling/Chatter.

Feel Concerns: Soft/Slipping (some or all)

Possible Component	Reference/Action
213 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test again.
Transmission Fluid Temperature (TFT) Sensor Damaged	
• Mechatronic assembly	• REMOVE the mechatronic unit. INSPECT and CLEAN the TFT terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Bolts not tightened to specification	• TIGHTEN to specification.
• Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stick or bore damaged	• INSPECT for damage. If damaged, install a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

Feel Concerns: Harsh (some or all)

Possible Component	Reference/Action

214 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. REPROGRAM the mechatronic assembly with the latest calibration. CARRY OUT Shift Point Road Test - Adaptive Drive Cycle, REFER to Shift Point Road Test in this section. ROAD TEST and PERFORM the OBD test.
Mechatronics	
• Bolts not tightened to specification	• TIGHTEN bolts to specification.
• Mechatronic assembly contaminated, solenoid(s) damaged, solenoids stuck or bore damaged	• INSPECT for damage. If damaged install a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
• Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged install a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

Feel Concerns: No 1st Gear, Engages in Higher Gear

Possible Component	Reference/Action
215 - ROUTINE	
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Incorrect Gear	
• Mechatronic failure	• DETERMINE which gear the transmission is in. REFER to the Clutch and Solenoid Application Charts in this section.

Feel Concerns: No Manual 1st Gear

Possible Component	Reference/Action
216 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Selector Lever Linkage	
• Selector lever cable system - damaged, misaligned	• INSPECT and REPAIR as necessary.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid A (SSA)	• INSPECT and CLEAN the SSA terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.

Clutch Plates	
• Forward clutch (A) friction and steel plate - failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate - failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
Pump	
• Pump gear - failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No Manual 2nd Gear

Possible Component	Reference/Action
217 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Selector Lever Linkage	
• Selector lever cable system - damaged, misaligned	• INSPECT and REPAIR as necessary.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.

• Defective Shift Solenoid A (SSA)	• INSPECT and CLEAN the SSA terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Clutch Plates	
• Forward clutch (A) friction and steel plate - failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate - failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
Pump	
• Pump gear - failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No Manual 3rd Gear

Possible Component	Reference/Action
218 - ROUTINE	
Selector Lever Linkage	
• Selector lever cable system - damaged, misaligned	• INSPECT and REPAIR as necessary.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs.

	ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
Powertrain Control System	
• PCM electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Clutch Plates	
• Forward clutch (A) friction and steel plate - failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate - failure.	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
Pump	
• Pump gear - failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No 1-2 Shift

Possible Component	Reference/Action
220 - ROUTINE	
Transmission Fluid	

• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid C (SSC)	• INSPECT and CLEAN the SSC terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid D (SSD)	• INSPECT and CLEAN the SSD terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch C regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	

• Intermediate clutch (C) friction and steel plate - failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate - failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.

Feel Concerns: No 2-3 Shift

Possible Component	Reference/Action
221 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly - plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid C (SSC)	• INSPECT and CLEAN the SSC terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic

	unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch C regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate - failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 3-4 Shift

Possible Component	Reference/Action
222 - ROUTINE	
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.

• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid D (SSD)	• INSPECT and CLEAN the SSD terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid E (SSE)	• INSPECT and CLEAN the SSE terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch E regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective solenoid multiplex valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.

• Overdrive clutch (E) friction and steel plate - failure	• Inspect the overdrive clutch assembly for damage. Repair as required. Refer to Overdrive Clutch Assembly in this section.

Feel Concerns: No 4-3 Shift

Possible Component	Reference/Action
223 - ROUTINE	
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid D (SSD)	• INSPECT and CLEAN the SSD terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch E regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch E latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B regulator	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.

valve	
• Solenoid multiplex valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Drive enable valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Overdrive clutch (E) friction and steel plate - failure	• INSPECT the overdrive clutch assembly for damage. REPAIR as required. REFER to Overdrive Clutch Assembly in this section.

Feel Concerns: No 3-2 Shift

Possible Component	Reference/Action
224 - ROUTINE	
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic

	unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid C (SSC)	• INSPECT and CLEAN the SSC terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch C regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate - failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 2-1 Shift

Possible Component	Reference/Action
225 - ROUTINE	
Mechatronics	

• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid C (SSC)	• INSPECT and CLEAN the SSC terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch C regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch D regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (C) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate - failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.

Torque Converter Operation Concerns: No Apply

Possible Component	Reference/Action
240 - ROUTINE	
Transmission Fluid	

• Condition	• CARRY OUT the Transmission Fluid Condition Check. REFER to Preliminary Inspection in this section.
Mechatronics	
• Defective Torque Converter Clutch (TCC) solenoid	• INSPECT and CLEAN the TCC solenoid terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective torque converter apply regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective torque converter release regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic assembly bolts - not tightened to specification	• TIGHTEN to specification.
• Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
PCM	
• Powertrain control system electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses, TCC solenoid, Transmission Fluid Temperature (TFT) sensor	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Torque Converter	
• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission - Four Wheel Drive (4WD) or Transmission - Rear Wheel Drive (RWD) in this section.

Torque Converter Operation Concerns: Cycling/Chatter

Possible Component	Reference/Action
241 - ROUTINE	
Transmission Fluid	
• Condition	• CARRY OUT the Transmission Fluid Condition Check. REFER to Preliminary Inspection in this section.
Mechatronics	
• Defective Torque Converter Clutch (TCC) solenoid	• INSPECT and CLEAN the TCC solenoid terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective torque converter apply regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic assembly bolts - not tightened to specification	• TIGHTEN to specification.
• Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
PCM	
• Powertrain control system electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses, TCC solenoid, Transmission Fluid Temperature (TFT) sensor	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Torque Converter	
• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission - Four Wheel Drive (4WD) or Transmission - Rear Wheel Drive (RWD) in this section.

Torque Converter Operation Concerns: Always Applied/Stalls Vehicle

Possible Component	Reference/Action
242 - ROUTINE	
Transmission Fluid	
• Condition	• CARRY OUT the Transmission Fluid Condition Check. REFER to Preliminary Inspection in this section.
Mechatronics	
• Defective Torque Converter Clutch (TCC) solenoid	• INSPECT and CLEAN the TCC solenoid terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Mechatronic assembly bolts - not tightened to specification	• TIGHTEN to specification.
• Mechatronic unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
PCM	
• Powertrain control system electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses, TCC solenoid, Transmission Fluid Temperature (TFT) sensor	• PERFORM On-Board Diagnostic (OBD) tests. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Torque Converter	
• Torque converter components	• REMOVE the transmission. INSPECT for damage. Install a new or remanufactured torque converter. REFER to Transmission - Four Wheel Drive (4WD) or Transmission - Rear Wheel Drive (RWD) in this section.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission case vent - damaged, case porosity	• INSPECT and REPAIR as necessary.
• Leakage at gaskets, seals, bulkhead connector	• REFER to Leakage Inspection , Fluid Leakage in Torque Converter Area and Transmission Leak Check Test Procedures in this section for potential leak locations. REMOVE all traces of lubricant on exposed surface of the transmission. REPAIR as necessary.
Transmission Fluid Cooler Tubes	
• Transmission fluid cooler tube fittings	• LOCATE leak source. REPAIR as required. REFER to Section 307-02 .
• Transmission fluid cooler tube O-rings, transmission fluid cooler tubes	• LOCATE leak source. REPAIR as required. REFER to Section 307-02 .
Torque Converter	
• Torque converter studs	• INSTALL a new torque converter.
• Torque converter hub seal	• INSTALL a new torque converter hub seal.
• Torque converter weld	• INSTALL a new torque converter.
Transmission Case	
• Case - leaking	• INSTALL a new transmission case. REFER to Transmission in this section.
• Transmission electrical connector	• INSTALL a new transmission electrical connector O-ring.
• Transmission fluid fill plug	• INSTALL a new transmission fluid fill plug.
• Output shaft seal	• INSTALL a new seal. REFER to Output Shaft Seal in this section.

• Manual control valve lever seal	• INSTALL a new seal.
• Transmission fluid pan seal (gasket)	• INSTALL a new seal.
Fluid Pump	
• Fluid pump O-ring	• INSTALL a new O-ring. REFER to Pump Assembly in this section.
• Fluid pump seal ring	• INSTALL a new seal ring. REFER to Pump Assembly in this section.

Noise/Vibration in Forward or Reverse

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

Possible Component	Reference/Action
254 - ROUTINE	
Transmission Fluid	
• Incorrect level (low) pump cavitation	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Transmission Fluid Cooler Tubes	
• Transmission fluid cooler tubes grounding out	• ADJUST or reposition cooler tubes.
Torque Converter	
• Check the torque converter components/balance weight	• LOCATE source of disturbance. REPAIR as required.
Engine Driveline	
• Engine drive accessories	• REFER to Section 303-00 .

Engine Will Not Crank

Possible Component	Reference/Action
255 - ROUTINE	
Selector Lever Cable System	

• Selector lever cable system - damaged, misaligned	• INSPECT and REPAIR as necessary. REFER to Section 307-05 .
Powertrain Control System	
• Electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses, engine starting system, Transmission Range (TR) sensor	• PERFORM On-Board Diagnostic (OBD) tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of engine components. CHECK PIDs for TR park and neutral positions. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Torque Converter	
• Flexplate - damaged	• INSPECT and REPAIR as necessary.
Vehicle Starter	
• Starter system concerns	• INSPECT and REPAIR as necessary. REFER to Section 303-06 .
TR Sensor Assembly	
• TR assembly - damaged	• INSPECT and REPAIR as necessary.
Fluid Pump Assembly	
• Internal parts seized	• INSPECT and REPAIR as necessary.

No Park (P) Range

Possible Component	Reference/Action
256 - ROUTINE	
Selector Lever Cable	
• Selector lever cable system - damaged, misaligned	• INSPECT and REPAIR as necessary.
• Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged, park pawl pin loose or damaged, park rod actuating plate loose, damaged or missing	• INSPECT and REPAIR as necessary.
• Transmission case assembly	• INSPECT and REPAIR as necessary.
• Park gear, park pawl, park pawl return spring, part or guide, park actuating rod, park pawl shaft, manual lever	• INSPECT and REPAIR as necessary.
• External linkages/brackets - damaged	• INSPECT and REPAIR as necessary.
Transmission Range (TR) Assembly Damaged	

• Manual lever detent spring	
• TR assembly	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.

Transmission Overheating

Possible Component	Reference/Action
257 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Condition	• CARRY OUT the Transmission Fluid Condition Check. REFER to Preliminary Inspection in this section.
Powertrain Control System	
• Electrical inputs/outputs, Transmission Control Module (TCM), vehicle wiring harnesses, Torque Converter Clutch (TCC) solenoid	• PERFORM On-Board Diagnostic (OBD) tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of engine components. CHECK PIDs for Transmission Range (TR) park and neutral positions. REPAIR as required. CLEAR the DTCs. ROAD TEST and PERFORM the OBD test.
Torque Converter Not Engaging	
• Torque converter	• INSTALL a new torque converter.
Case Vent Damaged	
• Transmission case assembly	• INSPECT and REPAIR as necessary.
Other	
• Restriction in transmission cooling system	• CHECK transmission cooling system efficiency. REFER to Section 307-02 for automatic transmission cooling system diagnostic procedures.
• Excessive trailer tow load	• REFER to the Owner's Literature for specifications on trailer towing.
• Vehicle heat shield - missing or damaged	• INSPECT and REPAIR as necessary.
	• INSPECT and REPAIR as necessary.

• Vehicle airflow is restricted	
• Thermal bypass valve - missing or damaged	• INSPECT for damage. If damaged, repair as necessary. REFER to Mechatronic Assembly .

Fluid Venting/Foaming

Possible Component	Reference/Action
261 - ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Case Vent Damaged	
• Transmission case assembly	• INSPECT and REPAIR as necessary.

Shift Concerns: No 4-5 Shift

Possible Component	Reference/Action
270 - ROUTINE	
Mechatronics	
• Electronic component - failure	• Remove the mechatronic unit. Inspect and clean the shift solenoid terminals on the mechatronic leadframe for metallic contamination. Install the mechatronic unit. Refer to Mechatronic Assembly in this section. Connect the scan tool and clear the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. Refer to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid A (SSA)	• Inspect and clean the SSA terminals on the mechatronic leadframe for metallic contamination. Refer to Mechatronic Assembly in this section. Connect the scan tool and clear the DTCs. Road test the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. Refer to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid	• Inspect and clean the SSB terminals on the mechatronic leadframe for metallic contamination. Refer to Mechatronic Assembly in this section. Connect the scan tool and clear the DTCs. Road test the vehicle and check for DTCs. If the DTC

B (SSB)	returns, install a new mechatronic unit. Refer to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch A regulator valve	• Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
• Defective clutch A latch valve	• Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
• Defective clutch B regulator valve	• Inspect mechatronic assembly for stuck valves or contamination. Refer to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• Install a new mechatronic assembly. Refer to Mechatronic Assembly in this section.
Clutch Plates	
• Forward clutch (A) friction and steel plate - failure	• Inspect the forward clutch assembly for damage. Repair as required. Refer to Forward Clutch Assembly in this section.
• Direct clutch (B) friction and steel plate - failure	• Inspect the direct clutch assembly for damage. Repair as required. Refer to Direct Clutch Assembly in this section.

Feel Concerns: No 5-4 Shift

Possible Component	Reference/Action
271 - ROUTINE	
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If

		the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
	• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
	• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
	• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
	• Defective clutch A regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
	• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates		
	• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Forward clutch (A) friction and steel plate - failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.

Feel Concerns: No 5-6 Shift

Possible Component	Reference/Action
272 - ROUTINE	
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section.

	CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid B (SSB)	• INSPECT and CLEAN the SSB terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid C (SSC)	• INSPECT and CLEAN the SSC terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch C regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate - failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

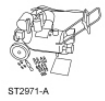
Feel Concerns: No 6-5 Shift

Possible Component	Reference/Action
273 - ROUTINE	
Mechatronics	
• Electronic component - failure	• REMOVE the mechatronic unit. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. INSTALL the mechatronic unit. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective Shift Solenoid C (SSC)	• INSPECT and CLEAN the SSC terminals on the mechatronic leadframe for metallic contamination. REFER to Mechatronic Assembly in this section. CONNECT the scan tool and clear the DTCs. ROAD TEST the vehicle and check for DTCs. If the DTC returns, install a new mechatronic unit. REFER to Mechatronic Assembly in this section. After installing the new mechatronic unit, it must be programmed with the latest calibration.
• Defective clutch B regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch B latch valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Defective clutch C regulator valve	• INSPECT mechatronic assembly for stuck valves or contamination. REFER to Mechatronic Assembly in this section.
• Mechatronic unit - failed	• INSTALL a new mechatronic assembly. REFER to Mechatronic Assembly in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.

	• Intermediate clutch (C) friction and steel plate - failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Transmission Fluid Cooler Backflushing and Cleaning

Special Tool(s)

 ST2971-A	Transmission Heated Cooler Line Flusher 222-00007, 222-00004 or equivalent

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

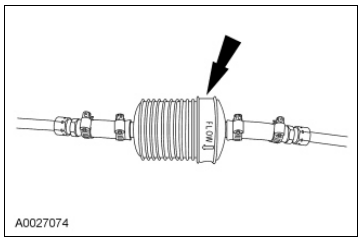
NOTICE: **Use transmission fluid specified for this transmission. Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products could cause internal transmission components to fail; this will affect the operation of the transmission.**

NOTE: Transmission fluid cooler backflushing and cleaning will be performed using the Transmission Heated Cooler Line Flusher or equivalent. Follow the manufacturer's instructions included with the machine. Test the equipment to make sure that a vigorous fluid flow is present before proceeding.

NOTE: If the Transmission Heated Cooler Line Flusher or equivalent is not available, install a new transmission fluid cooler and/or an auxiliary transmission fluid cooler will be required.

NOTE: If the vehicle is equipped with an in-line transmission fluid filter, remove and discard the in-line filter.

1. Check and top off the fluid level of the cooler line flusher with transmission fluid.
2. Allow the transmission fluid in the cooler line flusher 15-30 minutes to heat up to 60°C (140°F) before using.
3. If equipped, remove and discard the in-line transmission fluid filter.



4. Install the line adapters into the transmission fluid cooler tubes.
5. Attach the cooler line flusher red line to the transmission fluid cooler pressure tube quick connect fitting.

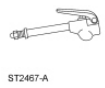
6. Attach the cooler line flusher blue line to the transmission fluid cooler return tube quick connect fitting.

7. Follow the equipment instructions to purge the transmission fluid cooler tubes and cooler prior to starting the flushing procedure.

8. Allow the transmission fluid cooling system to backflush for 10-15 minutes, then flush the transmission fluid cooler in a normal flow direction for an additional 10-15 minutes.

Transmission Fluid Drain and Refill

Special Tool(s)

 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST2933-A	Transmission Fluid Fill Tube 307-570
 ST2715-A	Transporter Fluid Evacuator/Injector 307-D465 or equivalent
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

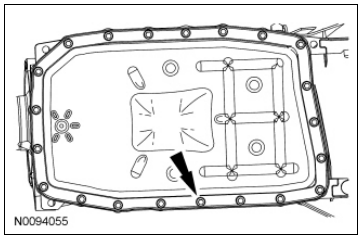
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Drain

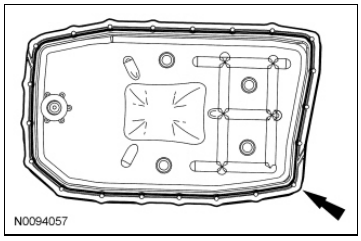
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid pan and allow the transmission fluid to drain.

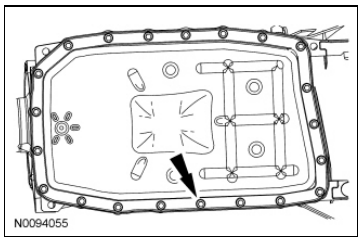

N0094055

3. **NOTE:** The transmission fluid pan gasket can be reused if not damaged.

   Install a new transmission fluid pan gasket, if required.



4. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 12 Nm (106 lb-in).



Refill

NOTICE: **This procedure contains the air purge steps required to purge air from the transmission fluid cooling system. This procedure is NOT intended for use with the Transmission Fluid Level Check.**

NOTICE: **The vehicle should not be driven if the transmission fluid level is low as internal failure could result.**

NOTICE: **The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.**

NOTICE: **The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.**

NOTE: If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

NOTE: Here is an overview of the Transmission Fluid Drain and Refill procedure.

- Adding 3.3L (3.5 qt) of transmission fluid to the transmission is an initial fill enabling the engine to be started.
- The cold level range shown in the procedure allows the vehicle to be driven.
- The vehicle should be driven to allow the Transmission Fluid Temperature (TFT) to reach 85ºC-88ºC (185ºF-190ºF) in order to purge the air from the transmission fluid cooling system.
- Fill the transmission fluid to the fill range on the transmission fluid level indicator at the normal operating range 80ºC-85ºC (176ºF-185ºF).

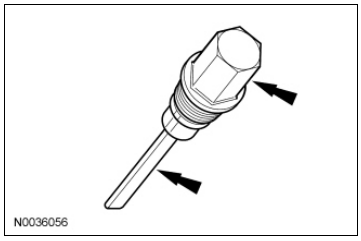
1. **NOTE:** The transmission will need 3.3L (3.5 qt) of transmission fluid added to the transmission as an initial fill if:

    - a new mechatronic assembly has been installed.
    - the transmission fluid pan or transmission fluid filter have been removed.

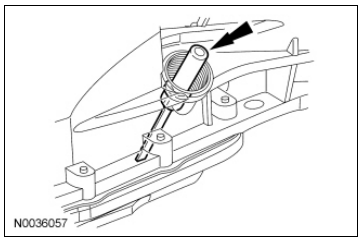
    NOTE: The transmission will need 11.35L (12 qt) of transmission fluid added to the transmission as an initial fill if the transmission has been overhauled.

Using the Transmission Fluid Fill Tube, add the transmission fluid to the transmission through the transmission fluid fill hole. For additional information, refer to Adding Additional Transmission Fluid in this procedure.

2. Separate the transmission fluid level indicator from the transmission fluid fill plug.



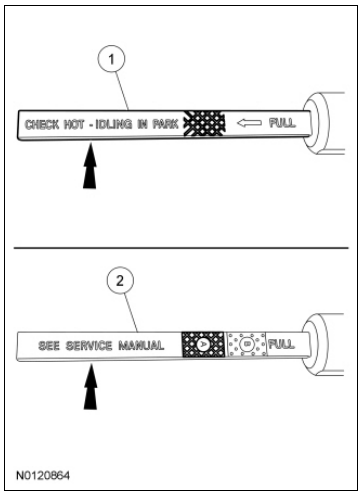
3. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



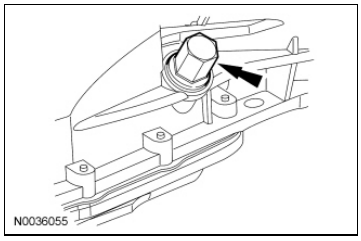
4. **NOTE:** The transmission can have 2 types of transmission fluid level indicators, the original or the replacement. The original transmission fluid level indicator has a single crosshatch area for the fluid level. The replacement has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area.

   Add transmission fluid to the cold level location as shown in the illustration.

   1. Original transmission fluid level indicator
   2. Replacement transmission fluid level indicator

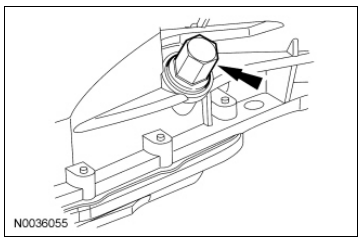


5. Install the transmission fluid fill plug.
   - Tighten to 35 Nm (26 lb-ft).

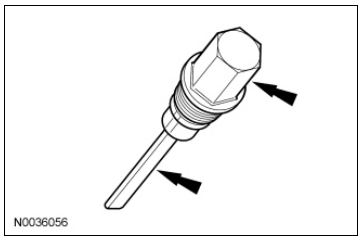


6. While driving the vehicle, use the scan tool to verify that the TFT has reached a temperature of 88°C (190°F). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.
    - With the engine idling (600-750 rpm) in PARK, verify that the TFT is between 80ºC-85ºC (176ºF-185ºF).

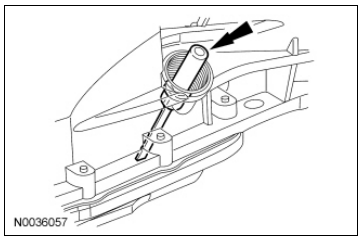
7. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case.



8. Separate the transmission fluid level indicator from the transmission fluid fill plug.



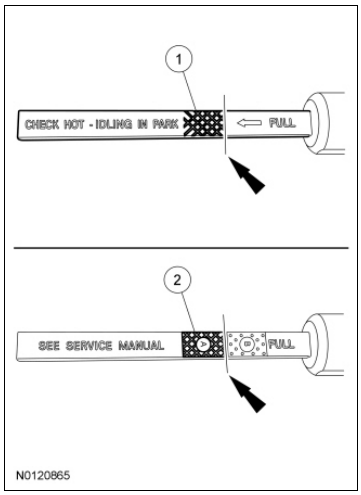
9. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



10. **NOTE:** The transmission can have 2 types of transmission fluid level indicators, the original or the replacement. The original transmission fluid level indicator has a single crosshatch area for the fluid level. The replacement has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the crosshatched area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.

    Using the scan tool verify that the TFT is between 80ºC-85ºC (176ºF-185ºF). The transmission fluid level must be at the upper level of the crosshatch mark.

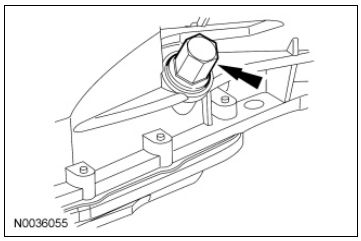
1. Original transmission fluid level indicator
2. Replacement transmission fluid level indicator



11. **NOTE:** If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid in this procedure.

    Install the transmission fluid fill plug.

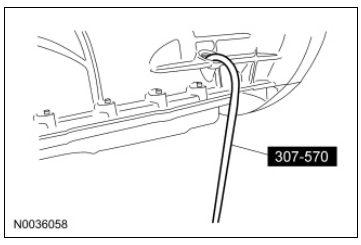
    - Tighten to 35 Nm (26 lb-ft).



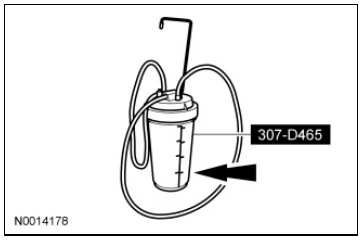
Adding Additional Transmission Fluid

NOTE: To get an accurate transmission fluid level reading the engine should be idling (600-750 rpm) in PARK.

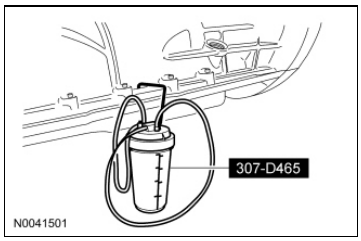
1. Install the Transmission Fluid Fill Tube into the transmission fluid fill hole.



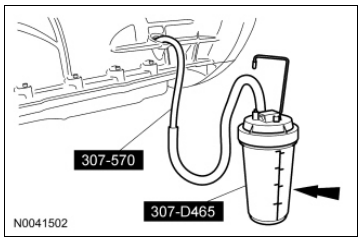
2. Fill the Transporter Fluid Evacuator/Injector with approximately 0.47L (1 pt) of transmission fluid.



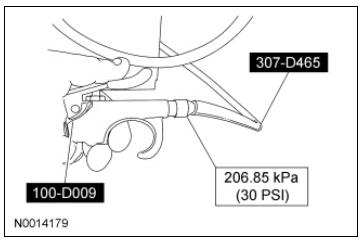
3. Hang the Transporter Fluid Evacuator/Injector under the vehicle, upright and close to the transmission.



4. Connect the Transporter Fluid Evacuator/Injector and Transmission Fluid Fill Tube.
   - Connect the open end of the fluid hose from the Transporter Fluid Evacuator/Injector onto the Transmission Fluid Fill Tube from the transmission case.

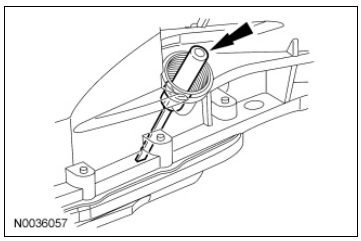


5. Use a Rubber Tip Air Nozzle to apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the Transporter Fluid Evacuator/Injector. Transmission fluid will immediately start flowing out of the Transporter Fluid Evacuator/Injector into the transmission.

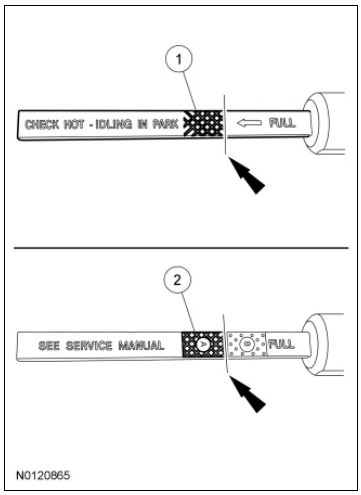


6. **NOTE:** Do not overfill the transmission. The transmission fluid level must be at the upper level of the crosshatch mark.

   Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



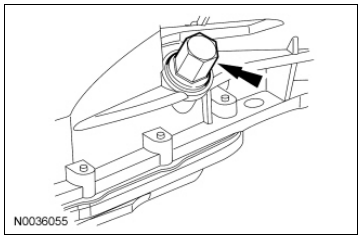
7. Using the scan tool, verify that the TFT is between 80ºC-85ºC (176ºF-185ºF). The transmission fluid level must be at the upper level of the crosshatch mark.
    1. Original transmission fluid level indicator
    2. Replacement transmission fluid level indicator



8. **NOTE:** If the transmission fluid is over full, follow the steps for Removing Transmission Fluid in this procedure.

   Install the transmission fluid fill plug.

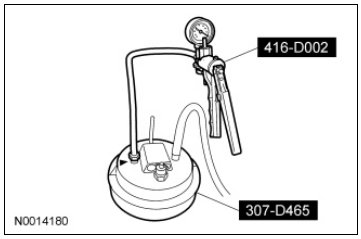
   - Tighten to 35 Nm (26 lb-ft).



Removing Transmission Fluid

NOTE: To get an accurate transmission fluid level reading the engine should be idling (600-750 rpm) in PARK.

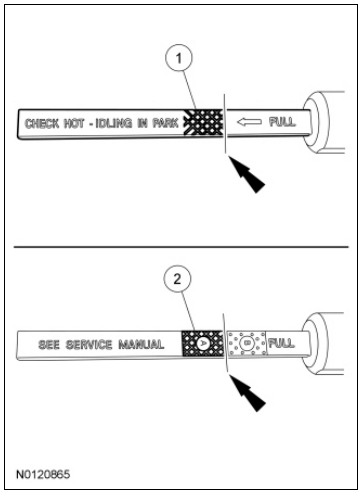
1. If the transmission is overfilled, transmission fluid must be removed to the correct level. Use the Transporter Fluid Evacuator/Injector and the Vacuum Pump Kit to extract any excessive transmission fluid.



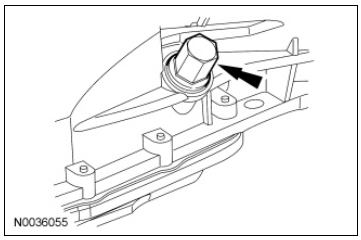
2. Using the scan tool, verify that the TFT is between 80ºC-85ºC (176ºF-185ºF). The transmission fluid level must be at the upper level of the crosshatch mark. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this

until a consistent reading is established.

1. Original transmission fluid level indicator
2. Replacement transmission fluid level indicator



3. Install the transmission fluid fill plug.
   - Tighten to 35 Nm (26 lb-ft).



Transmission Fluid Exchange

Special Tool(s)

 ST3088-A	Heavy-Duty Transmission and Power Steering Fluid X-Changer 078-00531 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

NOTICE: **Use transmission fluid specific for this transmission. Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products can cause internal transmission components to fail, which will affect the operation of the transmission.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Use the Heavy-Duty Transmission and Power Steering Fluid X-Changer to change the fluid.
3. Connect the Heavy-Duty Transmission and Power Steering Fluid X-Changer to the transmission fluid cooler tube after the transmission fluid cooler on the return tube. This will help remove any foreign material trapped in the transmission fluid coolers.
4. Perform the transmission fluid exchange using the Heavy-Duty Transmission and Power Steering Fluid X-Changer. Follow the manufacturer's instructions included with the machine.
5. Once the transmission fluid exchange is completed, disconnect the Heavy-Duty Transmission and Power Steering Fluid X-Changer. Reconnect any disconnected transmission fluid cooler tubes.
6. Using the scan tool with the engine running, check and make sure that the transmission is at normal operating temperature 66-77°C (150-170°F). Check and adjust the transmission fluid level and check for any leaks. If transmission fluid is needed, add transmission fluid in increments of 0.24L (0.5 pt) until the correct level is achieved.

Transmission Fluid Level Check

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

NOTICE: **The vehicle should not be driven if the transmission fluid level is low as internal failure could result.**

NOTICE: **The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.**

NOTE: If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the transmission fluid must cool down to obtain an accurate reading.

NOTE: If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

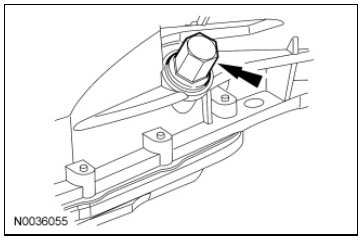
NOTE: Do not overfill the transmission. The transmission fluid level must be at the upper level of the crosshatch mark.

NOTE: If the installation of a new transmission fluid cooler or transmission fluid cooler tubes has been carried out, the vehicle must be driven to get the transmission fluid to a temperature of 88ºC (190ºF) in order to purge the air from the transmission fluid cooling system.

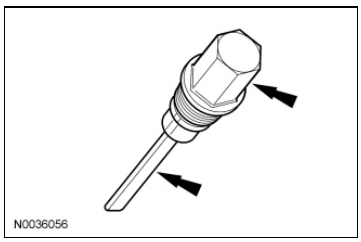
1. With the engine running, place the transmission selector lever in each gear position and hold approximately 5 seconds. Place the transmission selector lever in PARK.

2. With the engine idling (600-750 rpm) in PARK, position it on a hoist. For additional information, refer to Section 100-02 .

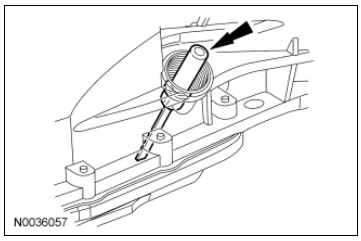
3. Remove the transmission fluid fill plug transmission fluid level indicator assembly, located on the passenger side front portion of the transmission case.



4. Separate the transmission fluid level indicator from the transmission fluid fill plug.



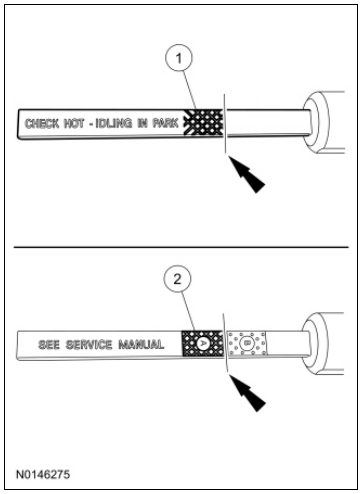
5. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level.



6. **NOTE:** The transmission can have 2 types of transmission fluid level indicators, the original or the replacement. The original transmission fluid level indicator has a single crosshatch area for the fluid level. The replacement has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the crosshatched area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.

   Using the scan tool, verify that the Transmission Fluid Temperature (TFT) is between 80ºC-85ºC (176ºF-185ºF). Do not overfill the transmission. The transmission fluid level must be at the upper level of the crosshatch mark.

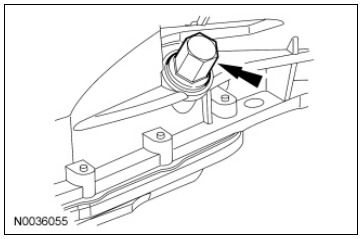
   1. Original transmission fluid level indicator
   2. Replacement transmission fluid level indicator



7. **NOTE:** If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

   Install the transmission fluid fill plug.

   - Tighten to 35 Nm (26 lb-ft).



Torque Converter Contamination Inspection

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - The torque converter stud or studs, impeller hub or bushing are damaged.
    - The torque converter exhibits external discoloration (due to overheating).
    - There is evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes.
        - Major metallic failure
        - Multiple clutch plates or band failures
        - Sufficient component wear which results in metallic contamination
        - Water or antifreeze contamination

2. If none of the above conditions are present, continue with the following fluid inspection.

3. Pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter.

4. Examine the fluid for contaminants, color and smell. The fluid must be free of contaminants, red in color and not have a burnt smell.

5. ***NOTICE:*** **Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur.**

   If the fluid passed inspection:

    - drain the remaining fluid from the torque converter.
    - using only the recommended transmission fluid, add 1.9L (2 qt) of clean fluid into the converter and agitate by hand.
    - thoroughly drain the fluid.

Fluid Pan, Gasket and Filter

Material

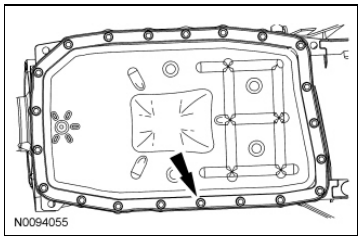
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Removal

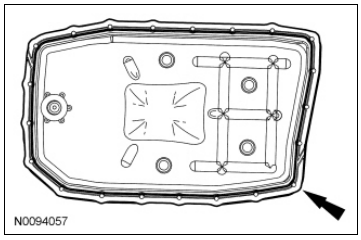
NOTICE: **The use of any transmission fluid other than specified can result in the transmission failing to operate in a normal manner or transmission failure.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the transmission fluid pan and allow the transmission fluid to drain.

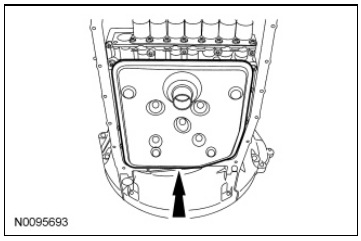


3. Remove the transmission fluid pan gasket.

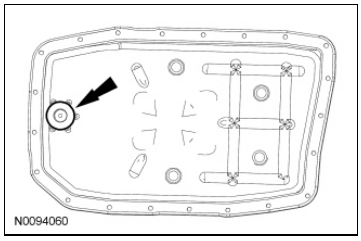


4. **NOTE:** The transmission fluid filter may be reused if no excessive contamination is indicated.

   Remove and discard the transmission fluid filter.



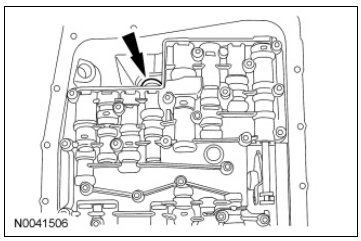
5. Clean and inspect the transmission fluid pan and magnet.



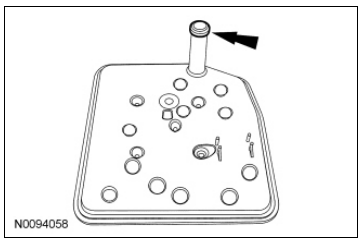
Installation

NOTE: If the transmission is being repaired for a contamination-related failure, install a new transmission fluid filter and seal assembly. The transmission fluid filter may be reused if no excessive contamination is indicated.

1. Inspect the transmission case for the transmission fluid filter seal. If the seal is in the case, carefully remove the seal without scratching the case.

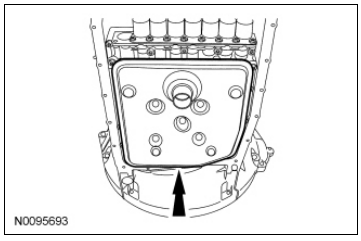


2. Make sure that the seal is on the transmission fluid filter and lubricate the seal with automatic transmission fluid.

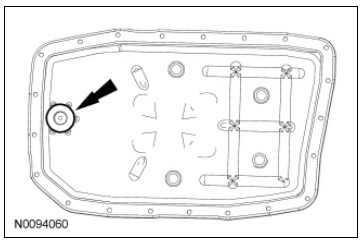


3. **NOTE:** The transmission fluid filter may be reused if no excessive contamination is indicated.

   If required, install a new transmission fluid filter.

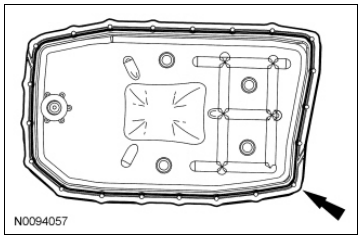


4. Position the magnet in the transmission fluid pan.

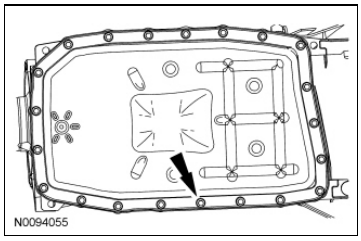


5. **NOTE:** The transmission fluid pan gasket can be reused if not damaged.

   Install a new transmission fluid pan gasket if required.



6. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   - Tighten to 12 Nm (106 lb-in).



7. Using the Adding Additional Transmission Fluid procedure, fill and check the transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Mechatronic Assembly

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Removal

Mechatronic assembly

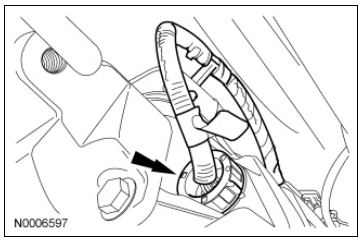
NOTICE: **The only serviceable solenoid in the mechatronic assembly is Shift Solenoid E (SSE). If the mechatronic assembly is being removed due to a faulty SSE , follow the specific steps in this procedure to install a new SSE . If the mechatronic assembly is being removed due to a faulty solenoid other than SSE , a new mechatronic assembly must be installed.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

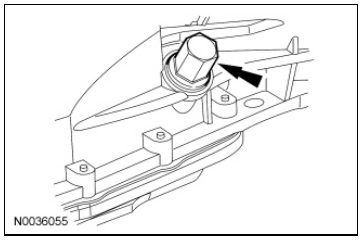
2. Retrieve the module configuration from the PCM. Carry out the module configuration retrieval steps of the Programmable Module Installation (PMI) procedure. For additional information, refer to Section 418-01 .

3. ***NOTICE:*** **Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

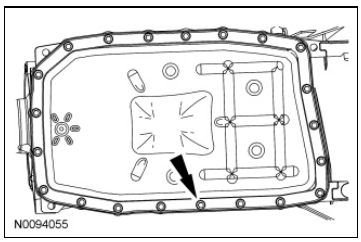
   Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.


N0006597

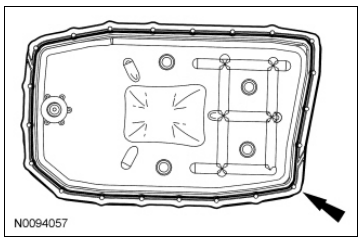
4. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the transmission fluid fill plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the transmission fluid pan to be easily removed when the bolts are removed.



5. Remove the transmission fluid pan and allow the transmission fluid to drain.

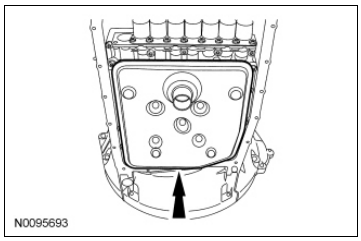


6. Remove the transmission fluid pan gasket.

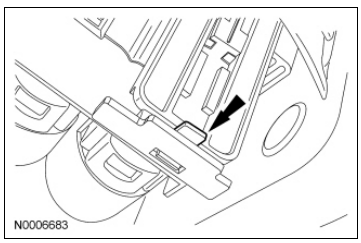


7. **NOTE:** The transmission fluid filter may be reused if no excessive contamination is indicated.

   Remove and discard the transmission fluid filter.

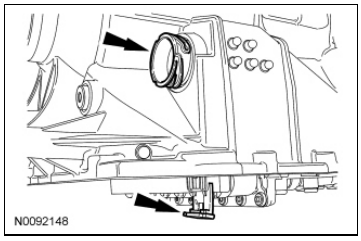


8. Pull the release tab and pull down on the transmission bulkhead electrical connector retainer.



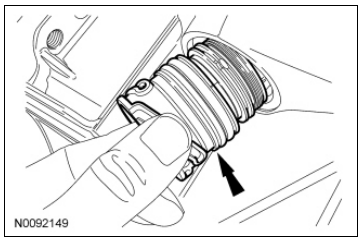
9. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission bulkhead electrical connector. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

   With the release tab down, pull the outer shell of the transmission bulkhead electrical connector out of the mechatronic assembly.



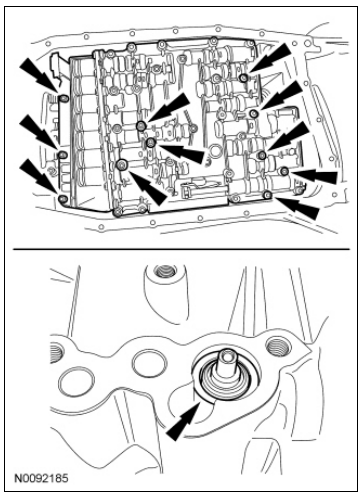
10. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission bulkhead electrical connector. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

    Pull the transmission bulkhead electrical connector out of the transmission case.



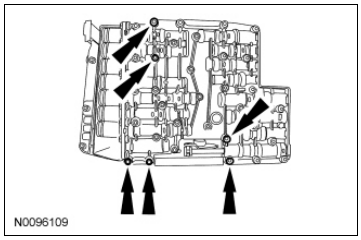
11. ***NOTICE:*** **During removal of the mechatronic assembly, the thermal bypass valve will fall out of the transmission case. Damage to the valve will occur if the valve falls out.**

    Remove the 11 bolts from the mechatronic assembly and remove the mechatronic assembly and the bypass valve.



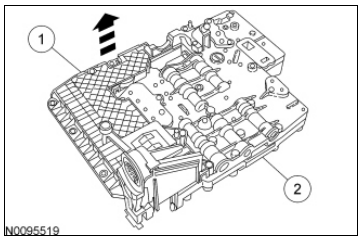
SSE

12. Remove the 6 long bolts from the TCM unit.

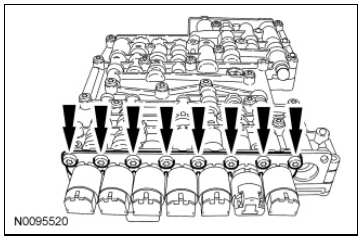


13. Carefully separate the TCM from the mechatronic assembly.

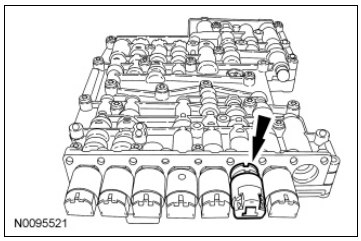
1. TCM
2. Mechatronic assembly



14. Remove the 8 solenoid bracket bolts and the solenoid bracket.



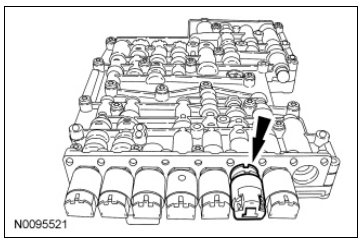
15. Remove SSE .



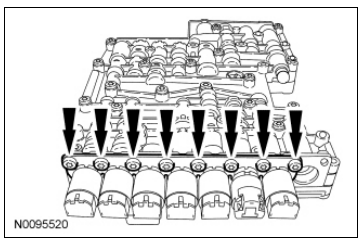
Installation

SSE

1. Install SSE .



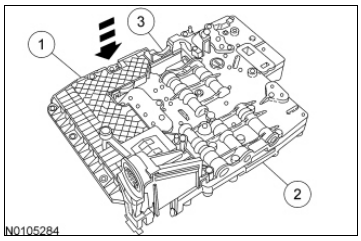
2. Position the solenoid bracket in place and install the 8 bolts.
   - Tighten to 6 Nm (53 lb-in).



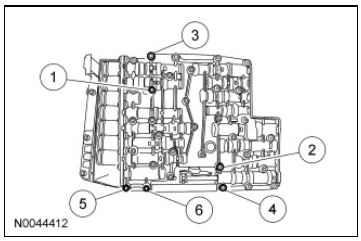
3. **NOTE:** The Transmission Range (TR) sensor pin must be aligned with the manual control valve during installation.

   Position the TCM on the mechatronic assembly.

   1. TCM
   2. Mechatronic assembly
   3. TR sensor pin



4. Install the 6 long bolts into the TCM unit. Tighten the bolts in the sequence shown.
   - Tighten to 6 Nm (53 lb-in).

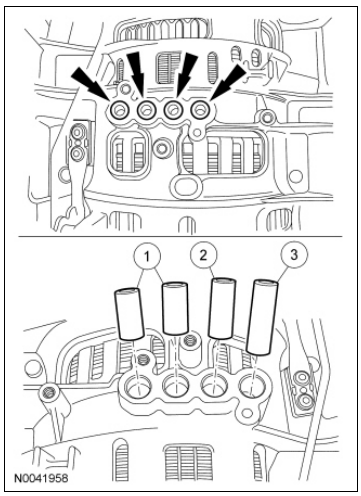


Mechatronic assembly

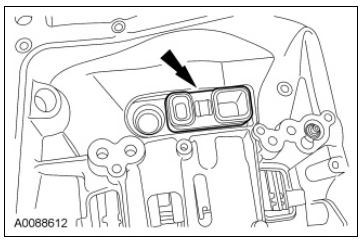
5. **NOTE:** Before installing the mechatronic assembly into the transmission case, verify the presence and correct orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the mechatronic assembly during removal and should be installed into the transmission case at this time.

   Verify the 4 rubber feed tubes for the center support are in place.

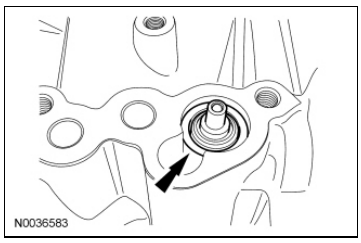
   1. Black feed tubes
   2. Green feed tube
   3. Blue feed tube



6. Verify the rubber adapter is in place.



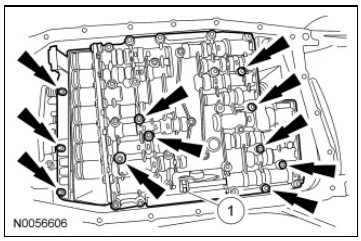
7. Coat the thermal bypass valve with petroleum jelly to hold it in place and install the thermal bypass valve in the transmission case.



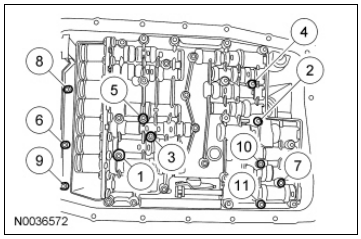
8. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission vehicle harness connector. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

   Position the mechatronic assembly in place and loosely install the 11 bolts.

   1. Align the manual valve and control lever linkage.

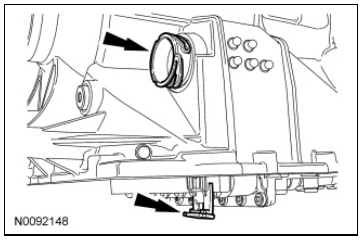


9. Tighten the mechatronic bolts in the sequence shown.
   - Tighten to 8 Nm (71 lb-in).

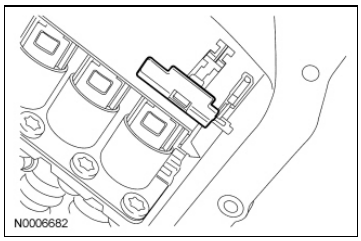


10. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission bulkhead electrical connector. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

    With the release tab down and unlocked, push the outer shell of the transmission bulkhead electrical connector into the transmission. Make sure that the transmission bulkhead electrical connector is fully seated into the mechatronic assembly.

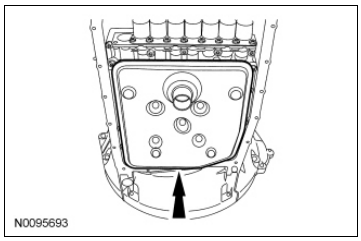


11. Press up on the tab and lock the outer shell of the transmission bulkhead electrical connector in place. Make sure that the locking tab is securely locked.



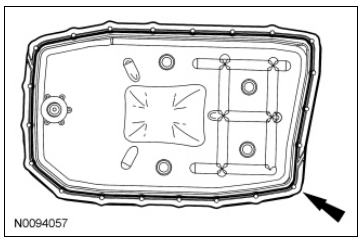
12. **NOTE:** The transmission fluid filter may be reused if no excessive contamination is indicated.

    If required, install a new transmission fluid filter.

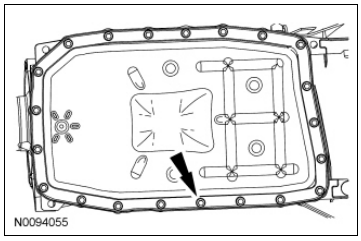


13. **NOTE:** The transmission fluid pan gasket can be reused if not damaged.

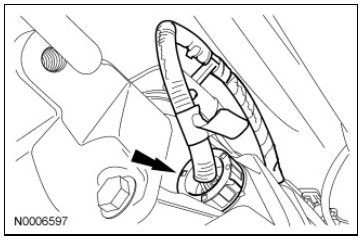
    Install a new transmission fluid pan gasket, if required.



14. Install the transmission fluid pan and tighten the transmission fluid pan bolts in a crisscross pattern.
    - Tighten to 12 Nm (106 lb-in).



15. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.

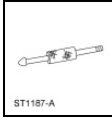


16. Make sure the transmission fluid is at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

17. Restore the module configuration. Carry out the module configuration restore steps of the PMI procedure for the PCM. For additional information, refer to Section 418-01 .

Output Shaft Seal

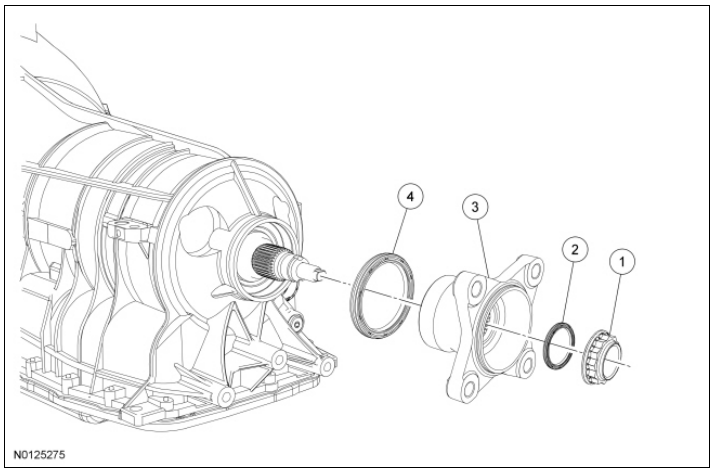
Special Tool(s)

 ST3059-A	Installer, Rear Seal 4X4 307-637
 ST3060-A	Rear Seal Installer 4X2 307-638
 ST2381-A	Remover, Input Shaft Oil Seal 308-375
 ST1187-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

NOTE: Rear Wheel Drive (RWD) shown, Four-Wheel Drive (4WD) similar.



Item	Part Number	Description
1	7045	Output shaft flange nut
2	7052	Extension housing flange seal
3	7089	Output shaft flange

4	7052	Output shaft seal

Removal

All vehicles

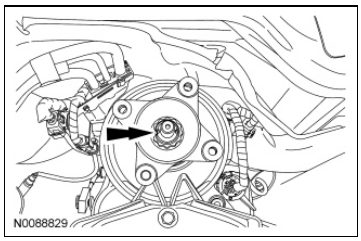
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Rear Wheel Drive (RWD) vehicles

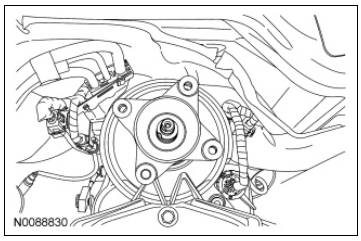
2. Remove the rear driveshaft. For additional information, refer to Section 205-01 .

3. **NOTE:** The output shaft flange nut has been staked to prevent it from coming loose. Prior to removing the nut, remove the stake to prevent damage to the output shaft.

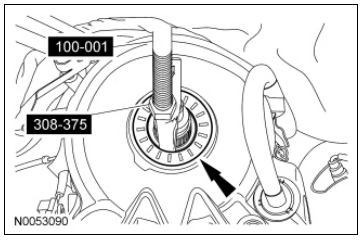
   Remove and discard the output shaft flange nut.



4. Remove the extension housing flange seal and the output shaft flange.



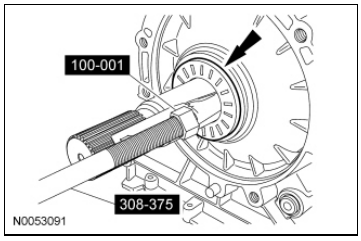
5. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the output shaft seal.



Four-Wheel Drive (4WD) vehicles

6. Remove the transfer case. For additional information, refer to Section 308-07B .

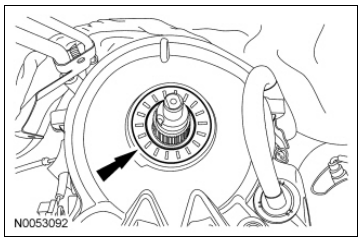
7. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the output shaft seal.



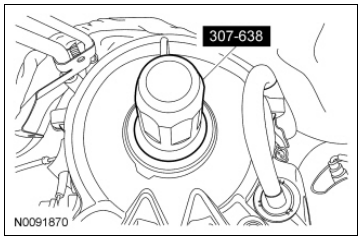
Installation

RWD vehicles

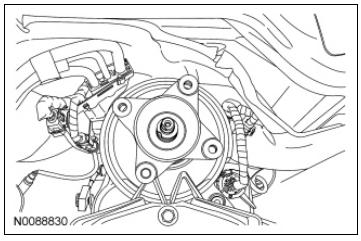
1. Position a new output shaft seal.



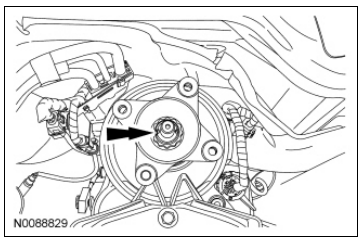
2. Using the Rear Seal 4X2 Installer, install the output shaft seal.



3. Install the output shaft flange.



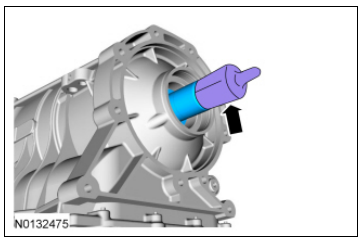
4. Install the extension housing flange seal and a new output shaft flange nut.
   - Tighten to 80 Nm (59 lb-ft).
   - After installing the new output shaft flange nut, it must be staked at the slots to prevent it from coming loose.



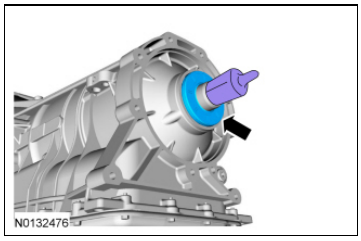
5. Install the rear driveshaft. For additional information, refer to Section 205-01 .

4WD vehicles

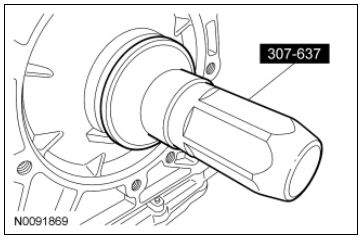
6. Install the seal protector provided with the new output shaft seal on the output shaft.



7. Slide the output shaft seal over the output shaft seal protector onto the output shaft. Remove the output shaft seal protector.



8. Using the Rear Seal 4X4 Installer, install a new output shaft seal.



9. Install the transfer case. For additional information, refer to Section 308-07B .

All vehicles

10. Fill and check the transmission fluid. For additional information, refer to Transmission Fluid Level Check in this section.

Manual Control Lever Shaft and Seal

Special Tool(s)

 ST2690-A	Installer, Shift Shaft Fluid Seal 307-559

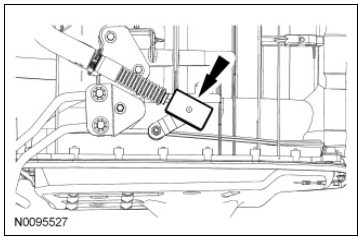
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

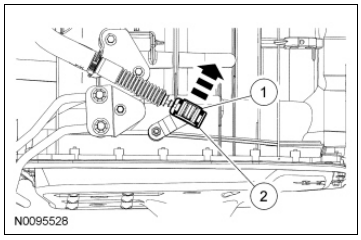
2. Remove the selector lever cable heat shield.


N0095527

3. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   Move the locking tab up and disconnect the transmission selector lever cable end from the manual control lever.

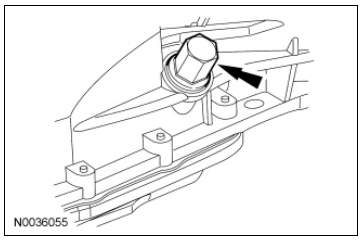
   1. Locking tab
   2. Selector lever cable end



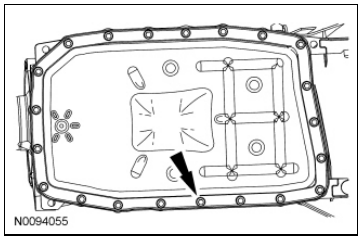
N0095528

4. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the transmission fluid fill plug will

relieve any vacuum that might have built up in the transmission. This will aid in allowing the transmission fluid pan to be easily removed when the bolts are removed.

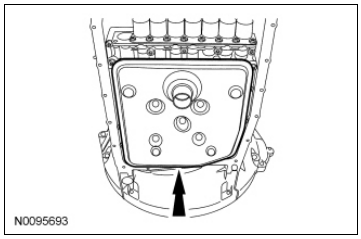


5. Remove the transmission fluid pan and allow the transmission fluid to drain.

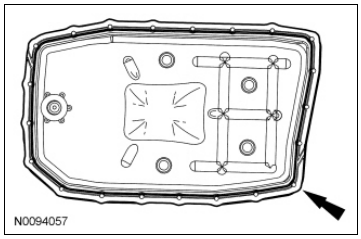


6. **NOTE:** The transmission fluid filter may be reused if no excessive contamination is indicated.

   Remove and discard the transmission fluid filter.

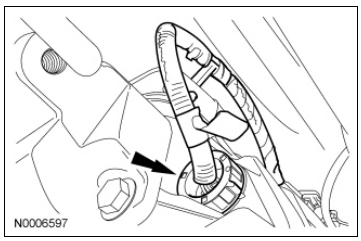


7. Remove the transmission fluid pan gasket.

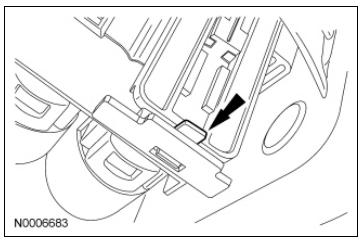


8. ***NOTICE:*** **Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.**

   Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.

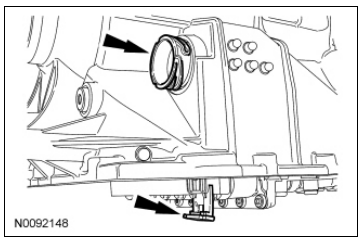


9. Pull the release tab and pull down on the transmission bulkhead electrical connector retainer.



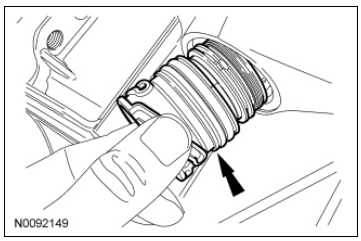
10. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the transmission bulkhead electrical connector. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

    With the release tab down, pull the outer shell of the transmission bulkhead electrical connector out of the mechatronic assembly.



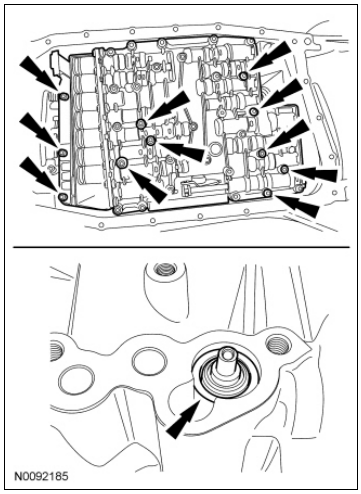
11. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the mechatronic unit. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

    Pull the transmission bulkhead electrical connector out of the transmission.

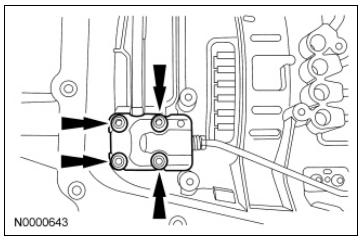


12. ***NOTICE:*** **During removal of the mechatronic assembly, the thermal bypass valve will fall out of the transmission case. Damage to the valve will occur if the valve falls out.**

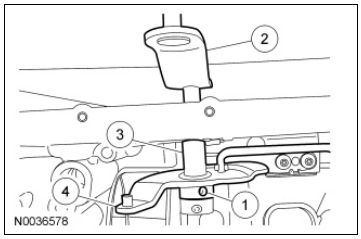
    Remove the 11 bolts from the mechatronic assembly and remove the mechatronic assembly and the bypass valve.



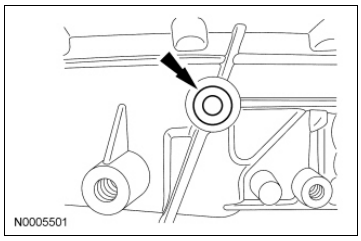
13. Remove the park rod actuating plate.



14. Remove the manual control lever.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the spacer to keep it from falling out of the case.
    4. Remove the manual valve inner lever and the park rod as an assembly.

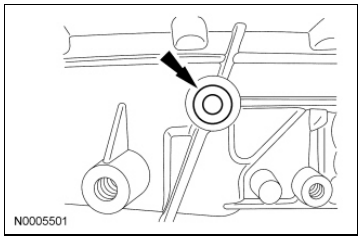


15. Remove and discard the manual control lever seal.

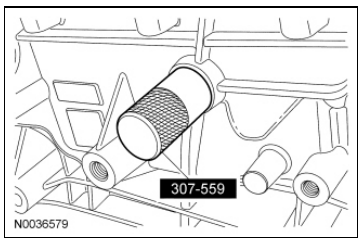


Installation

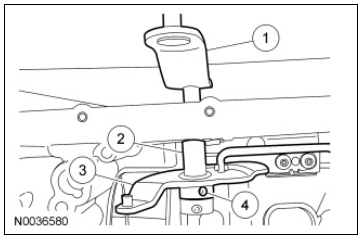
1. Position a new manual control lever seal in place.



2. Using the Shift Shaft Fluid Seal Installer, install a new manual control lever shaft seal.

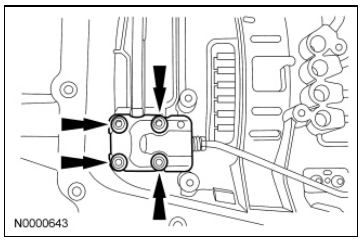


3. Install the manual lever in the case.
    1. Slide the manual lever in the case.
    2. Position the spacer in place while sliding the manual lever into the spacer.
    3. Position the manual valve inner lever while sliding the manual lever and lining up the roll pin hole.
    4. Install the roll pin.



4. Position the park rod in place. Push down on the park pawl and position the park rod in place.

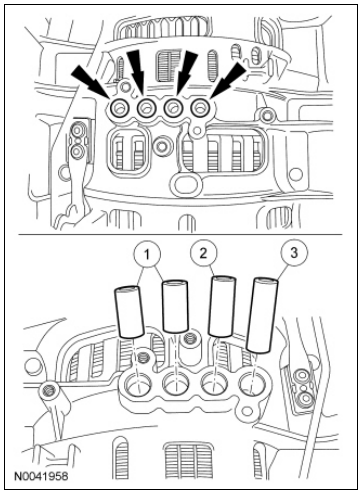
5. While holding the park rod down, install the park rod actuating plate.
    - Tighten to 12 Nm (106 lb-in).



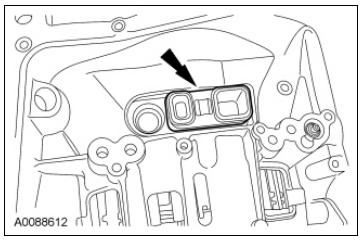
6. **NOTE:** Before installing the mechatronic assembly into the transmission case, verify presence and correct orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the mechatronic assembly during removal and should be installed into the transmission case at this time.

    Verify the 4 rubber feed tubes for the center support are in place.

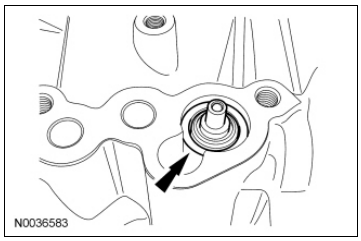
    1. Black feed tubes
    2. Green feed tube
    3. Blue feed tube



7. Verify the rubber adapter is in place.



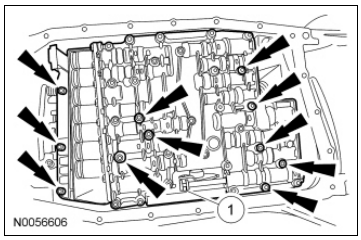
8. Coat the thermal bypass valve with petroleum jelly to hold it in place and install the thermal bypass valve in the transmission case.



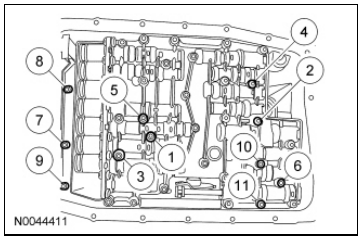
9. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the mechatronic unit. Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

   Position the mechatronic assembly in place and loosely install the 11 bolts.

   1. Align the manual valve and control lever linkage.

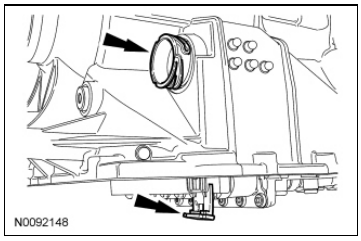


10. Tighten the mechatronic bolts in the sequence shown.
    - Tighten to 8 Nm (71 lb-in).

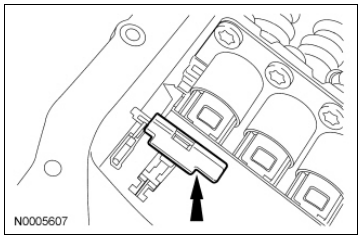


11. *NOTICE:* **Do not touch the electrical connector pins. Electrostatic discharge may occur and will cause damage to the mechatronic unit.**

    With the release tab down and unlocked, push the outer shell of the transmission bulkhead electrical connector into the transmission. Make sure that the transmission bulkhead electrical connector is fully seated into the mechatronic assembly.

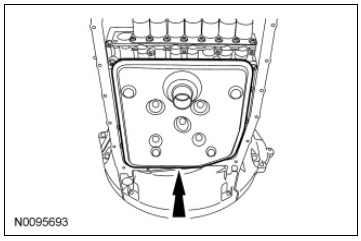


12. Press up on the tab and lock the outer shell of the transmission bulkhead electrical connector in place.



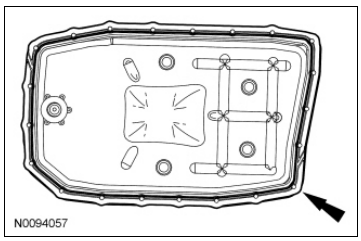
13. **NOTE:** The transmission fluid filter may be reused if no excessive contamination is indicated.

    If required, install a new transmission fluid filter.

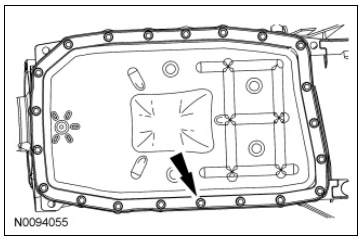


14. **NOTE:** The transmission fluid pan gasket can be reused if not damaged.

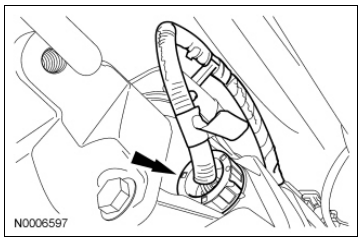
    Install a new transmission fluid pan gasket, if necessary.



15. Install the transmission fluid pan and tighten the transmission fluid pan bolts in a crisscross pattern.
    - Tighten to 12 Nm (106 lb-in).



16. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.

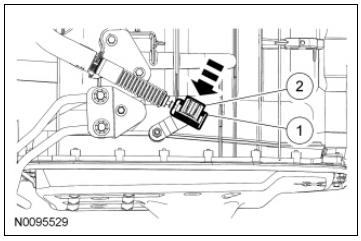


17. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

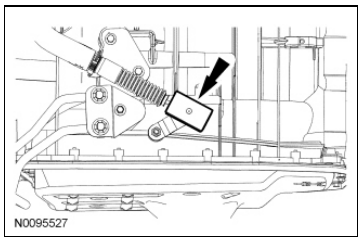
    NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is securely installed onto the manual control level.

    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual control lever and move the locking tab down.

    1. Selector lever cable end
    2. Locking tab
        - ♦ Listen for the audible click.
        - ♦ Pull back on the selector lever cable to make sure that it is correctly installed.



18. Install the selector lever cable heat shield.



19. Using the transmission fluid refill procedure, fill and check the transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Transmission - Four Wheel Drive (4WD)

Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Removal

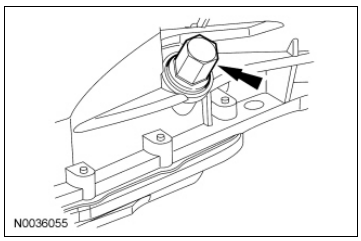
NOTE: Refer to the Transmission Cooler Flushing Job Aid on the FMCDealer website.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Retrieve the module configuration from the PCM. Carry out the module configuration retrieval steps of the Programmable Module Installation (PMI) procedure. For additional information, refer to Section 418-01 .

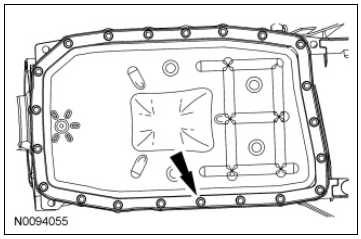
3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

4. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the transmission fluid fill plug will relieve any vacuum that might have built up in the transmission. This will allow the transmission fluid pan to be easily removed when the bolts are removed.

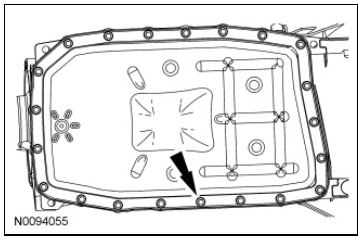

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5. **NOTE:** If transmission disassembly or installation of a new transmission is necessary, drain the transmission fluid.

   Remove the transmission fluid pan and allow the transmission fluid to drain.


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6. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   - Tighten to 12 Nm (106 lb-in).

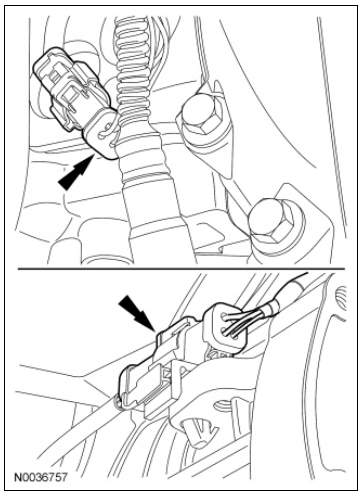


7. Remove the transfer case. For additional information, refer to Section 308-07B .
8. **NOTE:** Make sure the transmission jack makes contact on the outer ribs of the transmission fluid pan.

   NOTE: Make sure the transmission is securely fastened to the transmission jack.

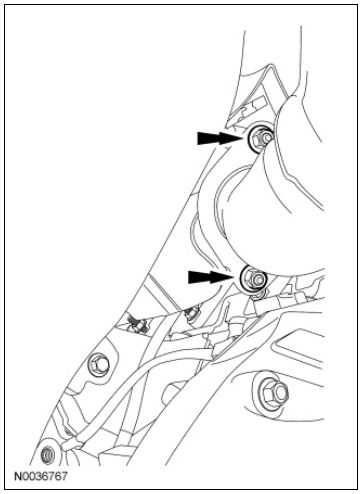
   Position a suitable high-lift transmission jack under the transmission and remove the jackstand.
9. Remove the transmission support crossmember. For additional information, refer to Section 502-02 .
10. **NOTE:** LH shown, RH similar.

    Disconnect the RH and LH Heated Oxygen Sensor (HO2S) and the Catalyst Monitor Sensor (CMS) connectors.

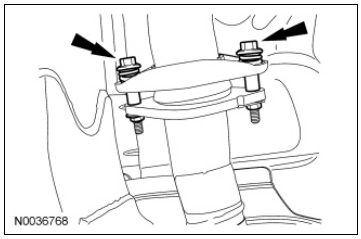


11. **NOTE:** LH shown, RH similar.

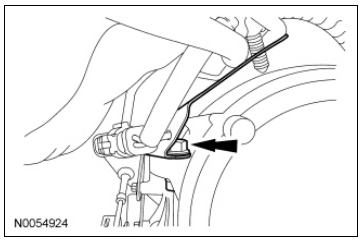
    Remove and discard the RH and LH exhaust flange nuts.



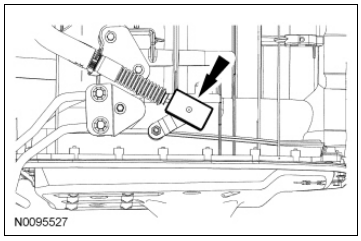
12. Remove the dual catalytic converter Y-pipe bolts, discard the nuts and remove the dual catalytic converter Y-pipe.



13. Remove the fuel line bracket bolt from the bracket. Position the bracket and lines aside.



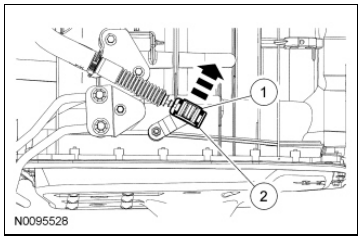
14. Remove the selector lever cable heat shield.



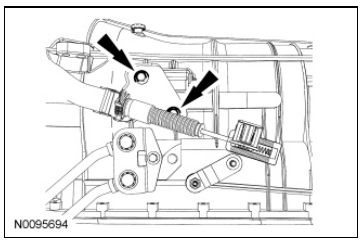
15. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

    Move the locking tab up and disconnect the selector lever cable end from the manual control lever.

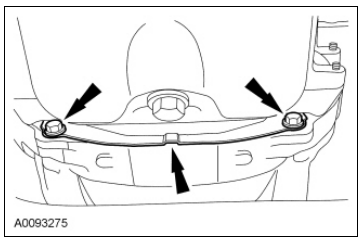
    1. Locking tab
    2. Selector lever cable end



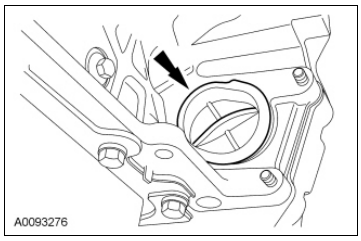
16. Remove the selector lever bracket bolts and remove the selector lever bracket.



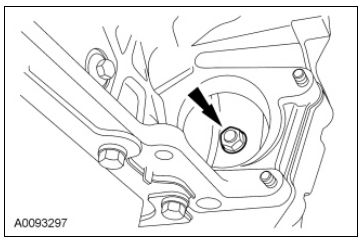
17. Remove the flexplate inspection cover bolts and the flexplate inspection cover.



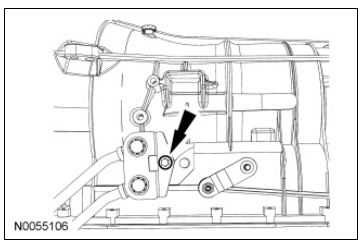
18. Remove the rubber torque converter nut access plug.



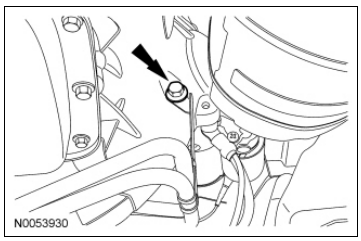
19. Remove and discard the 4 flexplate-to-torque converter nuts.



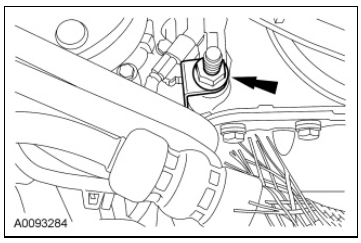
20. Remove the transmission fluid cooler tube bracket bolt.



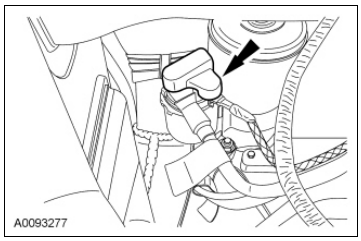
21. Remove the transmission-to-engine bolt.



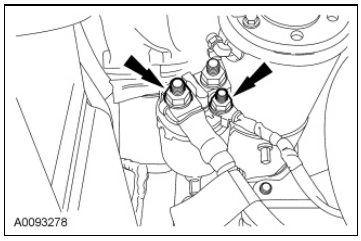
22. Remove the transmission fluid cooler tube bracket nut and position the transmission fluid cooler tube bracket and tubes aside.



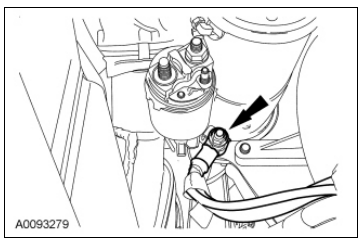
23. Remove the plastic starter motor electrical connector cap.



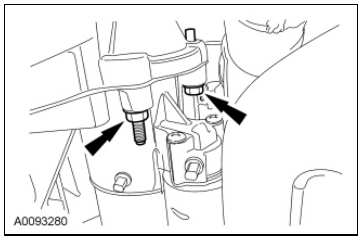
24. Remove the starter motor electrical connectors.



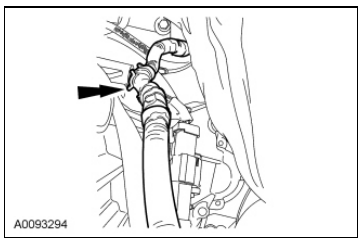
25. Remove the ground wire from the stud.



26. Remove the 3 starter motor bolts and the starter motor.

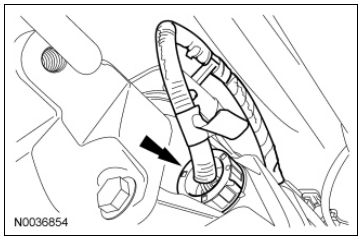


27. Disconnect the transmission vehicle harness from the top of the transmission.



28. ***NOTICE:*** **Do not pull on the transmission vehicle harness to disconnect the connector or damage to the connector will occur.**

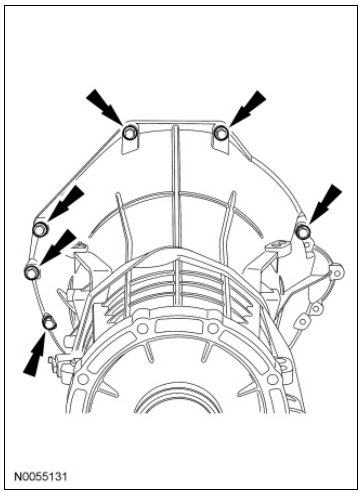
    Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.



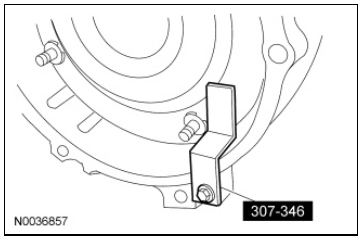
29. **NOTE:** The top 2 transmission-to-engine bolts need to be removed prior to removing the remaining bolts.

    NOTE: The top left bolt secures the fuel line bracket to the transmission case.

    Remove the 6 remaining transmission-to-engine bolts.



30. Slide the transmission back enough to install the Torque Converter Retainer.



31. Remove the transmission from the vehicle.

32. If the transmission is being disassembled to install new parts, or if a new or remanufactured transmission is being installed, the transmission fluid cooler, the auxiliary transmission fluid cooler (if equipped) and the transmission fluid cooler tubes must be cleaned and backflushed to keep contaminants from entering the transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

Transmission - Rear Wheel Drive (RWD)

Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Removal

NOTE: Refer to the Transmission Cooler Flushing Job Aid on the FMCDealer website.

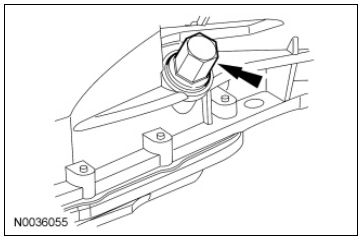
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Retrieve the module configuration from the PCM. Carry out the module configuration retrieval steps of the Programmable Module Installation (PMI) procedure. For additional information, refer to Section 418-01 .

3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

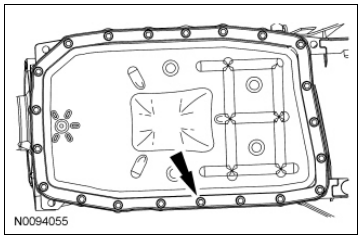
4. Remove the driveshaft. For additional information, refer to Section 205-01 .

5. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case. Removal of the transmission fluid fill plug will relieve any vacuum that might have built up in the transmission. This will allow the transmission fluid pan to be easily removed when the bolts are removed.


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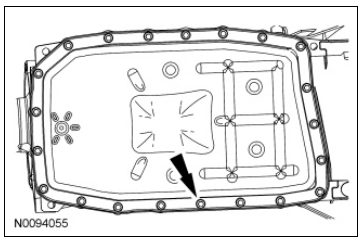
6. **NOTE:** If transmission disassembly or installation of a new transmission is necessary, drain the transmission fluid.

   Remove the transmission fluid pan and allow the fluid to drain.

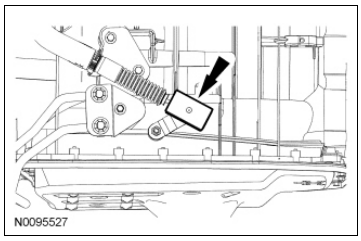

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7. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.

- Tighten to 12 Nm (106 lb-in).



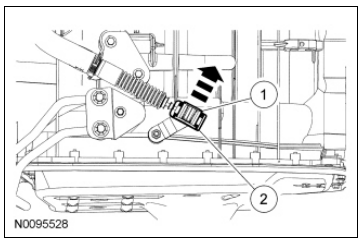
8. Remove the selector lever cable heat shield.



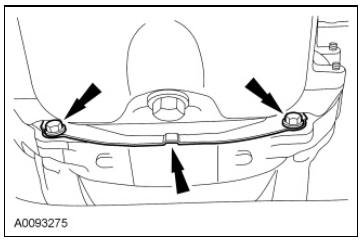
9. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   Move the locking tab up and disconnect the selector lever cable end from the manual control lever.

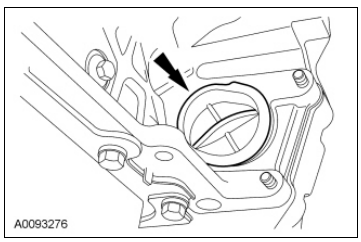
   1. Locking tab
   2. Selector lever cable end



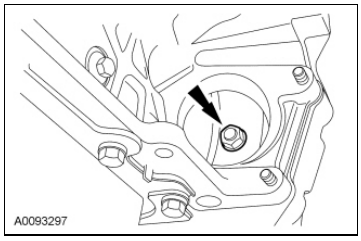
10. Remove the flexplate inspection cover bolts and the inspection cover.



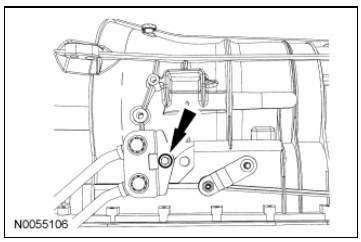
11. Remove the rubber torque converter nut access plug.



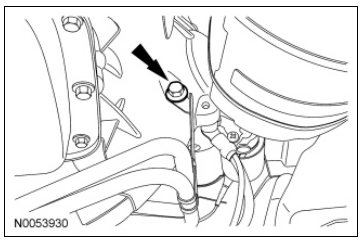
12. Remove and discard the 4 flexplate-to-torque converter nuts.



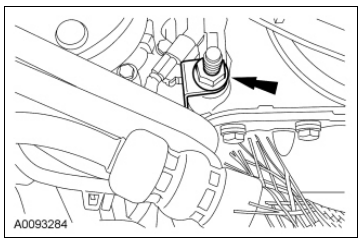
13. Remove the transmission fluid cooler tube bracket bolt.



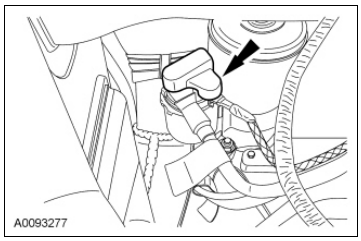
14. Remove the transmission-to-engine bolt.



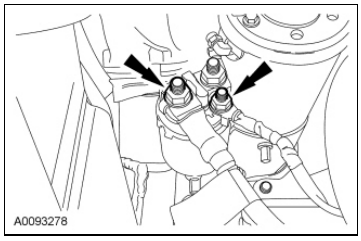
15. Remove the transmission fluid cooler tube bracket nut and position the transmission fluid cooler tube bracket and tubes aside.



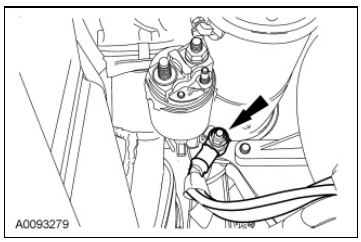
16. Remove the plastic starter motor electrical connector cap.



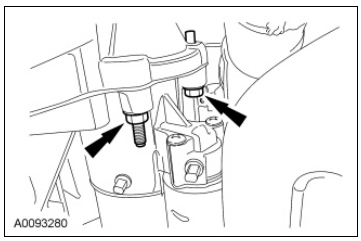
17. Remove the starter motor electrical connectors.



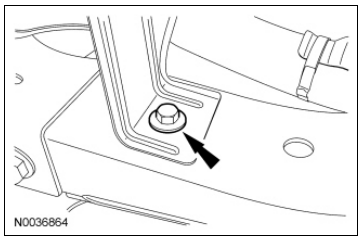
18. Remove the ground wire from the stud.



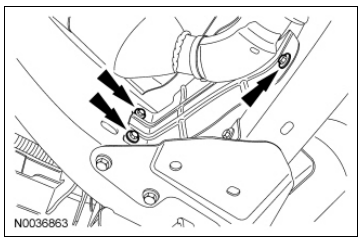
19. Remove the starter motor bolts and the starter motor.



20. Remove the LH exhaust heat shield bolt.

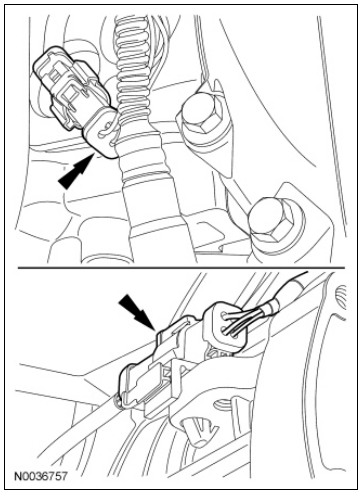


21. Remove the RH exhaust heat shield bolts and heat shield.

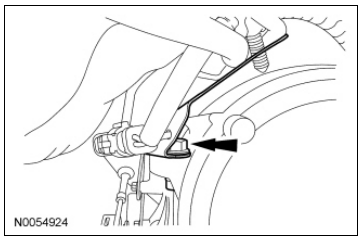


22. **NOTE:** LH shown, RH similar.

    Disconnect the RH and LH Heated Oxygen Sensor (HO2S) and the Catalyst Monitor Sensor (CMS) connectors.



23. Remove the fuel line bracket bolt and position the fuel line bracket and fuel lines aside.

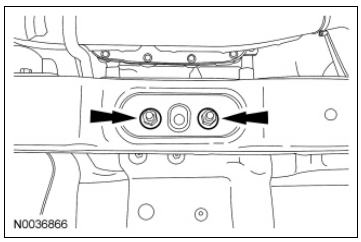


24. **NOTE:** Make sure the transmission jack makes contact on the outer ribs of the fluid pan.

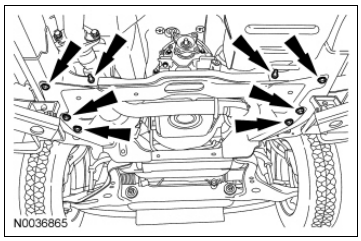
    NOTE: Make sure the transmission is securely fastened to the transmission jack.

    Position a suitable high-lift transmission jack under the transmission.

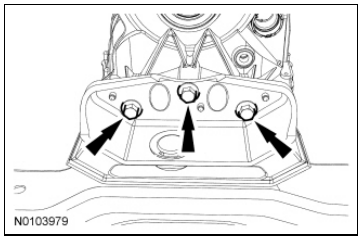
25. Remove the 2 transmission insulator and retainer nuts.



26. Remove the 8 transmission crossmember bolts.

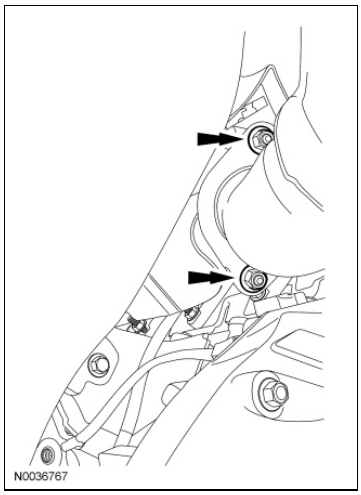


27. Remove the 3 transmission insulator and retainer bolts and remove the transmission insulator and retainer.

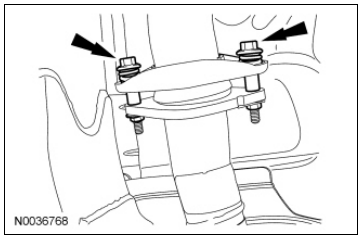


28. **NOTE:** LH shown, RH similar.

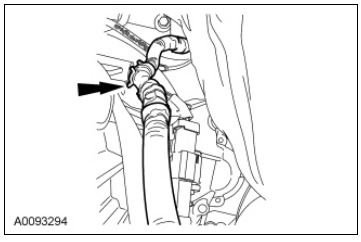
    Remove and discard the RH and LH exhaust flange nuts.



29. Remove the 2 dual catalytic converter Y-pipe bolts, discard the nuts and remove the dual catalytic converter Y-pipe.

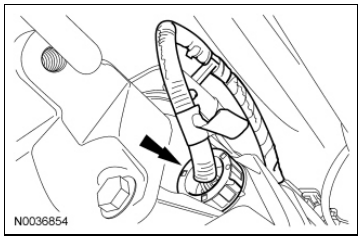


30. Disconnect the wire harness from the top of the transmission.



31. ***NOTICE:*** **Do not pull on the transmission vehicle harness to disconnect the connector or damage to the connector will occur.**

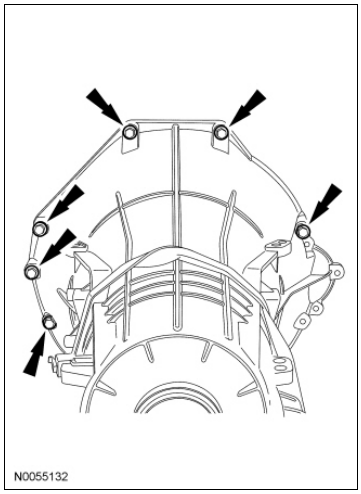
    Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.



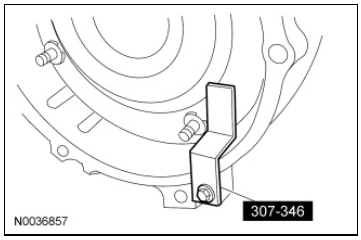
32. **NOTE:** The top 2 transmission-to-engine bolts need to be removed prior to removing the remaining bolts.

    NOTE: The top left bolt secures the fuel line bracket to the transmission case.

    Remove the 6 remaining transmission-to-engine bolts.



33. Slide the transmission back far enough to install the Torque Converter Retainer.

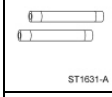


34. Remove the transmission from the vehicle.

35. If the transmission is being disassembled to install new parts, or if a new or remanufactured transmission is being installed, the transmission fluid cooler, the auxiliary transmission fluid cooler (if equipped) and the transmission fluid cooler tubes must be cleaned and backflushed to keep contaminants from entering the transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

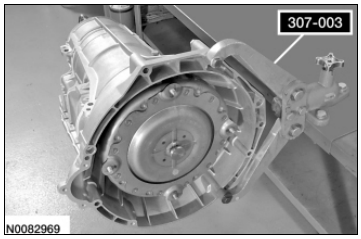
Transmission

Special Tool(s)

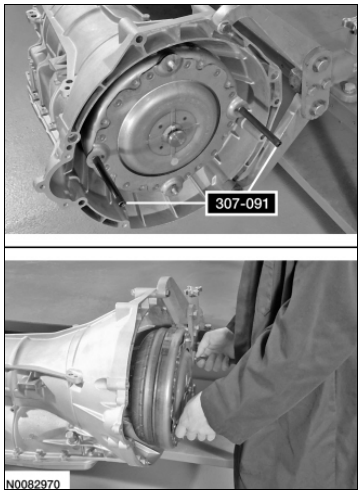
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1433-B	Installer, Front Wheel Hub Oil Seal 205-256
 ST2381-A	Remover, Input Shaft Oil Seal 308-375
 ST2932-A	Remover, Needle Bearing 307-562 (includes 307-562/1 and 307-562/2)
 ST1282-A	Remover, Pilot Bearing 308-001 (T58L-101-B)
 ST2891-A	Remover, Transmission Fluid Pump 307-553
 ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

All vehicles

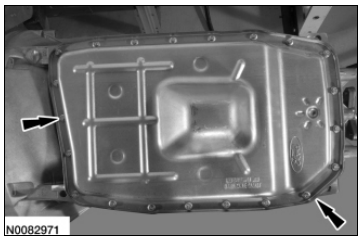
1. Install Transmission Holding Fixture 307-003 on the torque converter housing and install the transmission on a bench.



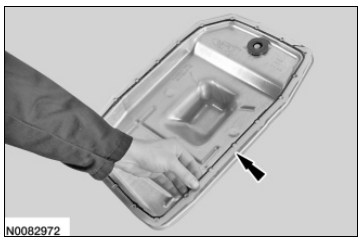
2. Using the Torque Converter Handle 307-091, remove the torque converter.



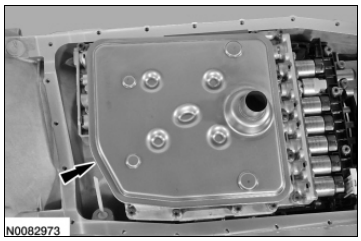
3. Remove the transmission fluid pan bolts and the pan.



4. Remove the transmission fluid pan gasket.



5. Remove and discard the transmission fluid filter.

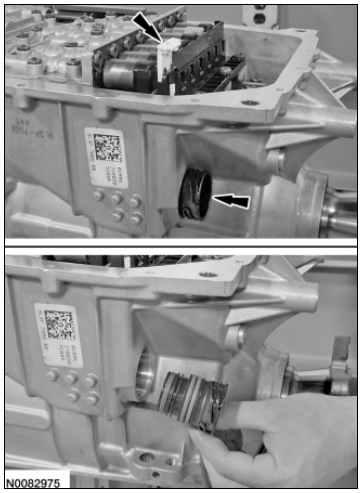


6. Press the release tab and lift up on the bulkhead connector retainer to release the bulkhead connector shell.

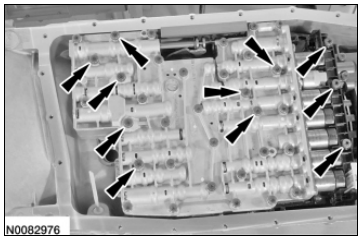


7. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the Transmission Control Module (TCM). Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

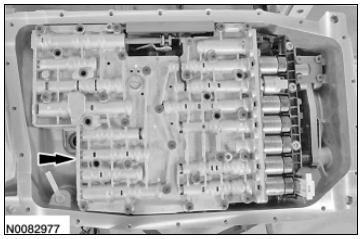
   With the transmission bulkhead connector retainer up, pull the outer shell of the bulkhead connector out of the transmission.



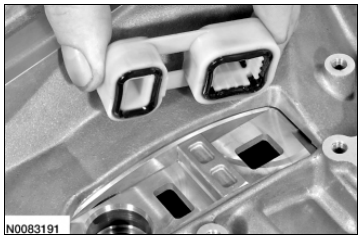
8. Remove the 11 bolts from the mechatronic assembly.



9. Remove the mechatronic assembly.

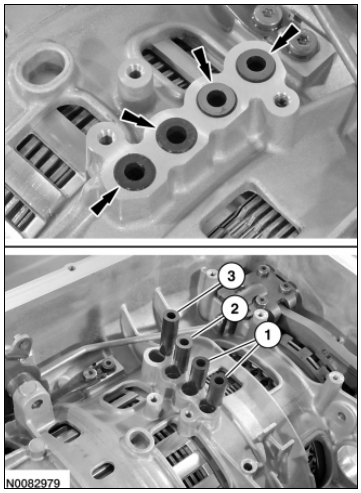


10. Remove the rubber adapter and the fluid filter seal.

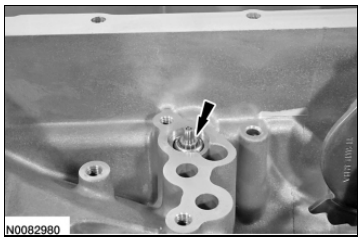


11. Remove and discard the 4 rubber feed tubes for the center support. Note the size and location while removing for correct installation.
    1. Black feed tubes
    2. Green feed tube

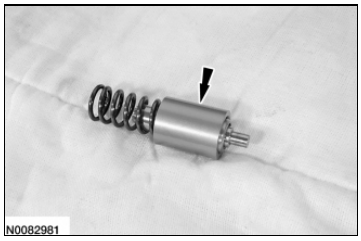
3. Blue feed tube



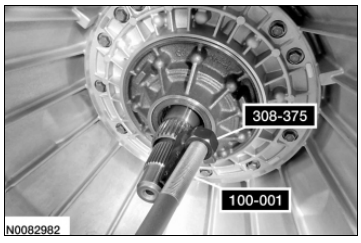
12. Remove the thermal bypass valve from the case.



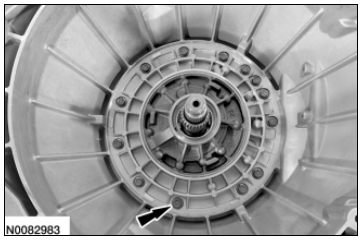
13. Inspect the thermal bypass valve for damage, install a new valve if damage is indicated.



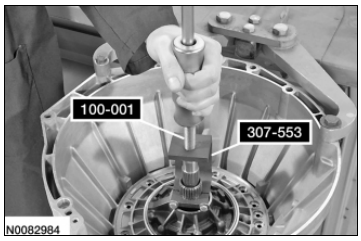
14. Using the Input Shaft Oil Seal Remover 308-375 and Slide Hammer 100-001, remove and discard the front pump seal.



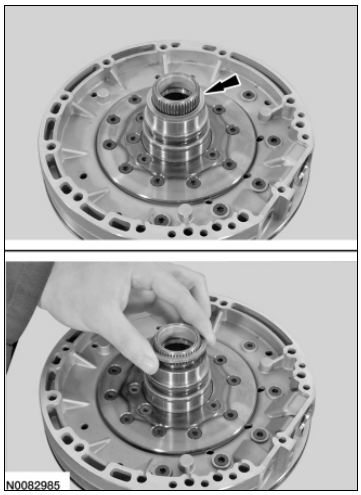
15. Remove and discard the 13 front pump bolts.



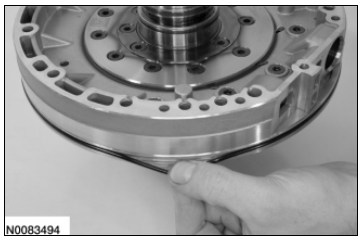
16. Using the Transmission Fluid Pump Remover 307-553 and Slide Hammer 100-001, remove the front pump support.



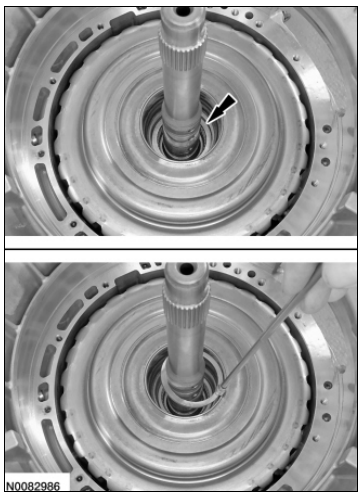
17. Inspect the back of the front pump to check if the selective shim is on the pump. If the selective shim is on the pump, remove it from the pump.



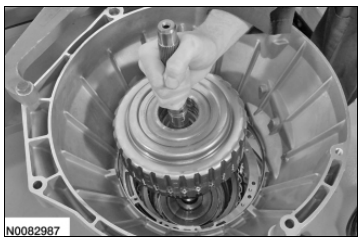
18. Remove and discard the front pump O-ring seal from the pump assembly.



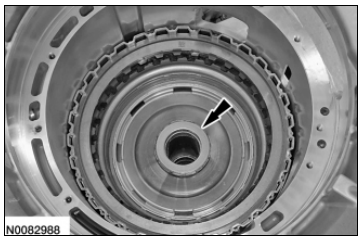
19. If the selective shim is not on the pump, using a magnet, remove it from the forward/overdrive clutch assembly.



20. Remove the forward (clutch A)/overdrive (clutch E) clutch assembly.



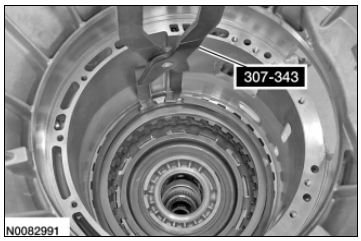
21. Remove the caged T5 roller bearing.



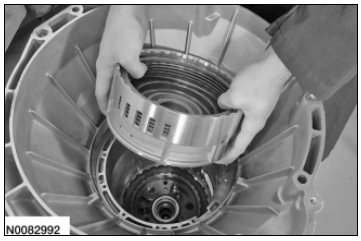
22. Remove the direct clutch assembly.



23. Using the Retaining Ring Pliers 307-343, remove the center support snap ring.



24. Remove the center support and T6 bearing.



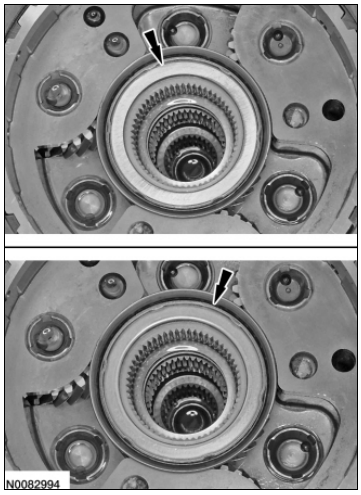
25. **NOTE:** If the thrust bearing stuck to the back of the center support during removal, remove the thrust bearing from the center support.

    Remove the selective shim from the center support.



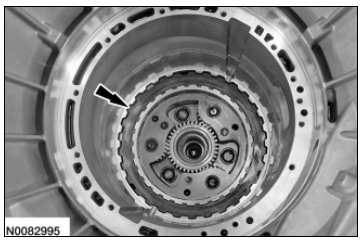
26. **NOTE:** If the selective shim stuck to the T7 thrust bearing during removal of the center support, remove the shim from the thrust bearing.

    If the selective shim is stuck to the T7 thrust bearing, remove the shim and remove the thrust bearing.

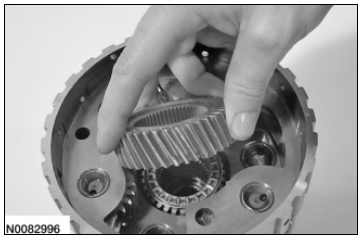


27. **NOTE:** When removing the planet carrier and the low/reverse clutch pack, some of the clutch plates may stay in the case. Remove any clutch plates from the transmission that were not removed with the carrier and keep the clutch plates together.

    Remove the planet carrier and the low/reverse clutch pack as an assembly.

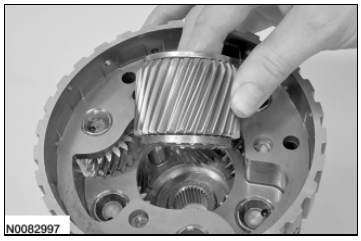


28. Remove the low/reverse sun gear.



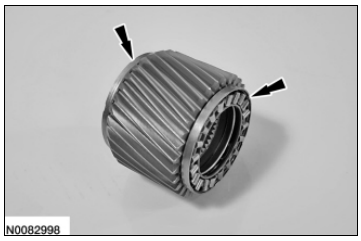
29. **NOTE:** When removing the sun gear, take note that the taper edge is facing up toward the torque converter housing.

    Remove the sun gear from the planet assembly.



30. **NOTE:** Remove the bearings with the sun gear.

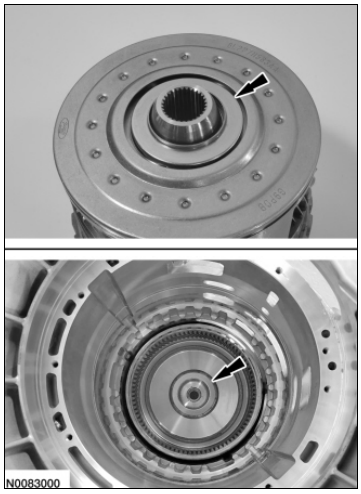
    Remove the top T8 and the bottom T9 roller bearings from the sun gear.



31. Remove the T9 roller bearing race in the bottom of the carrier.



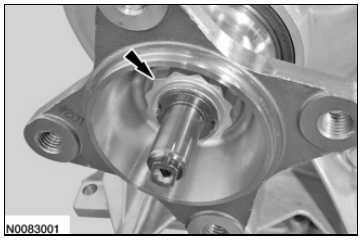
32. If the T10 thrust bearing is attached to the rear planetary carrier, remove it from the carrier. If it stayed in the transmission case when the rear planetary carrier was removed, remove it from the transmission case.



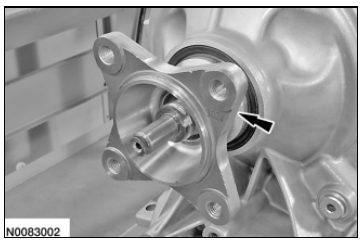
Rear Wheel Drive (RWD) vehicles

33. ***NOTICE:*** **The output shaft flange nut has been staked to prevent it from coming loose. Prior to removing the nut, remove the stake to prevent damage to the output shaft.**

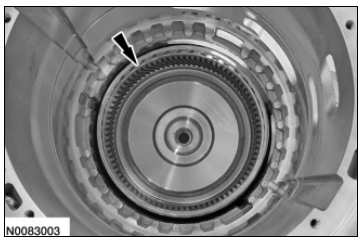
    Remove and discard the output shaft flange nut.



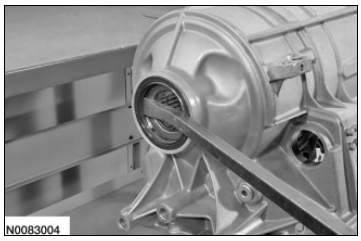
34. Remove the extension housing flange seal and the output shaft flange.



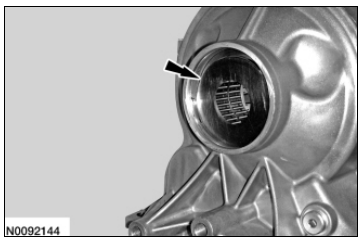
35. Remove the planet carrier hub, output shaft assembly and T11 bearing.



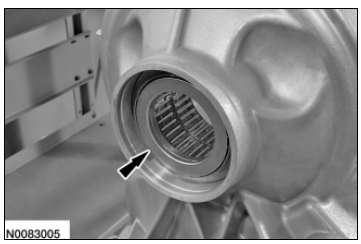
36. Using a suitable tool, remove the output shaft seal.



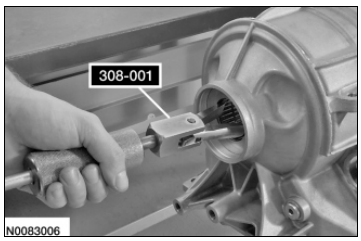
37. Remove the slip plane washer.



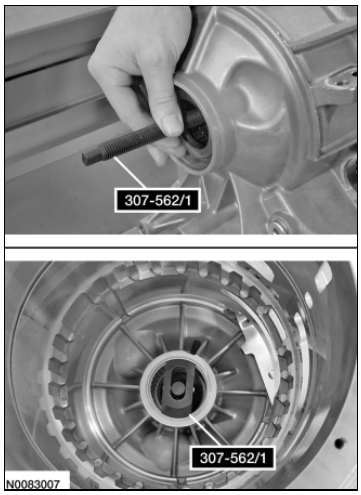
38. Remove the thrust bearing.



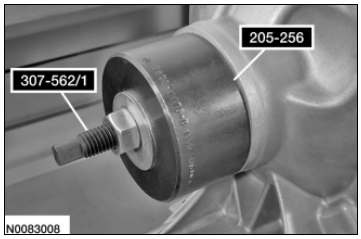
39. Using the Pilot Bearing Remover 308-001, remove the thrust bearing spacer.



40. Install the Needle Bearing Remover 307-562/1 on the bearing.

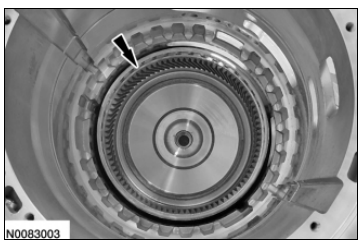


41. Install the Front Wheel Hub Oil Seal Installer 205-256 on the Needle Bearing Remover 307-562/1 and remove the bearing.

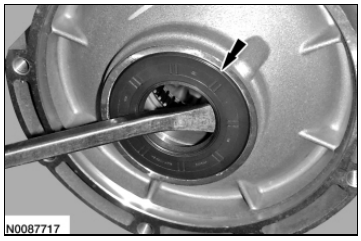


Four-Wheel Drive (4WD) vehicles

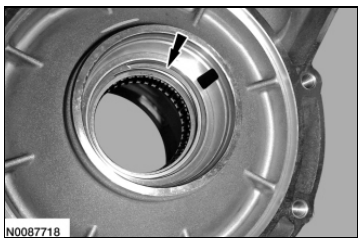
42. Remove the planet carrier hub, output shaft assembly and T11 bearing.



43. Remove and discard the output shaft seal.

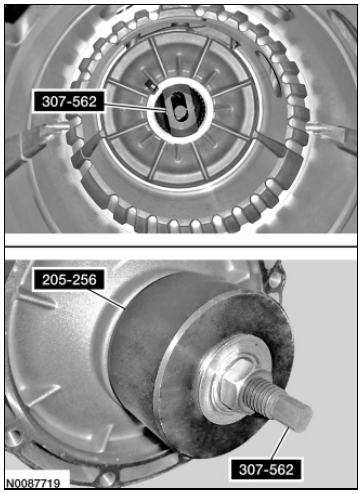


44. Remove the snap ring from the case.



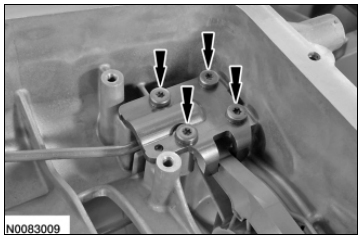
45. ***NOTICE:*** **Use care when installing the Needle Bearing Remover 307-562. Look inside the transmission case to make sure that the Needle Bearing Remover 307-562 contacts the bearing only and not the lip of the case, or damage to the case will occur.**

    Using the Needle Bearing Remover 307-562 and the Front Wheel Hub Oil Seal Installer 205-256, remove the bearing assembly.



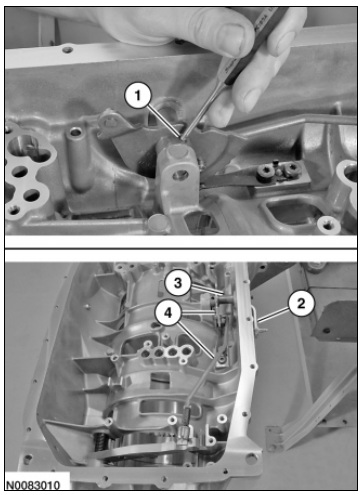
All vehicles

46. Remove the park rod actuating plate.

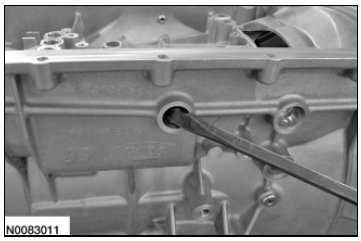


47. Remove the manual control lever detent plate and park pawl actuator rod.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the manual control lever spacer to keep it from falling into the case.

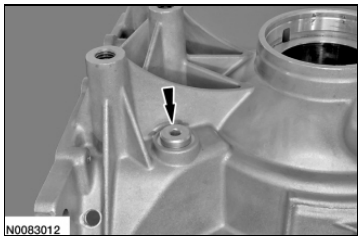
4. Remove the manual control lever detent plate and park pawl actuator rod as an assembly.



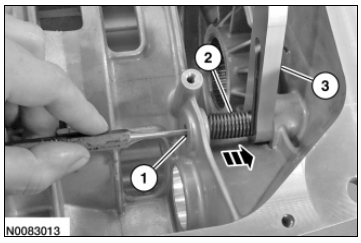
48. Using a suitable tool, remove and discard the manual control lever seal.



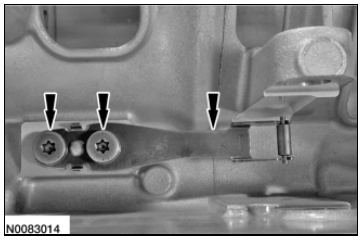
49. Remove the bolt from the back of the case to gain access to the park pawl pin.



50. From the inside of the case, push the park pawl pin out toward the back side of the case while holding the spring and the park pawl. Remove the park pawl pin then remove the park pawl and spring.
    1. Park pawl pin
    2. Park pawl spring
    3. Park pawl



51. Remove the 2 bolts and the park detent spring.


N0083014

Forward/Overdrive Clutch Assembly - Disassembly

Special Tool(s)

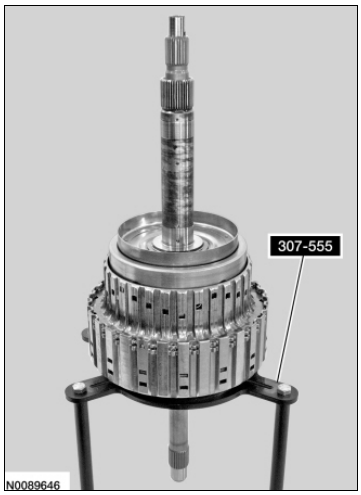
 ST2692-A	End Play Gauge, Clutch 307-555

Material

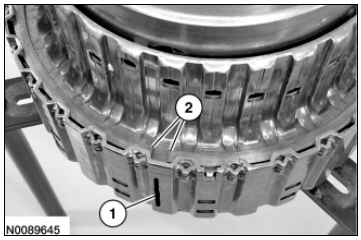
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Disassembly

1. Position the forward/overdrive clutch assembly in the Clutch End Play Gauge 307-555.



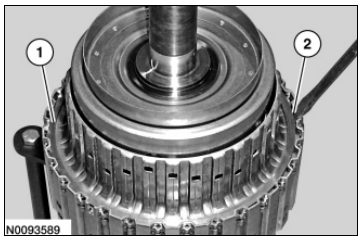
2. Index-mark the direct clutch outer shell snap ring gap location to the side of the forward clutch hub using a suitable paint marker.
    1. Index mark
    2. Snap ring gap



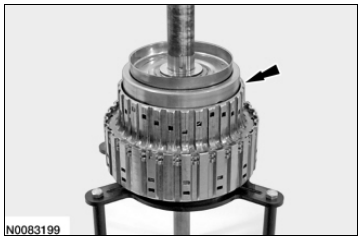
3. ***NOTICE:*** **Compress the snap ring out of the groove 180 degrees from the snap ring gap or damage to the forward clutch hub can occur.**

   Using a suitable tool, remove and discard the direct clutch outer shell retaining ring by compressing the snap ring 180 degrees from the snap ring gap.

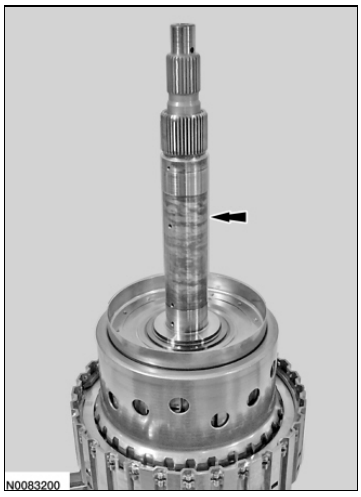
   1. Snap ring gap
   2. 180 degrees from the snap ring gap



4. Remove and discard the direct clutch hub.

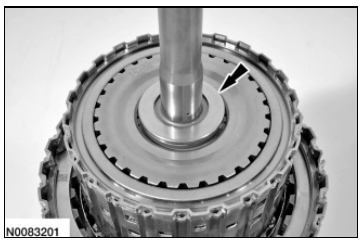


5. Remove the forward clutch hub and sun shaft assembly.

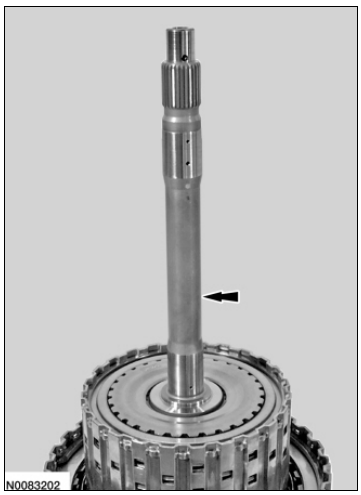


6. **NOTE:** The bearing may stick in the forward clutch drum.

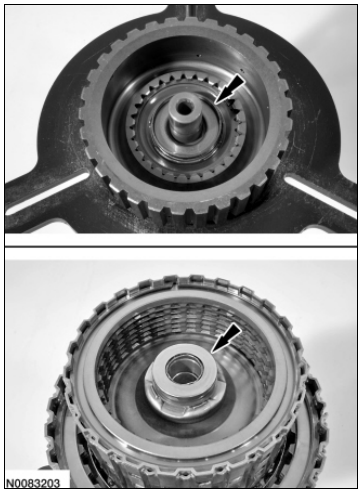
   Remove the intermediate shaft bearing.



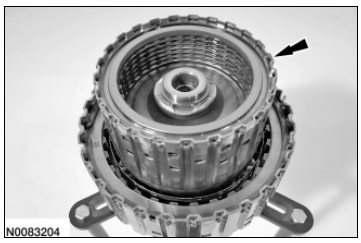
7. Remove the intermediate shaft assembly.



8. If the T3 thrust bearing stuck to the intermediate shaft assembly, remove it from the intermediate shaft assembly. If the T3 thrust bearing is on the overdrive clutch, remove it from the overdrive clutch assembly.

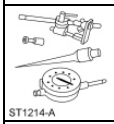


9. Remove the overdrive clutch pack from the forward clutch pack.



Forward Clutch Assembly

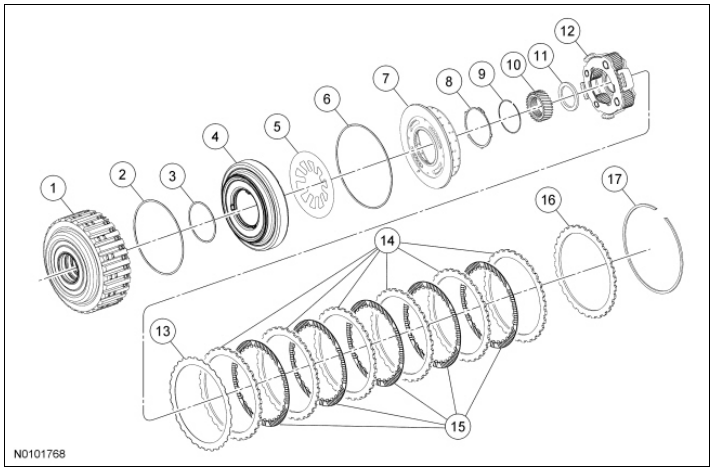
Special Tool(s)

 ST2681-A	Compressor, Clutch Spring 307-525
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Forward Clutch Assembly (A Clutch)



Item	Part Number	Description
1	7A360	Forward clutch drum
2	7A548	Forward clutch piston outer O-ring seal
3	7A548	Forward clutch piston inner O-ring seal
4	7A262	Forward clutch piston

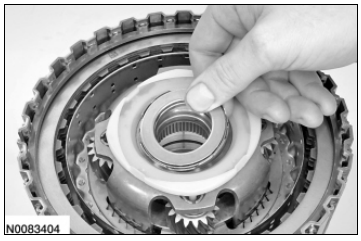
5	7A480	Forward clutch piston return spring
6	7A548	Forward clutch balance dam O-ring seal
7	7H360	Forward clutch balance dam
8	7H365	Forward clutch balance dam retaining ring
9	7H579	Sun gear retaining ring
10	7D063	Sun gear
11	7H375	Bearing (T1)
12	7A398	Planetary gear
13	7E085	Forward clutch cushion spring
14	7E314	Forward clutch external splined steel plates (quantity model dependent)
15	7B164	Forward clutch internal splined friction plates (quantity model dependent)
16	7B066	Forward clutch pressure plate
17	7D483	Forward clutch plate retaining ring

Disassembly

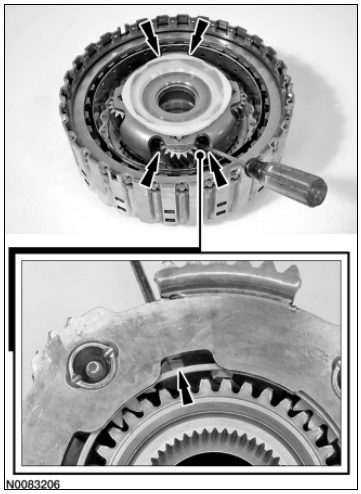
NOTE: Clutch plate quantity is model dependant based on engine displacement:

- 4.6L engine (Explorer, Mountaineer, Sport Trac, F-150)
  - ♦ Four friction plates
  - ♦ Five steel plates
- 5.4L engine (Expedition, Navigator, F-150)
  - ♦ Five friction plates
  - ♦ Six steel plates

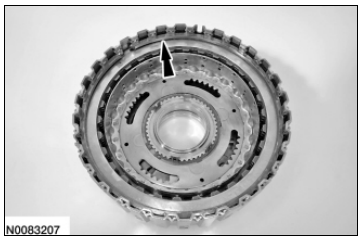
1. If the T2 thrust bearing is on the forward clutch assembly, remove it from the forward clutch assembly.



2. Remove the front planetary carrier and sun gear from the forward clutch assembly.
   - With a small screwdriver or a suitable pick inserted into the front planetary assembly, push on the retaining ring in 4 places while lifting up on the front planetary assembly.



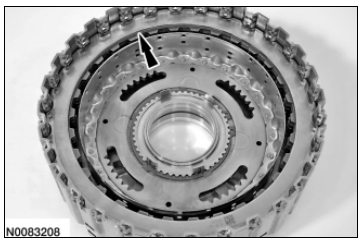
3. Remove the forward clutch pack snap ring.



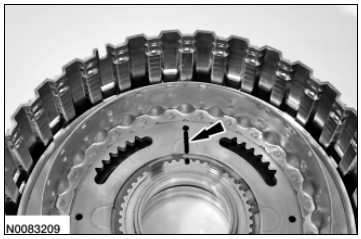
4. **NOTE:** Inspect the forward clutch drum and the friction and steel plates for damage. Install new components as necessary.

   Remove and inspect the forward clutch steel and friction plates.

   - If the plates are damaged, install a new forward clutch assembly.
   - If no damage is indicated, the forward clutch may be reassembled.

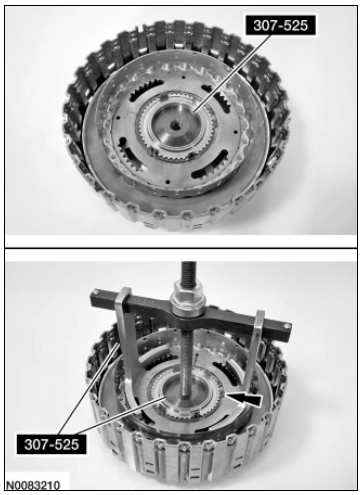


5. For correct alignment during assembly, make an identifying mark on the balance dam and the center part of the housing.

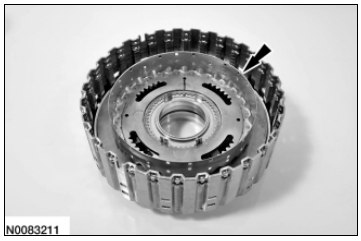


6. **NOTE:** The bottom of the Clutch Spring Compressor 307-525 will need to be installed from the back side of the forward clutch assembly.

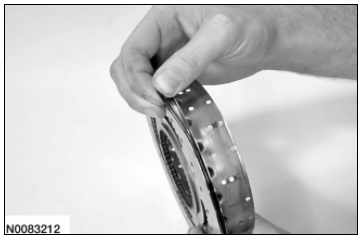
Using the Clutch Spring Compressor 307-525, slightly collapse the balance dam to gain access to the retaining ring and remove the retaining ring.



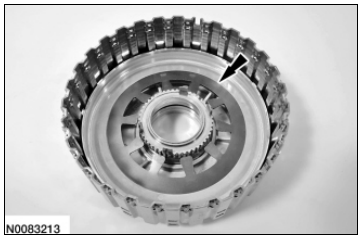
7. Remove the balance dam.



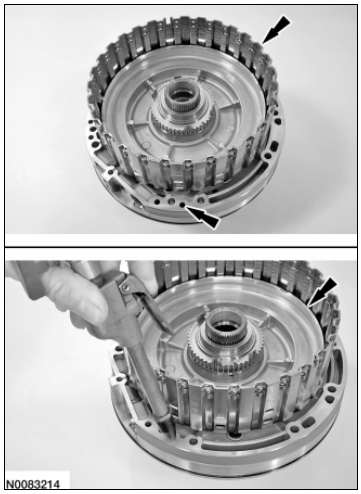
8. Remove and discard the O-ring seal from the balance dam.



9. Remove the forward clutch return spring.



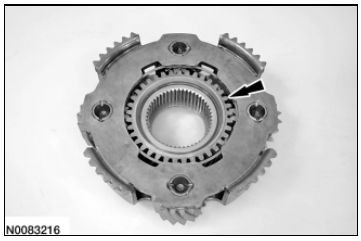
10. Install the forward clutch on the front pump to remove the forward clutch piston. Apply a small amount of shop air to remove the piston.



11. Remove and discard the inner and outer piston O-ring seals.

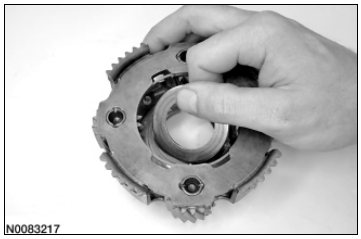


12. Remove the sun gear from the planet assembly.

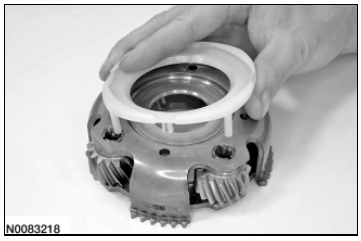


13. **NOTE:** The T1 thrust bearing may have stuck to the sun gear when it was removed.

    Remove the T1 bearing from the planetary carrier.



14. Remove the transmission fluid collector plate from the front planetary carrier.

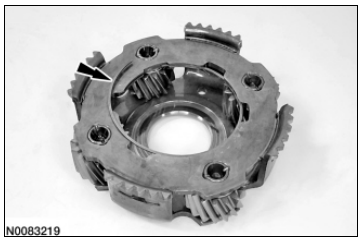


15. Clean and inspect the components of the forward clutch assembly for damage and install new components as necessary.

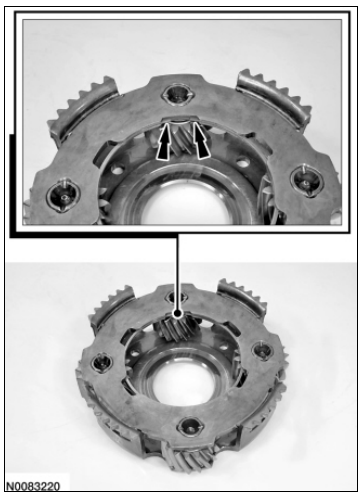
Assembly

1. **NOTE:** If a new planetary assembly is being installed, the new planetary assembly may not come with the snap ring installed.

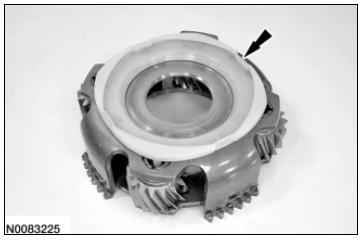
   Install the planetary assembly snap ring, if necessary.



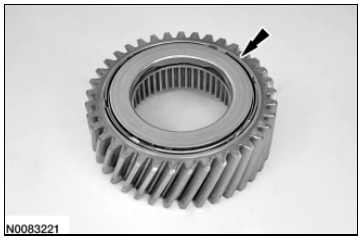
2. Make sure the planetary snap ring is oriented as shown.



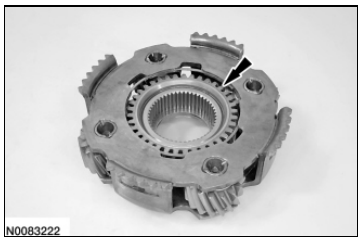
3. Install the transmission fluid collector plate on the front planetary carrier.



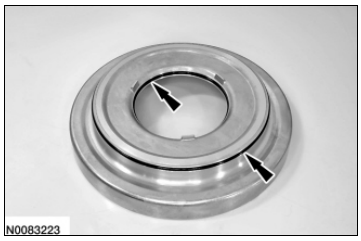
4. Install the T1 bearing onto the sun gear.



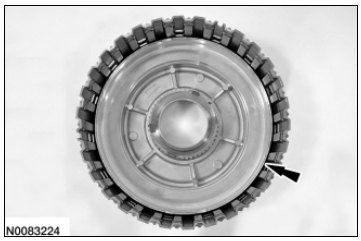
5. Install the sun gear into the planet assembly with the T1 bearing facing down and the recessed part of the gear up.



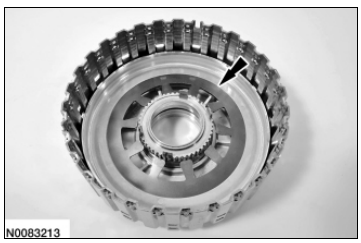
6. Install new O-ring seals onto the forward clutch piston.



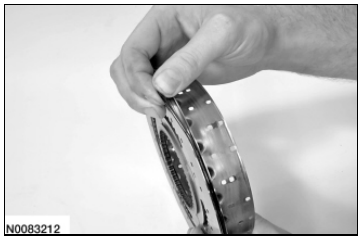
7. Lightly coat the O-ring seals with clean transmission fluid and install the forward clutch piston into the forward clutch drum.



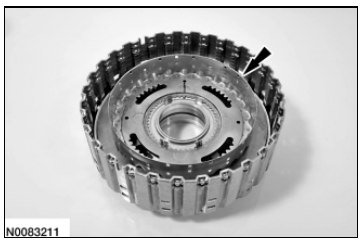
8. Install the forward clutch return spring.



9. Install a new O-ring seal onto the forward clutch balance dam. Lightly coat the O-ring seal with clean transmission fluid.

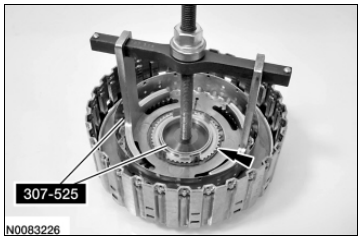


10. Align the marks made during disassembly and install the balance dam into the forward clutch drum.



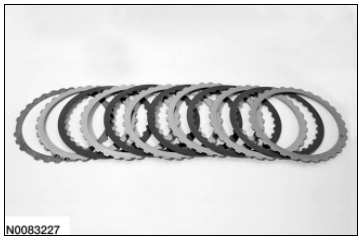
11. **NOTE:** Prior to releasing the Clutch Spring Compressor 307-525, make sure that the snap ring is fully seated.

    Using the Clutch Spring Compressor 307-525, slightly collapse the balance dam to install the retaining ring. Install the retaining ring.

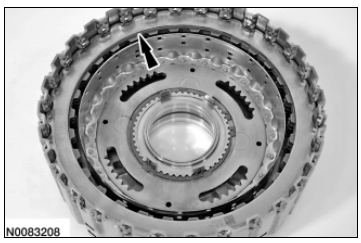


12. **NOTE:** Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

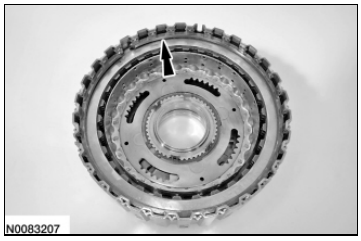
    Soak the new forward clutch plates in clean transmission fluid.



13. Install the new forward clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates and install the pressure plate.

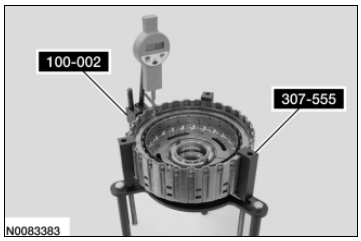


14. Install the forward clutch plate snap ring.

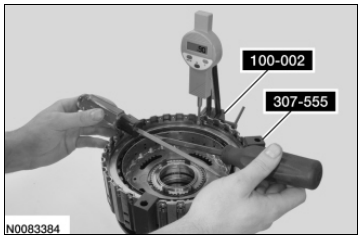


15. **NOTE:** All forward clutch plates, friction and steel are of a wave-type design.

    Install the forward clutch assembly into the Clutch End Play Gauge 307-555 and install the Dial Indicator Gauge with Holding Fixture 100-002 and position the plunger so it fits into the opening of the snap ring.



16. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



17. Rotate the forward clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

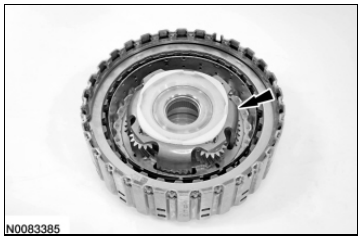
Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

18. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.

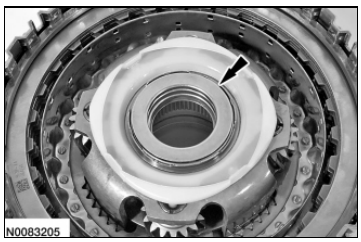
    - 5.4L engine - 0.71-1.10 mm (0.028-0.043 in).
    - 4.6L engine - 0.71-1.10 mm (0.028-0.043 in).

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

19. Install the sun gear and planetary gearset into the forward clutch drum. Make sure it snaps and locks in place.

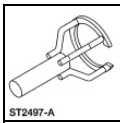
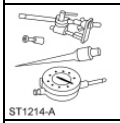
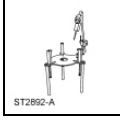


20. Install the T2 thrust bearing.



Overdrive Clutch Assembly

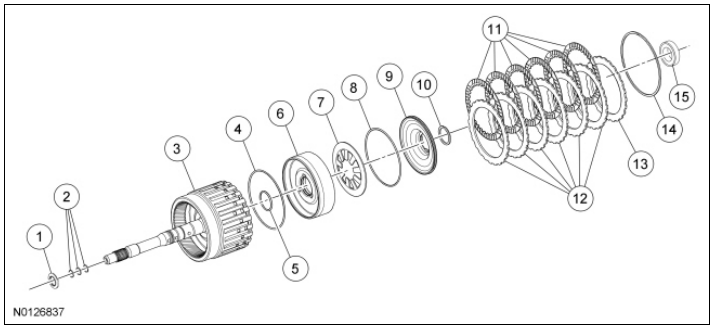
Special Tool(s)

 ST2497-A	Compressor, Spring Washer 307-209
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Overdrive (O/D) Clutch Assembly

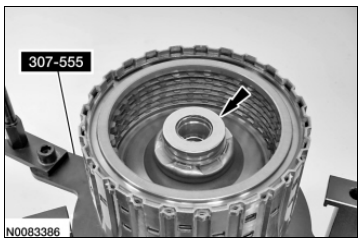


Item	Part Number	Description
1	7L495	Bearing (T2)
2	7G091	Turbine shaft seals (4.6L-2 required, 5.4L and 6.2L-3 required)
3	7F207	Input shaft
4	7A548	Overdrive (O/D) clutch piston outer seal
5	7A548	O/D clutch piston inner seal
6	7A262	O/D clutch piston
7	7B070	O/D clutch piston spring

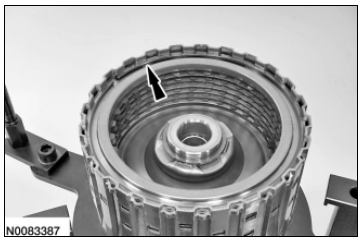
8	7A548	O/D balance piston outer seal
9	7H360	O/D balance piston
10	7C122	O/D balance piston snap ring
11	7B164	O/D clutch internal splined clutch plates (friction)
12	7B442	O/D clutch external splined clutch plates (steel)
13	7B066	O/D pressure plate
14	7D483	O/D clutch retaining ring
15	7C096	Bearing T3

Disassembly

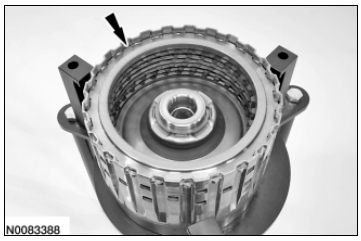
1. Position the Overdrive (O/D) clutch assembly in the Clutch End Play Gauge 307-555 and remove the T3 thrust bearing.



2. Remove the O/D clutch pack snap ring.



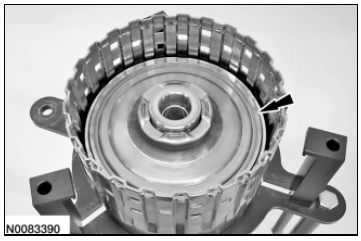
3. Remove the O/D clutch pack.



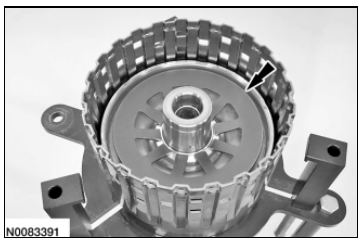
4. Using the Spring Washer Compressor 307-209 and a press, remove and discard the O/D clutch balance piston retaining ring.



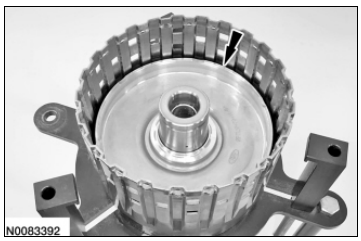
5. Remove the O/D clutch balance piston.



6. Remove the O/D clutch return spring.



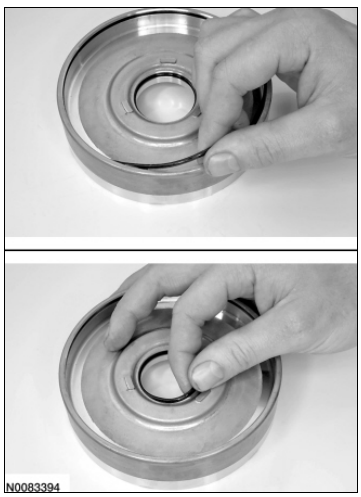
7. Remove the O/D clutch apply piston.



8. Remove and discard the outer O-ring seal on the O/D clutch balance piston.

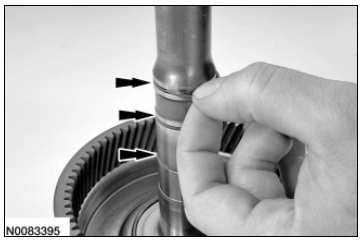


9. Remove and discard both the inner (one large and one small) O-ring seals on the O/D clutch apply piston.



10. **NOTE:** 5.4L/6.2L shown, 4.6L similar. Vehicles equipped with a 5.4L or 6.2L engine will have 3 scarf cut seals and vehicles equipped with a 4.6L engine will have 2 scarf cut seals.

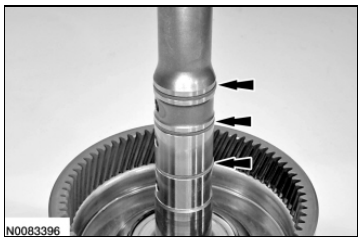
    Remove and discard the scarf cut seals.



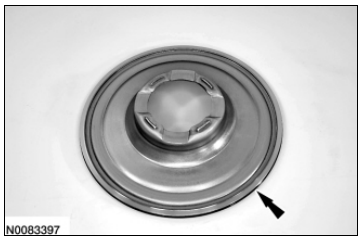
Assembly

1. **NOTE:** 5.4L/6.2L shown, 4.6L similar. Vehicles equipped with a 5.4L or 6.2L engine will have 3 scarf cut seals and vehicles equipped with a 4.6L engine will have 2 scarf cut seals.

   Install new scarf cut seals and the roller bearing.



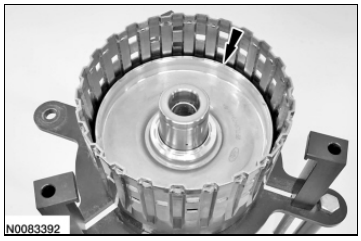
2. Install a new outer O-ring seal on the O/D clutch balance piston.



3. Install 2 new inner O-ring seals on the O/D clutch apply piston.

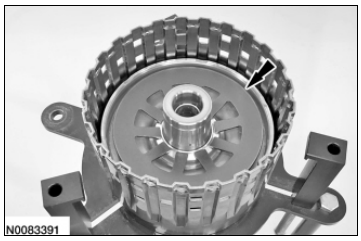


4. Lubricate all the O-ring seals with clean transmission fluid. Install the O/D clutch apply piston into the drum with the O-ring seals and the 3 pads facing down toward the drum.



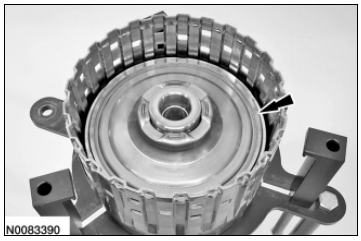
5. **NOTE:** The fingers on the return spring are facing down toward the piston.

   Install the O/D clutch return spring.

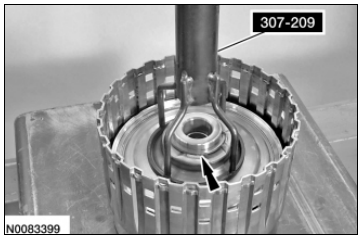


6. **NOTE:** The cone shape of the balance piston must face up when installed correctly.

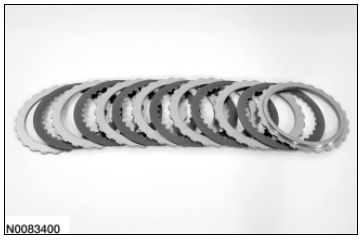
   Lubricate all the O-ring seals with clean transmission fluid. Install the O/D clutch balance piston.



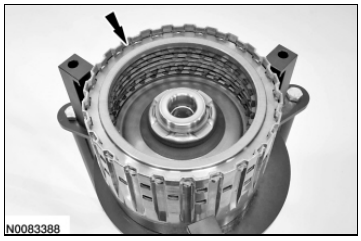
7. Using the Spring Washer Compressor 307-209, install a new O/D clutch balance piston retaining ring.



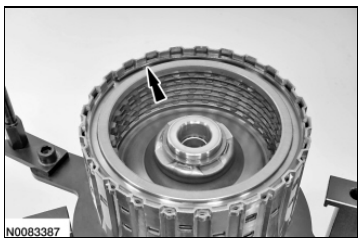
8. Soak the new O/D clutch plates in clean transmission fluid.



9. Install the new O/D clutch plates, starting with a steel plate and alternating between friction and steel plates, and ending with the pressure plate on the top.

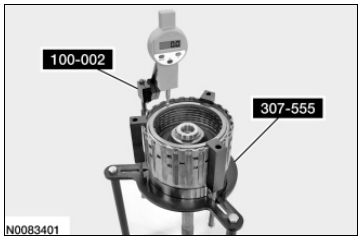


10. Install the O/D clutch pack snap ring.



11. **NOTE:** All O/D clutch plates, friction and steel are of a wave-type design.

    Install the O/D clutch assembly into the Clutch End Play Gauge 307-555 and install the Dial Indicator Gauge with Holding Fixture 100-002 and position the plunger so it fits into the opening of the snap ring.



12. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



13. Rotate the O/D clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

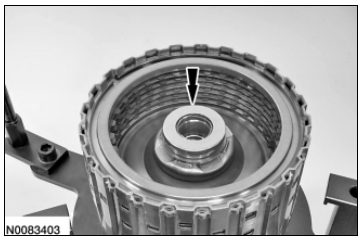
14. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.

- 0.5-0.9 mm (0.019-0.035 in).

If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

15. **NOTE:** Inspect and install new thrust bearings as required.

    Install the T3 thrust bearing.



Forward/Overdrive Clutch Assembly - Assembly

Special Tool(s)

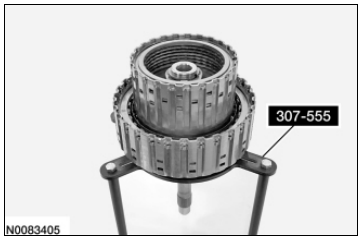
 ST2692-A	End Play Gauge, Clutch 307-555

Material

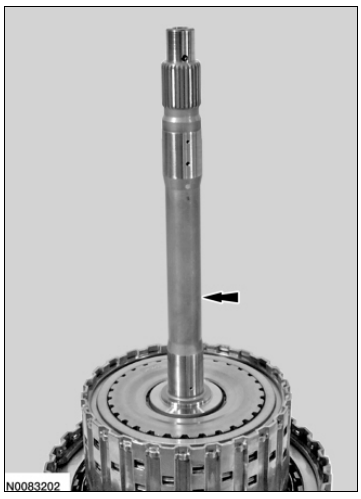
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Assembly

1. Position the forward clutch assembly in the Clutch End Play Gauge 307-555 and install the overdrive clutch pack onto the forward clutch and planetary gear set.

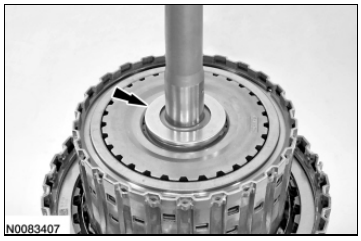


2. Install the intermediate shaft assembly.

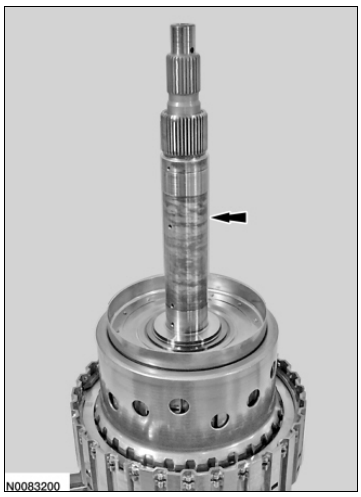


3. **NOTE:** Inspect and install new thrust bearings as required.

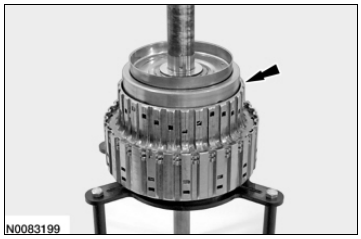
   Install the T4 intermediate shaft bearing.



4. Install the forward clutch hub and sun shaft assembly.



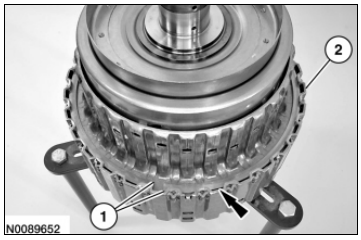
5. Install a new the direct clutch hub.



6. ***NOTICE:*** **Do not install the snap ring on the forward clutch hub with the snap ring gap in the same position as the original snap ring or damage to the transmission can occur.**

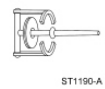
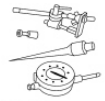
   Install a new direct clutch outer shell retaining ring with the snap ring gap positioned approximately 120 degrees from the index mark made on the forward clutch hub during disassembly.

   1. New snap ring gap
   2. Index mark from original snap ring gap



Direct Clutch Assembly

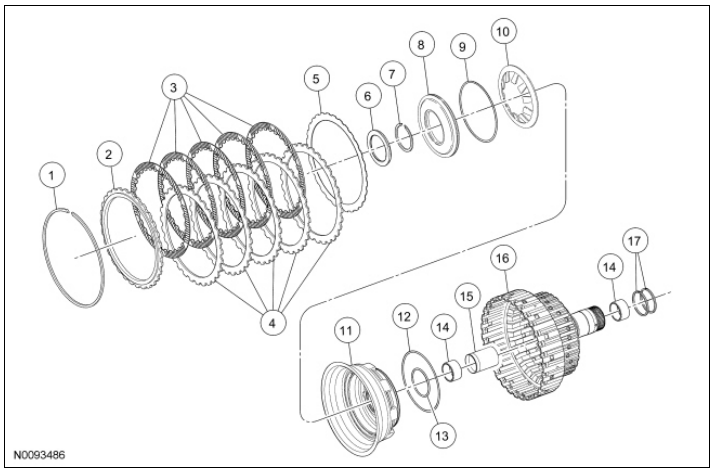
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST2893-A	Compressor, Clutch Spring 307-552
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Direct Clutch Assembly



Item	Part Number	Description
1	7D483	Direct clutch pressure plate retaining ring
2	7B066	Direct clutch pressure plate (quantity model dependant)

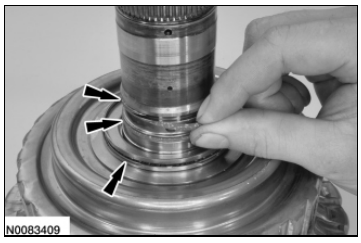
3	7B164	Direct clutch internal splined friction plates (quantity model dependant)
4	7B442	Direct clutch external splined steel plates
5	-	Direct clutch cushion plate (wave spring)
6	7C096	Bearing (T5)
7	7A577	Piston retaining ring
8	7A262	Direct clutch balance piston
9	7A548	Direct clutch balance piston seal
10	7B488	Return spring
11	7A262	Direct clutch apply piston
12	7A548	Direct clutch apply piston outer seal
13	7C099	Direct clutch apply piston inner seal
14	-	Direct clutch bushing hubs (part of 7F283) (2 required)
15	-	Gear shaft tube sleeve (part of 7F283)
16	7F283	Direct clutch cylinder
17	7D020	Seal shell cylinders

Disassembly

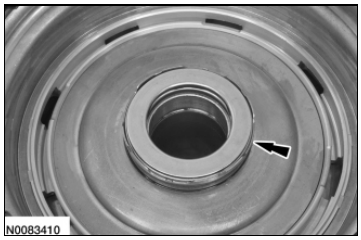
NOTE: Clutch plate quantity is model dependant based on engine displacement:

- 4.6L engine (Explorer, Mountaineer, Sport Trac, F-150)
  - Four friction plates
  - Five steel plates
- 5.4L engine (Expedition, Navigator, F-150)
  - Five friction plates
  - Six steel plates

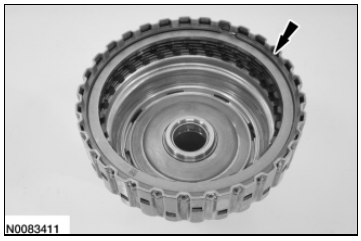
1. Remove and discard the 2 scarf cut seals and the roller bearing.



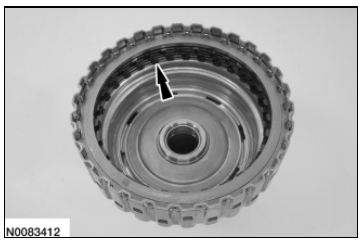
2. Remove the T5 thrust bearing.



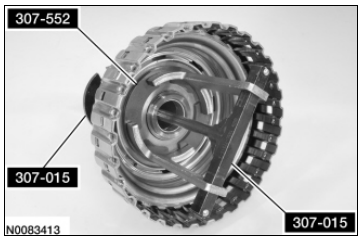
3. Remove the direct clutch snap ring.



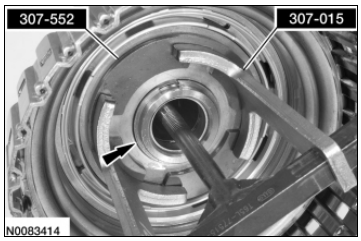
4. Remove the direct clutch steel and friction plates.



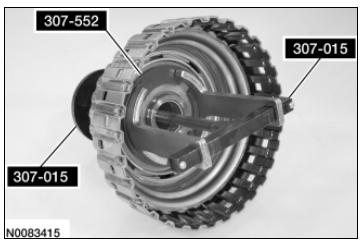
5. Install the Clutch Spring Compressor 307-552 and the Clutch Spring Compressor 307-015 onto the direct clutch assembly.



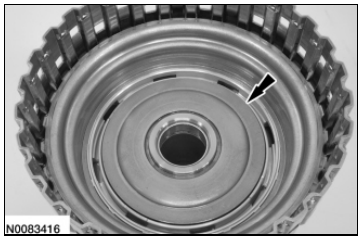
6. Using the Clutch Spring Compressor 307-552 and Clutch Spring Compressor 307-015, compress the direct clutch return spring and remove the direct clutch return spring retainer.



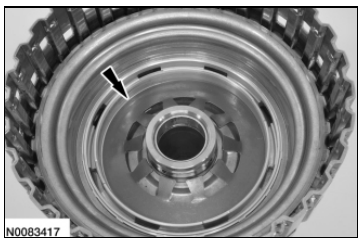
7. Remove the Clutch Spring Compressor 307-552 and the Clutch Spring Compressor 307-015.



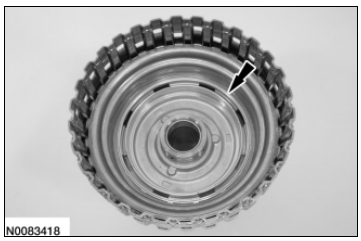
8. Remove the balance piston.



9. Remove the direct clutch return spring.



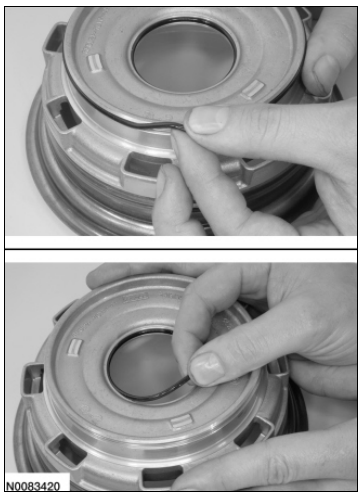
10. Remove the direct clutch piston.



11. Remove and discard the outer O-ring seal from the balance piston.



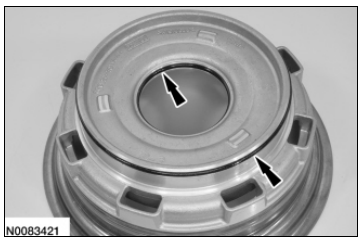
12. Remove and discard the outer and inner O-ring seals from the apply piston.



13. Inspect the components of the direct clutch for damage. If damage is indicated, install new components as necessary.

Assembly

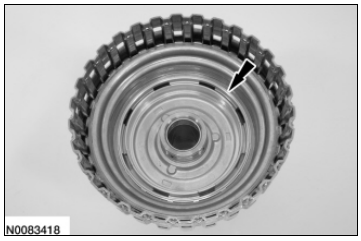
1. Install a new inner and outer O-ring seal on the apply piston.



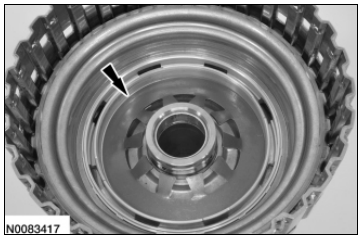
2. Install a new outer O-ring seal on the balance piston.



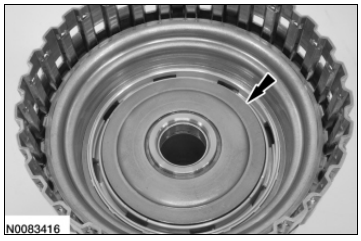
3. Lightly coat the O-ring seals in clean transmission fluid and install the direct clutch piston.



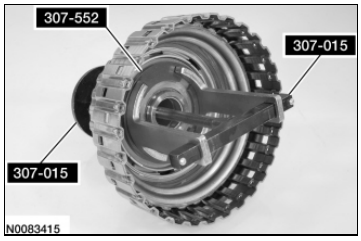
4. Install the direct clutch return spring.



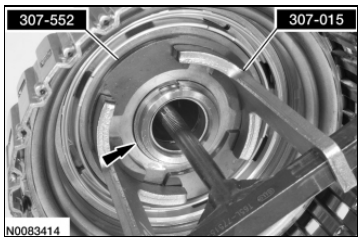
5. Install the balance piston.



6. Install the Clutch Spring Compressor 307-552 and the Clutch Spring Compressor 307-015 onto the direct clutch assembly.

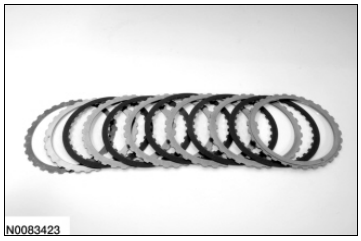


7. Using the Clutch Spring Compressor 307-552 and the Clutch Spring Compressor 307-015, compress the direct clutch return spring and install the direct clutch return spring retainer.

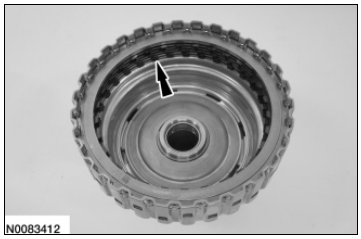


8. **NOTE:** Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

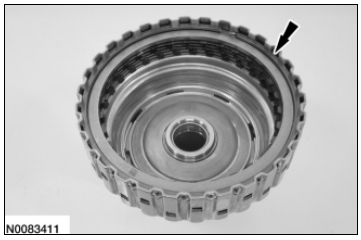
   Soak the new direct clutch in clean transmission fluid.



9. Install the new direct clutch plates, starting with the wave spring then a steel plate and alternating between steel and friction plates, and ending with the pressure plate on the top.

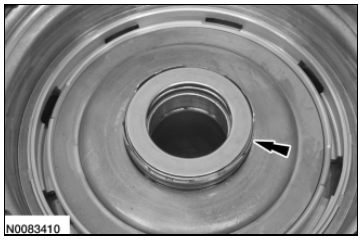


10. Install the direct clutch snap ring.



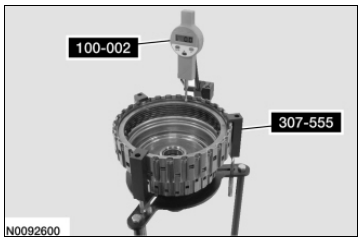
11. **NOTE:** Inspect and install a new thrust bearing as required.

    Install the T5 thrust bearing.

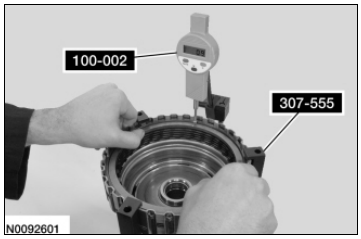


12. **NOTE:** All direct clutch plates, friction and steel are of a wave-type design.

    Install the direct clutch assembly into the Clutch End Play Gauge 307-555 and install the Dial Indicator Gauge with Holding Fixture 100-002 and position the plunger so it fits into the opening of the snap ring.



13. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



14. Rotate the direct clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

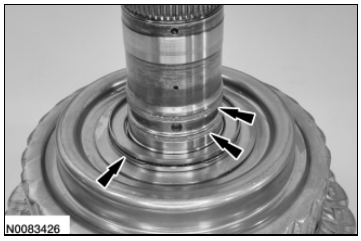
Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

15. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.

    - 5.4L engine - 0.5-1.3 mm (0.019-0.051 in).
    - 4.6L engine - 0.5-1.3 mm (0.019-0.051 in).

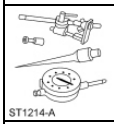
    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

16. Install 2 new scarf cut seals and the roller bearing.


N0083426

Intermediate Clutch Assembly

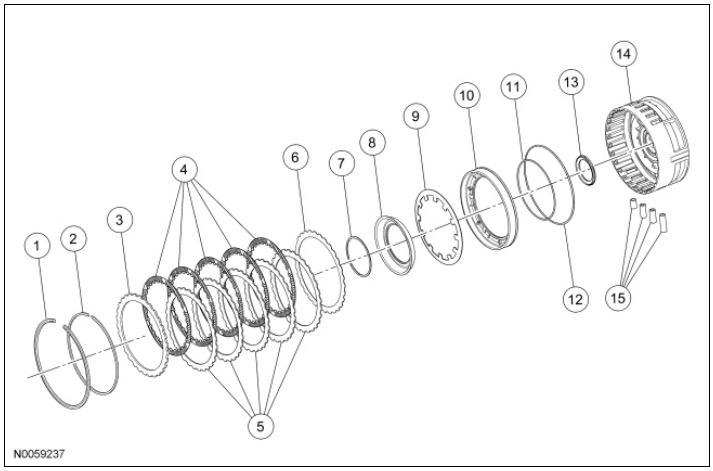
Special Tool(s)

 ST2681-A	Compressor, Clutch Spring 307-525
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Intermediate Clutch Assembly



Item	Part Number	Description
1	7D483	Center support retaining ring
2	7D483	Intermediate clutch pack retaining ring
3	7B066	Intermediate clutch pressure plate
4	7B164	Intermediate clutch internal splined friction plates (quantity model dependent)

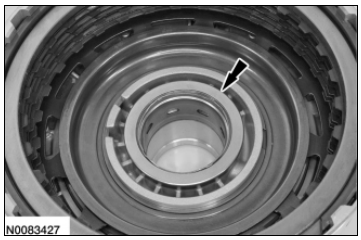
5	7B442	Intermediate clutch external splined steel plates (quantity model dependent)
6	7E085	Intermediate clutch cushion spring
7	7A577	Intermediate clutch snap ring
8	7B043	Intermediate clutch return spring retaining ring
9	7A480	Intermediate clutch piston return spring
10	7E005	Intermediate clutch piston
11	7F225	Intermediate clutch piston inner seal
12	7F224	Intermediate clutch piston outer seal
13	7F373	Bearing (T6)
14	-	Intermediate/low/reverse clutch center support
15	7G199	Center support seals (2 - 7G199, 1 - 7G087, 1 - 7G484)

Disassembly

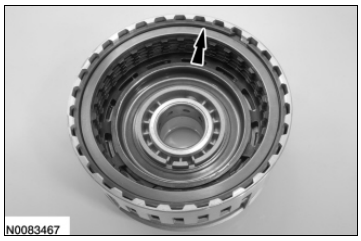
NOTE: Clutch plate quantity is model dependant based on engine displacement:

- 4.6L engine (Explorer, Mountaineer, Sport Trac, F-150)
  - ♦ Four friction plates
  - ♦ Four steel plates
- 5.4L engine (Expedition, Navigator, F-150)
  - ♦ Five friction plates
  - ♦ Five steel plates

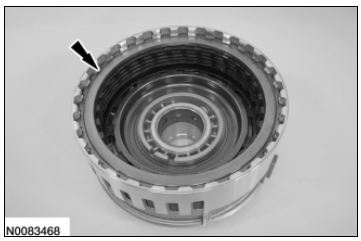
1. Remove the T6 thrust bearing.



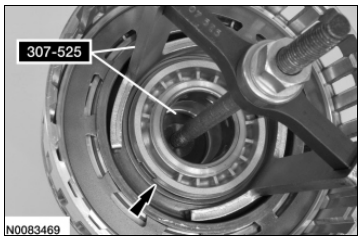
2. Remove the intermediate clutch plate snap ring.



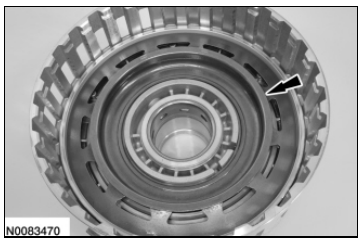
3. Remove the intermediate clutch plates.



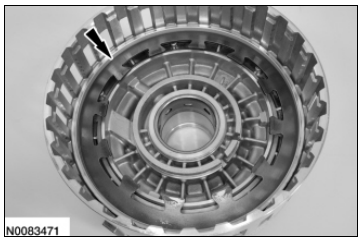
4. Using the Clutch Spring Compressor 307-525, remove and discard the intermediate clutch return spring retainer.



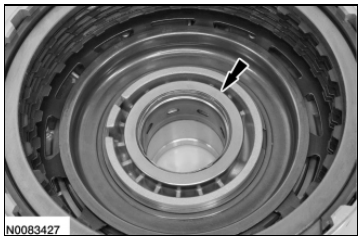
5. Remove the intermediate clutch return spring top plate.



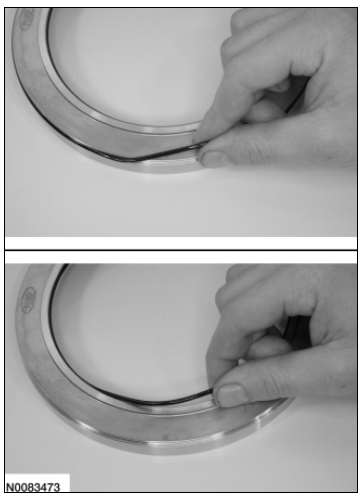
6. Remove the intermediate clutch return spring.



7. Applying a slight amount of air to the port, remove the intermediate clutch piston.

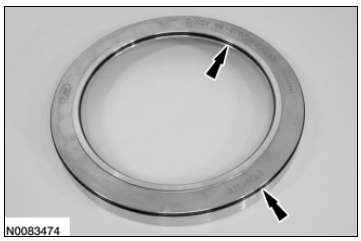


8. Remove and discard the inner and outer intermediate clutch piston O-ring seals.

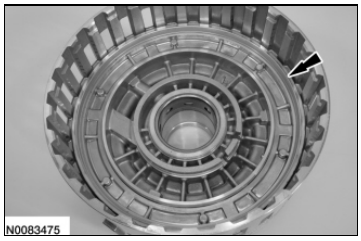


Assembly

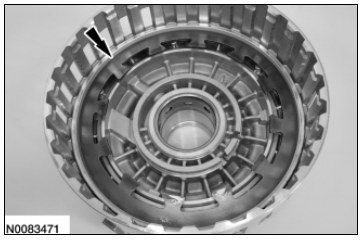
1. Install new inner and outer intermediate clutch piston O-ring seals.



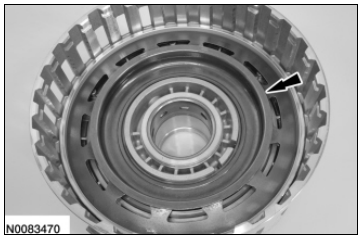
2. Lightly coat the O-ring seals in clean automatic transmission fluid and install the intermediate clutch piston.



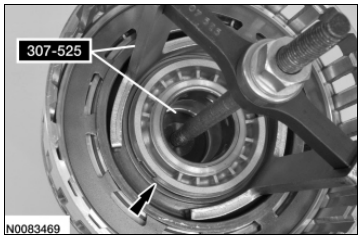
3. Install the intermediate clutch return spring.



4. Install the intermediate clutch return spring top plate.

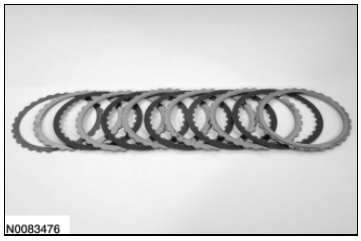


5. Using the Clutch Spring Compressor 307-525, install a new intermediate clutch return spring retainer.

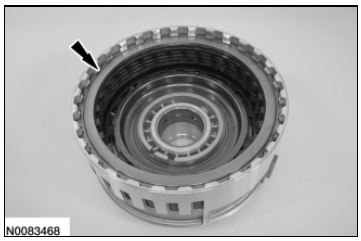


6. **NOTE:** Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

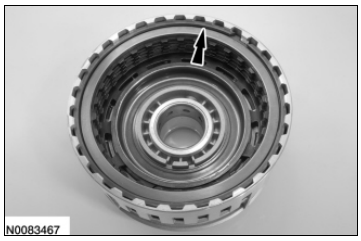
   Soak the new intermediate clutch plates in clean automatic transmission fluid.



7. Install the new intermediate clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending with the pressure plate.

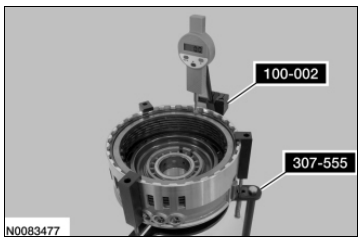


8. Install the intermediate clutch plate snap ring.

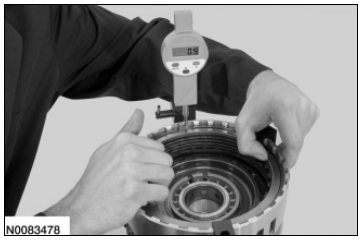


9. **NOTE:** All intermediate clutch plates, friction and steel are of a wave-type design.

   Install the intermediate clutch assembly into the Clutch End Play Gauge 307-555 and install the Dial Indicator Gauge with Holding Fixture 100-002 and position the plunger so it fits into the opening of the snap ring.



10. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



11. Rotate the intermediate clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

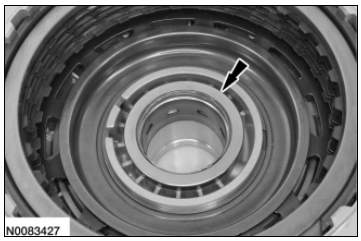
Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

12. **NOTE:** If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.

    - 5.4L engine - 0.7-1.1 mm (0.027-0.043 in).
    - 4.6L engine - 0.7-1.1 mm (0.027-0.043 in).

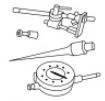
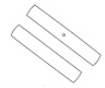
    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

13. Install the T6 thrust bearing.



Low/Reverse Clutch Assembly

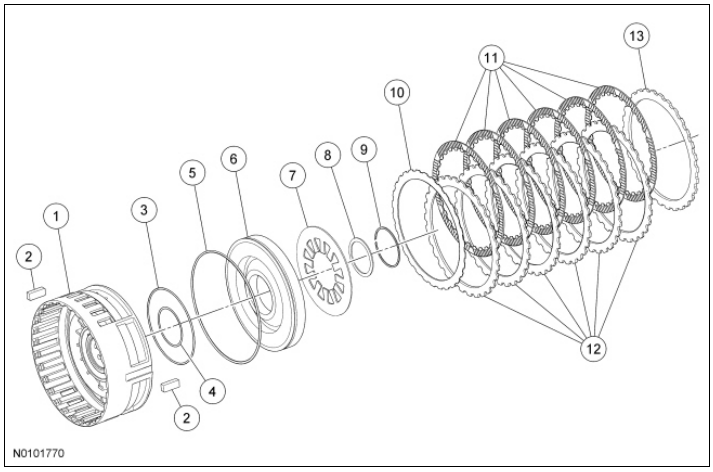
Special Tool(s)

 ST2681-A	Compressor, Clutch Spring 307-525
 ST1274-A	Depth Micrometer 303-D075 (D92P-4201-A) or equivalent
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555
 ST2896-A	Gauge, D-Clutch Measurement 307-554

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

Low/Reverse Clutch Assembly



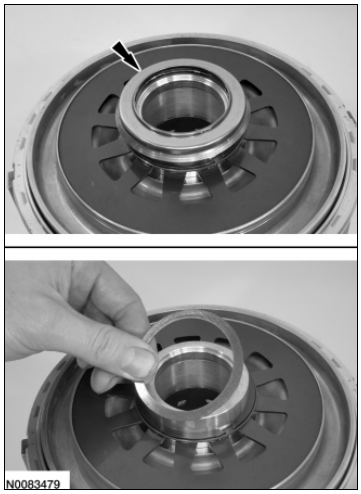
Item		Description

	Part Number	
1	-	Intermediate/low/reverse clutch center support
2	7B220	Center support keys (2 required)
3	7F225	Low/reverse clutch piston center seal
4	7D404	Low/reverse clutch cylinder inner seal
5	7D403	Low/reverse clutch cylinder outer seal
6	7A262	Low/reverse clutch piston
7	7B070	Low/reverse clutch return spring
8	-	Washer
9	7D483	Low/reverse clutch return spring retainer
10	7E085	Low/reverse clutch cushion spring
11	7B164	Low/reverse clutch internal splined friction plates (internal to case)
12	7B442	Low/reverse clutch external splined steel plates (internal to case)
13	7B066	Low/reverse clutch pressure plate (internal to case) (select fit)

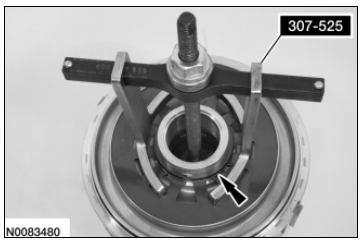
Disassembly

NOTE: The low/reverse clutch plates are installed in the case during the Assembly procedure.

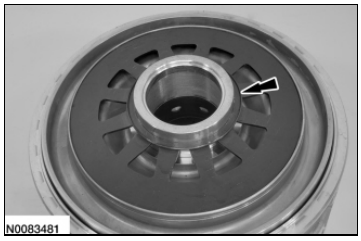
1. Remove the T7 thrust bearing and the shim from the center support.



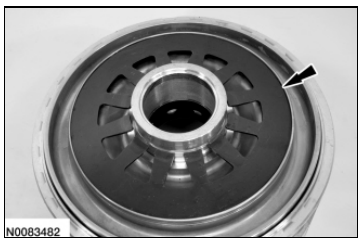
2. Using the Clutch Spring Compressor 307-525, remove and discard the low/reverse clutch return spring retainer.



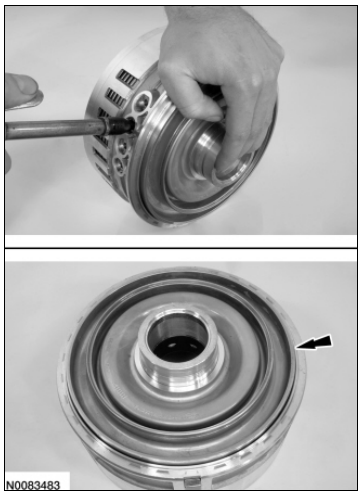
3. Remove and discard the low/reverse clutch return spring washer.



4. Remove the low/reverse clutch return spring.



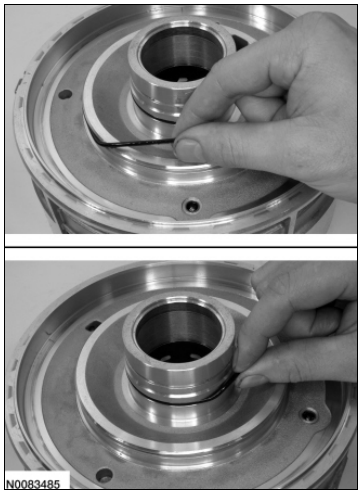
5. Apply a slight amount of air to the port, remove the low/reverse clutch piston from the low/reverse clutch drum.



6. Remove and discard the low/reverse outer piston O-ring seals.



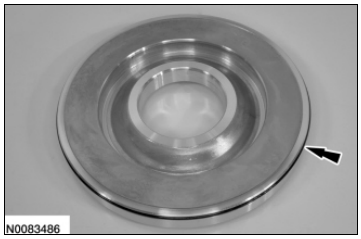
7. Remove and discard the low/reverse drum O-ring seals.



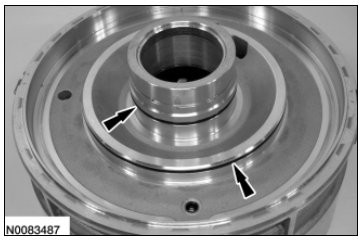
Assembly

Low/reverse piston

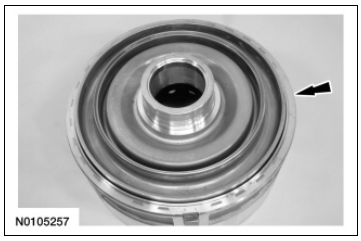
1. Install new low/reverse outer piston O-ring seals.



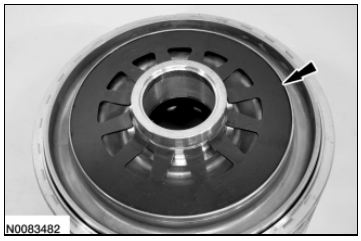
2. Install new low/reverse drum O-ring seals.



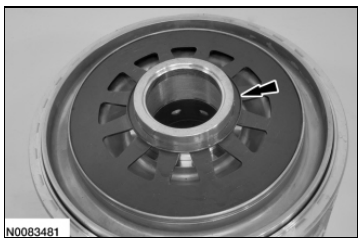
3. Lubricate the O-ring seal with clean automatic transmission fluid and install the low/reverse piston.



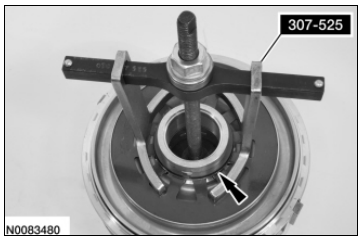
4. Install the low/reverse clutch return spring.



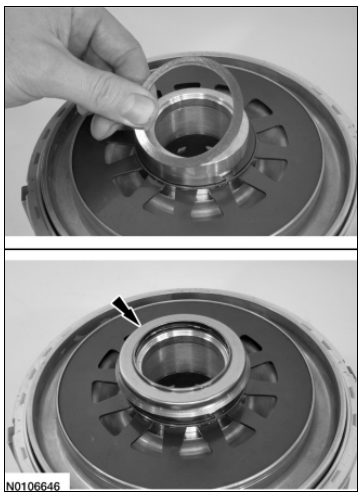
5. Install a new low/reverse clutch return spring washer.



6. Using the Clutch Spring Compressor 307-525, compress the low/reverse clutch return spring and install the retaining ring.



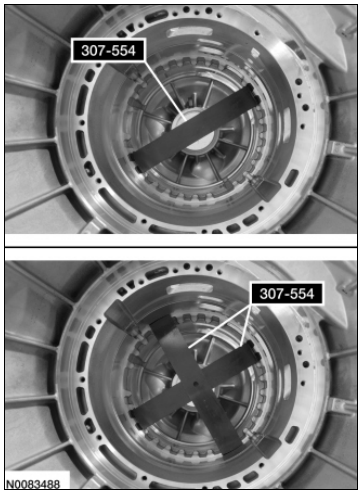
7. Install the shim and the T7 thrust bearing on the center support.



Low/reverse clutch stackup

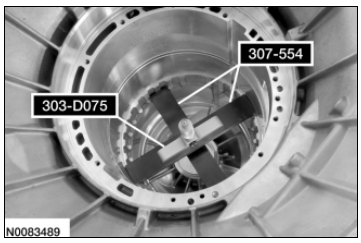
8. **NOTE:** All intermediate clutch plates, friction and steel are of a wave-type design.

   Install the D-Clutch Measurement Gauge 307-554 into the case.



9. With the D-Clutch Measurement Gauge 307-554 positioned in the case, use the Depth Micrometer 303-D075 to measure the case stop depth.

Description	Reading
Measure the distance from the top of the upper gauge bar to the top of the lower gauge bar. Record this reading as the case measurement. Record as reading A.	



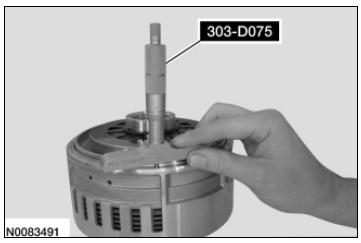
10. Measure the clutch pack height.

Description	Reading
Place the low/reverse clutch pack on the Clutch End Play Gauge 307-555 with the wave spring down and the pressure plate on top. Using the Dial Indicator Gauge with Holding Fixture 100-002, place the plunger on the pressure plate. Slide the clutch to the side so the plunger of the Dial Indicator is touching the gauge plate of the Clutch End Play Gauge 307-555. Zero out the Dial Indicator Gauge.	
Carefully lift the plunger enough to slide the clutch pack under the plunger to take a reading. Record this reading. Rotate the clutch pack 180 degrees and take a second reading. Add the first and second readings together and divide the total by 2. Record this reading as B.	



11. Using the Depth Micrometer 303-D075, measure the piston to center support shoulder height.

Description	Reading
Measure the piston to center support shoulder height. Record this measurement. Rotate the center support 180 degrees and record this measurement. Add the first and the second measurements, then divide by 2. Record this as reading C.	



12. Calculate the end clearance.

Description	Reading
Subtract B and C from A to determine end clearance	
Total C measurement	
End clearance specification	1.0-1.6 mm (0.039-0.062 in)

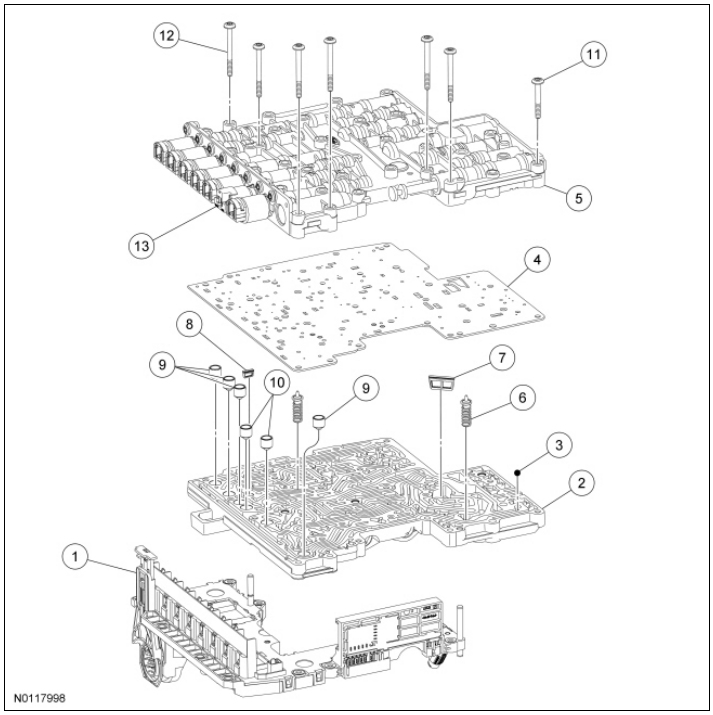
Compare the end clearance to the specification. If the end clearance is out of specification, select the next thinner or thicker plate as required and repeat Steps 10, 11 and 12.

Mechatronic Assembly

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV

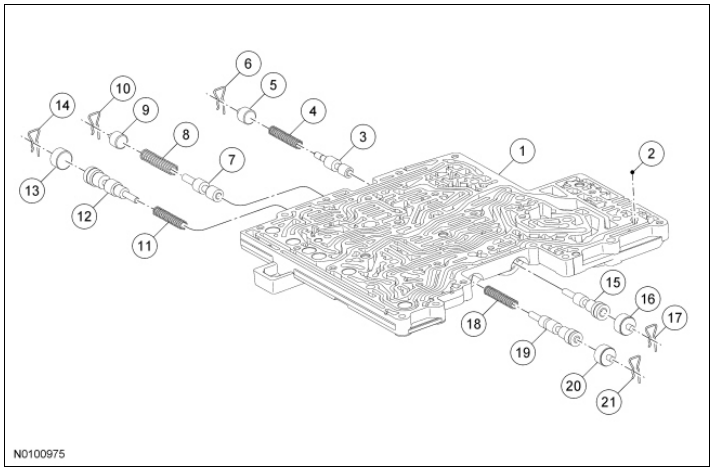
Mechatronic



Item	Part Number	Description
1	7A100	Transmission Control Module (TCM)
2	-	Transmission control valve body (upper)
3	7E195	Transmission control valve check ball (8 required)
4	7Z490	Transmission control valve body separator plate (model dependent)
5	-	Transmission control valve body (lower)
6	-	Transmission control valve assembly
7	7H187	Transmission control filter assembly
8	7B155	Transmission fluid filter

9	7J191	Transmission solenoid damper valve assembly (early build vehicles only)
10	7J191	Transmission solenoid damper valve assembly (all vehicles)
11	W707886	Mechatronic assembly bolt - connects upper and lower half together (19 required)
12	W707884	Mechatronic assembly bolt - connects TCM to transmission control valve assembly (6 required)
13	-	Transmission shift control solenoids

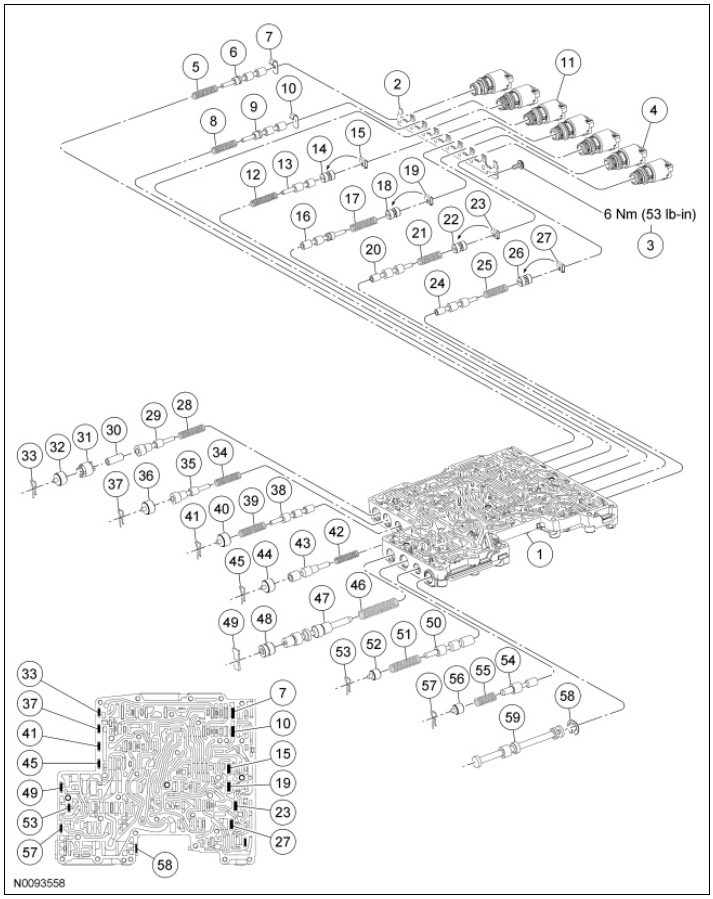
Mechatronic Upper Half



Item	Part Number	Description
1	7A092	Transmission control valve assembly (ditch plate) (upper half)
2	7E195	Transmission control valve check ball (8 required)
3	-	Transmission clutch D2 latch valve
4	-	Transmission clutch valve spring
5	-	Transmission clutch valve spring plug
6	7G007	Transmission clutch valve spring plug retainer clip
7	-	Transmission clutch D2 regulator valve
8	-	Transmission clutch valve spring
9	-	Transmission clutch valve spring plug
10	7G007	Transmission clutch valve spring plug retainer clip
11	-	Transmission clutch valve spring
12	-	Transmission clutch B regulator valve
13	-	Transmission clutch valve spring plug
14	7G007	Transmission clutch valve spring plug retainer clip
15	-	Transmission clutch valve
16	-	Transmission clutch valve spring plug
17	7G007	Transmission clutch valve spring plug retainer clip
18	-	Transmission clutch valve spring

19	-	Transmission clutch valve
20	-	Transmission clutch valve spring plug
21	7G007	Transmission clutch valve spring plug retainer clip

Mechatronic Lower Half

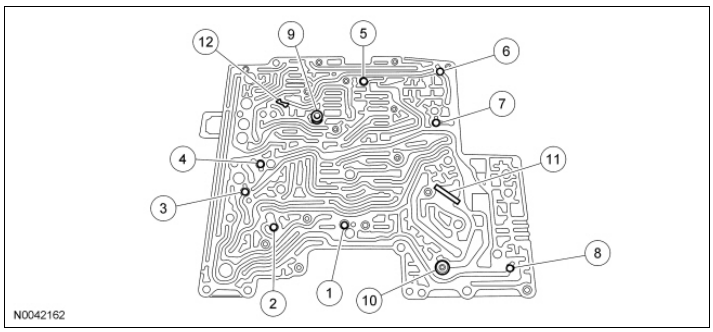


Item	Part Number	Description
1	-	Transmission control valve assembly (lower half)
2	-	Transmission shift control solenoid hold-down bracket
3	-	Transmission shift control solenoid hold-down bracket bolt M5 x 0.80 x 12
4	7G484	Transmission shift control solenoid
5	-	Transmission clutch valve spring
6	-	Transmission clutch A latch valve
7	-	Transmission spring retainer plate
8	-	Transmission clutch valve spring
9	-	Transmission clutch B latch valve
10	7F194	Transmission spring retainer plate
11	7G383	Electronic Pressure Control (EPC) solenoid
12	-	Transmission solenoid regulator valve spring
13	-	Transmission solenoid pressure regulator valve

14	-	Transmission solenoid plug
15	7G007	Transmission valve plug retainer
16	-	Transmission clutch D1 latch valve
17	-	Transmission clutch valve spring
18	-	Transmission solenoid plug
19	7G007	Transmission valve plug retainer
20	-	Transmission drive enable valve
21	-	Transmission solenoid valve spring
22	-	Transmission solenoid plug
23	7G007	Transmission valve plug retainer
24	-	Transmission solenoid multiplex valve
25	-	Transmission solenoid valve spring
26	-	Transmission solenoid plug
27	7G007	Transmission valve plug retainer
28	-	Transmission clutch valve spring
29	-	Transmission clutch A pressure regulator valve
30	-	Transmission clutch regulator valve sleeve
31	-	Transmission valve return plug
32	-	Transmission valve return plug
33	7G077	Transmission valve plug return clip
34	-	Transmission clutch valve spring
35	-	Transmission clutch E pressure regulator valve
36	-	Transmission valve return plug
37	7G007	Transmission valve plug return clip
38	-	Transmission clutch E latch valve
39	-	Transmission clutch control valve spring
40	-	Transmission valve return plug
41	7G007	Transmission valve plug return clip
42	-	Transmission bypass clutch control valve spring
43	-	Transmission bypass clutch control valve
44	-	Transmission valve return plug
45	7G007	Transmission valve plug return clip
46	-	Transmission manual oil pressure regulator valve spring
47	-	Transmission main oil pressure regulator valve
48	-	Transmission manual oil pressure regulator valve sleeve
49	7G007	Transmission valve plug return clip
50	-	Transmission converter regulator valve
51	-	Transmission converter regulator valve spring
52	-	Transmission valve return plug
53	7G007	Transmission valve plug return clip
54	-	Transmission lube control valve
55	-	Transmission lube control valve spring

56	-	Transmission valve return plug
57	7G007	Transmission valve plug return clip
58	W527007-S	Retaining ring
59	-	Transmission control manual valve

Check Ball Location



Item	Description
1	Reverse/drive control check ball
2	Shift solenoid control check ball
3	Intermediate clutch exhaust control check ball
4	Direct clutch exhaust control check ball
5	Low/reverse clutch exhaust control check ball
6	Forward clutch exhaust control check ball
7	Overdrive (O/D) clutch exhaust control check ball
8	Reverse exhaust control check ball
9	Clutch exhaust valve
10	Converter drain back valve
11	Large screen
12	Small screen

Disassembly

NOTICE: **Do not touch the electrical connector pins or the exposed solenoid tabs on the Transmission Control Module (TCM). An electrostatic discharge may occur and may cause damage to the TCM /mechatronic assembly.**

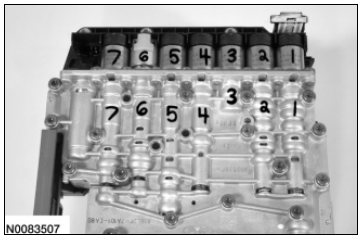
NOTE: Make an identifying mark on each solenoid and the corresponding bore for correct assembly.

NOTE: Solenoids may visually appear the same but their designs/functions are different. Caution must be taken not to assemble the mechatronic assembly incorrectly. Incorrect solenoid installation will result in poor transmission shift quality.

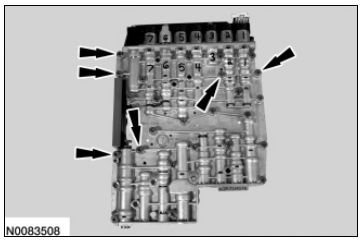
NOTE: Note where the 8 check balls, 6 (early build) or 2 (late build) solenoid dampers, 2 internal valves and springs and 2 internal filters are located for reassembly.

Mechatronic assembly upper half

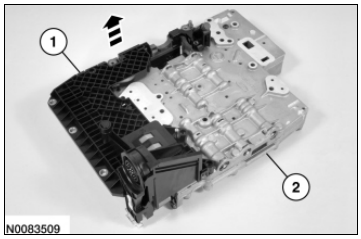
1. Make an identifying mark on each solenoid and the corresponding bore for correct assembly.



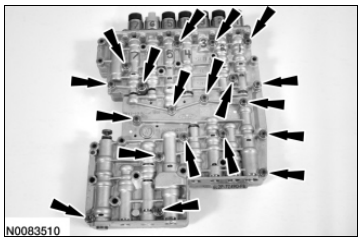
2. Remove the 6 long bolts from the Transmission Control Module (TCM) unit.



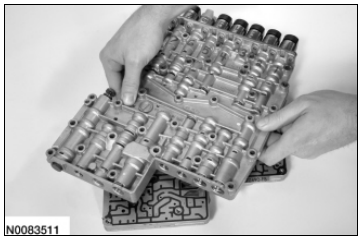
3. Carefully separate the TCM from the mechatronic assembly.
    1. TCM
    2. Mechatronic assembly



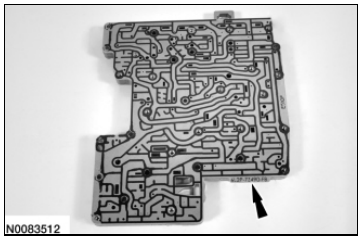
4. Remove 19 short bolts from the mechatronic assembly.



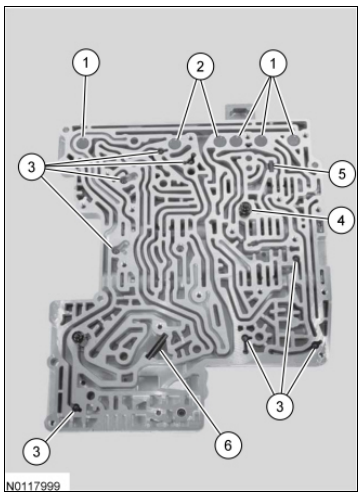
5. Separate the lower half of the mechatronic assembly from the upper half of the mechatronic assembly.



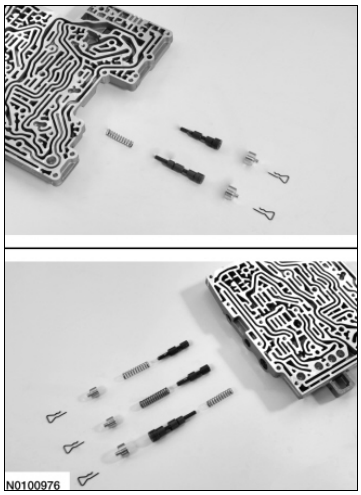
6. Remove and discard the separator plate.



7. Remove the solenoid dampers, check balls, converter drain back valve and filter screens from the mechatronic assembly. Note the location for assembly. Refer to the preceding exploded views.
    1. Solenoid dampers (early build vehicles only)
    2. Solenoid dampers
    3. Check balls
    4. Converter drain back valve
    5. Small screen
    6. Big screen



8. Remove the clips, caps, valves and springs from each bore of the mechatronic assembly. Note the location and order for assembly. Refer to the preceding exploded views.



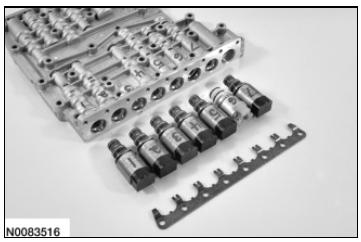
9. Using clean mineral spirits, clean the upper half of the mechatronic assembly.

Mechatronic assembly lower half

10. Remove the 8 solenoid bracket bolts and the solenoid bracket.

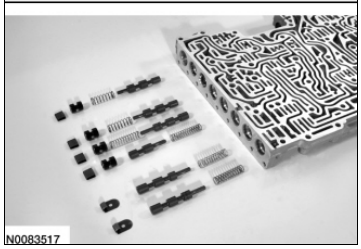


11. Remove the solenoids.



12. Remove the clips, caps, valves and springs from each bore of the mechatronic assembly. Note the location and order for assembly. Refer to the preceding exploded views.





13. Using clean mineral spirits, clean the lower half of the mechatronic assembly.

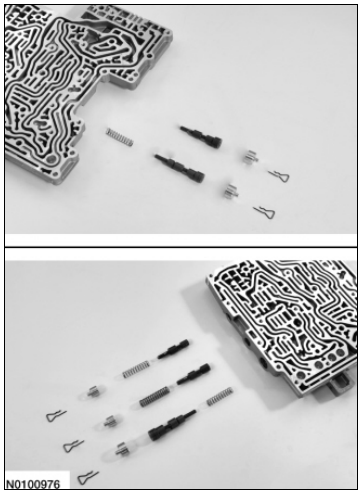
Assembly

NOTICE: **Do not touch the electrical connector pins or the exposed solenoid tabs on the Transmission Control Module (TCM). An electrostatic discharge may occur and may cause damage to the TCM /mechatronic assembly.**

Mechatronic assembly upper half

1. **NOTE:** Many components and surfaces in the mechatronic valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly will prevent unnecessary damage to machined surfaces.

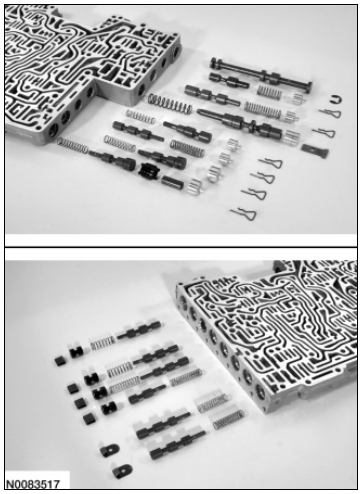
   Install the clips, caps, valves and spring into each bore. Refer to the preceding exploded views.



Mechatronic assembly lower half

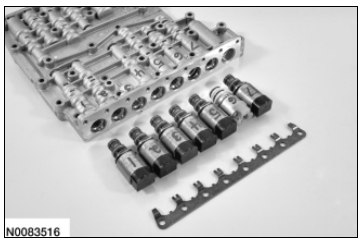
2. **NOTE:** Many components and surfaces in the mechatronic valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly will prevent unnecessary damage to machined surfaces.

   Install the clips, caps, valves and spring into each bore.



3. **NOTE:** Lubricate the O-ring seals of the solenoids with clean automatic transmission fluid when installing them into the valve body.

   Install the solenoids into their correct bores as indicated during disassembly.



4. Install the solenoid bracket and the 8 bolts.
   - Tighten to 6 Nm (53 lb-in).

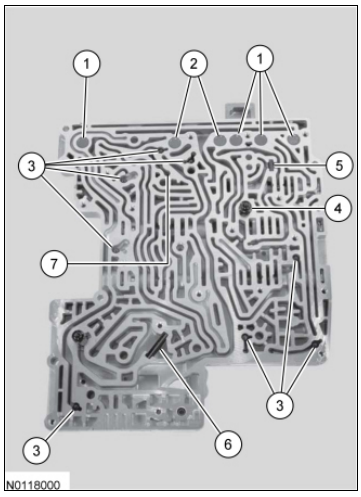


5. ***NOTICE:*** **Early build vehicles will have 6 solenoid valve dampers and late build vehicles will have 2. Failure to install the dampers in the correct ports can result in harsh, soft or erratic shifts or damage to the transmission.**

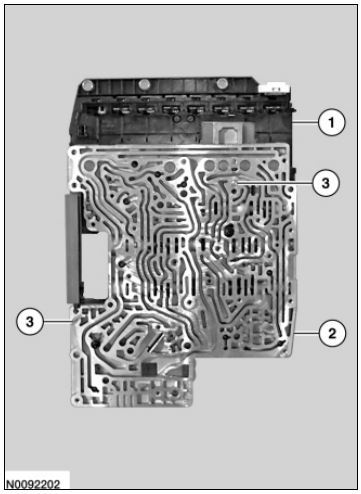
   NOTICE: **Towards the back of the upper valve body there is a hydraulic passage that is shaped as though it receives a check ball. This passage does not require a check ball. Be sure not to mistake this hydraulic passage for a passage that does require a check ball or damage to the transmission can occur.**

   Install the solenoid dampers, check balls, converter drain back valve and filter screens.

   1. Solenoid dampers (early build vehicles only)
   2. Solenoid dampers
   3. Check balls
   4. Converter drain back valve
   5. Small screen
   6. Big screen
   7. Empty hydraulic passage (no check ball)



6. Align the guide pins on the TCM with the holes in the upper valve body and install the valve body on the TCM .
   1. TCM
   2. Upper valve body
   3. Guide pins

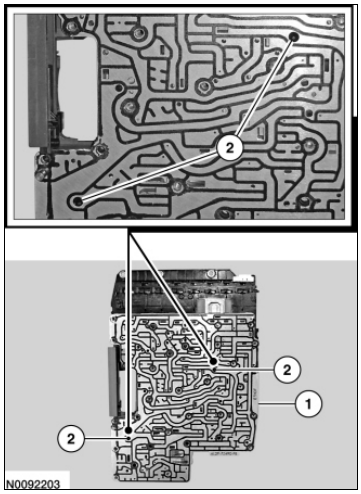


7. ***NOTICE:*** **The separator plates are different between the early and late build mechatronic assemblies to accommodate the different number of dampers. Failure to install the correct separator plate can result in harsh, soft or erratic shifts or damage to the transmission.**

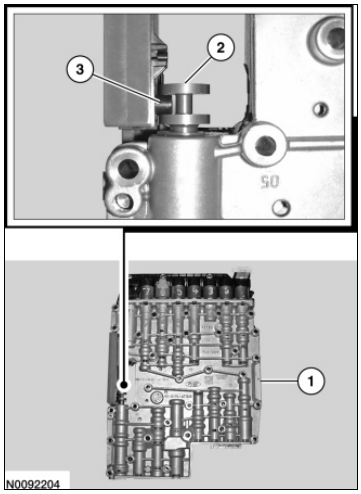
   NOTICE: **If the drain back valves are not installed correctly in the separator plate, damage to the transmission can occur.**

   Position the separator plate on the upper valve body.
   Check the 2 drain back valves to be sure they are correctly positioned in the separator plate when the separator plate is pressed flush against the upper valve body.

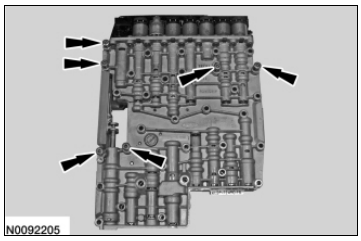
   1. Separator plate
   2. Drain back valves



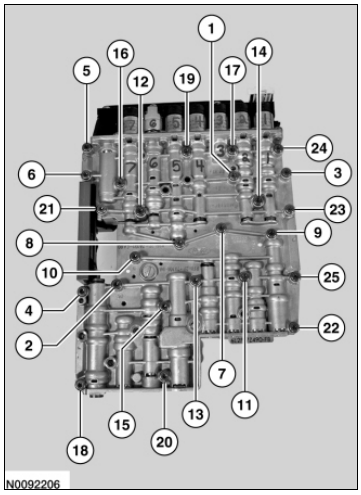
8. Position the lower valve body on the 2 TCM alignment studs, align the manual valve with the Transmission Range (TR) sensor on the TCM and install the lower valve body.
   1. Lower valve body
   2. Manual valve
   3. TR sensor



9. Install the 6 (long) TCM -to-valve body bolts hand-tight.



10. Install the 19 (short) mechatronic assembly lower-to-upper valve body bolts.
    - Tighten the bolts in the sequence shown.
    - Tighten bolts 1 through 6 in the tightening sequence to 7 Nm (62 lb-in).
    - Tighten bolts 7 through 25 in the tightening sequence to 6 Nm (53 lb-in).



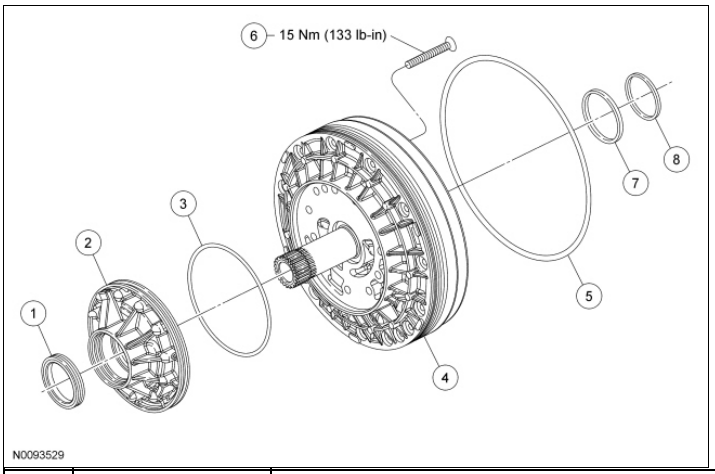
Pump Assembly

Special Tool(s)

 ST2687-A	Installer, Fluid Pump Seal 307-556

Material

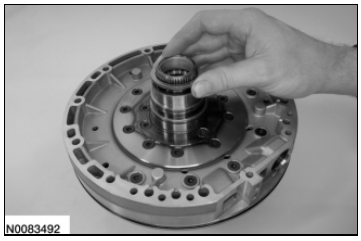
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV



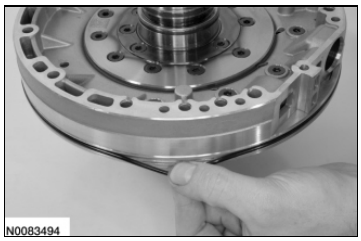
Item	Part Number	Description
1	7A248	Front pump oil seal
2	-	Pump body (part of 7A103)
3	7A248C	Pump body seal
4	7A103	Pump plate assembly
5	7A248A	Pump plate assembly seal
6	W707871-S300	Pump plate assembly-to-front pump body bolt (11 required)
7	7D019	Clutch support fluid seal
8	7L323	Front pump support seal

Disassembly

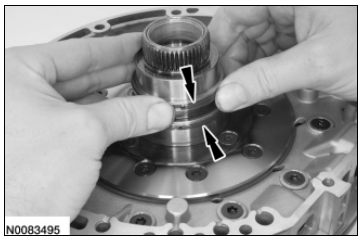
1. Remove the front pump washer.



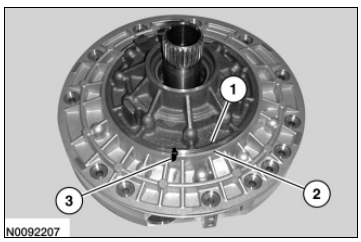
2. If the O-ring seal was not removed during disassembly, remove and discard the front pump O-ring seal from the pump assembly.



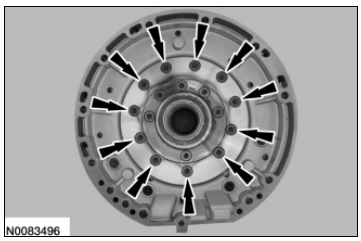
3. Remove and discard the front pump seal rings from the stator support.



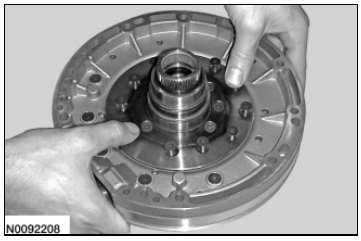
4. Index-mark the pump body to the pump plate assembly.
    1. Pump body
    2. Pump plate assembly
    3. Index mark



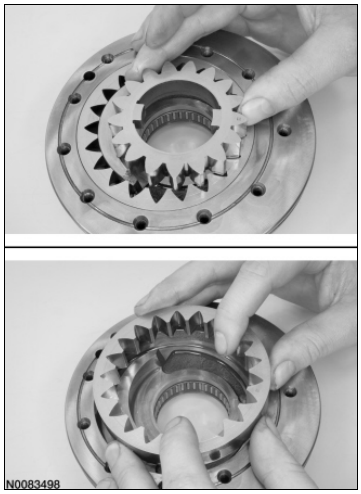
5. Remove the 11 pump plate assembly-to-pump body bolts.



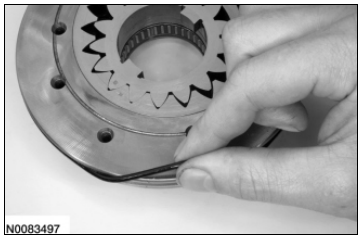
6. Push down on the loose pump plate assembly-to-pump body bolts to remove the pump body from the pump plate assembly and remove the 11 bolts.



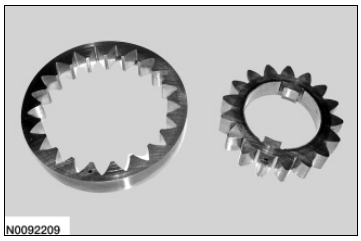
7. Remove the fluid pump gears.



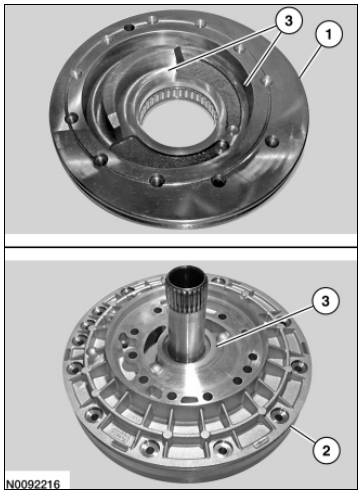
8. Remove and discard the pump body outer seal.



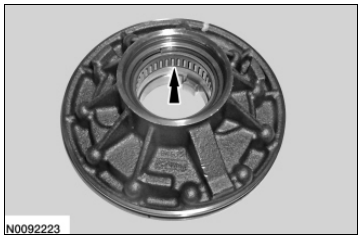
9. Inspect the inner and the outer pump gears for damage.
    - Clean all pump components in solvent.
    - Dry the parts with compressed air.
    - Inspect the pump gears, faces, gear teeth and mating surfaces for damage or scoring.
    - Install a new pump as necessary.



10. Inspect the pump body and pump plate thrust surfaces for damage or scoring.
    1. Pump body
    2. Pump plate assembly
    3. Pump gear thrust surfaces



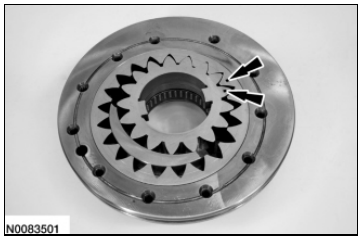
11. Inspect the torque converter hub bearing for damage or scoring. Make sure that the bearing rotates smoothly.



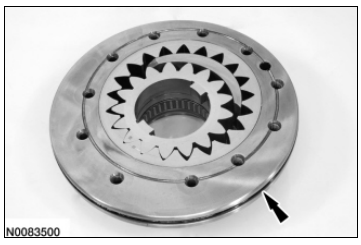
Assembly

1. **NOTE:** Prior to installation, lightly lubricate the pump gears with clean automatic transmission fluid.

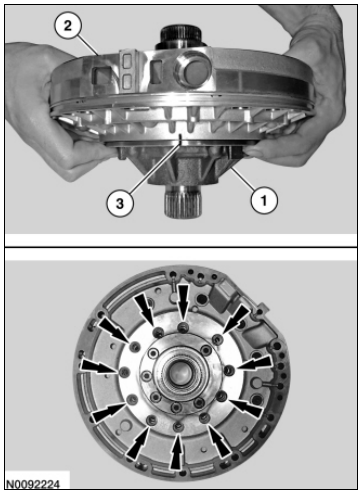
   Install the pump gears with the dot facing the pump plate assembly.



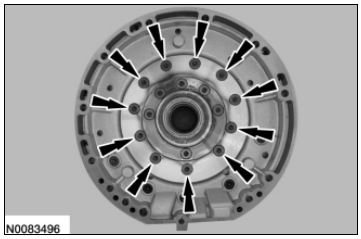
2. Install a new pump body outer seal.



3. Align the marks made during disassembly to correctly assemble the pump. Press the pump body into the pump plate assembly. Visually inspect the pump body-to-pump plate assembly bolt holes to be sure that the pump body and pump plate are correctly aligned.
   1. Pump body
   2. Pump plate assembly
   3. Pump gear thrust surfaces

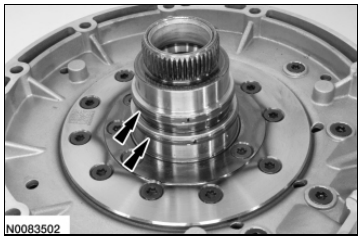


4. Install the pump plate assembly-to-front pump body bolts.
    - Tighten to 15 Nm (133 lb-in).

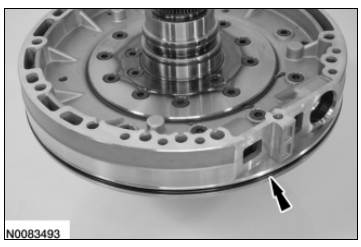


5. ***NOTICE:*** **Make sure that the seal ends of each seal ring are hooked together or fluid leakage can occur.**

   Install the 2 front pump seal rings onto the stator support. Make sure the seals are fully seated in the stator support seal grooves and the seal ends are oriented 180 degrees apart.



6. Install the pump outer diameter front pump O-ring seal.



7. Install a new front pump seal on the Fluid Pump Seal Installer 307-556.

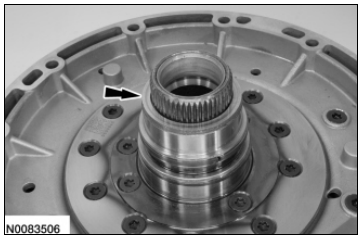


8. Using the Fluid Pump Seal Installer 307-556, install the front pump seal.



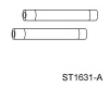
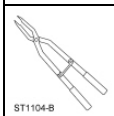
9. **NOTE:** Lightly lubricate the thrust washer with petroleum jelly to hold it in place during assembly.

   Install the pump thrust washer.



Transmission

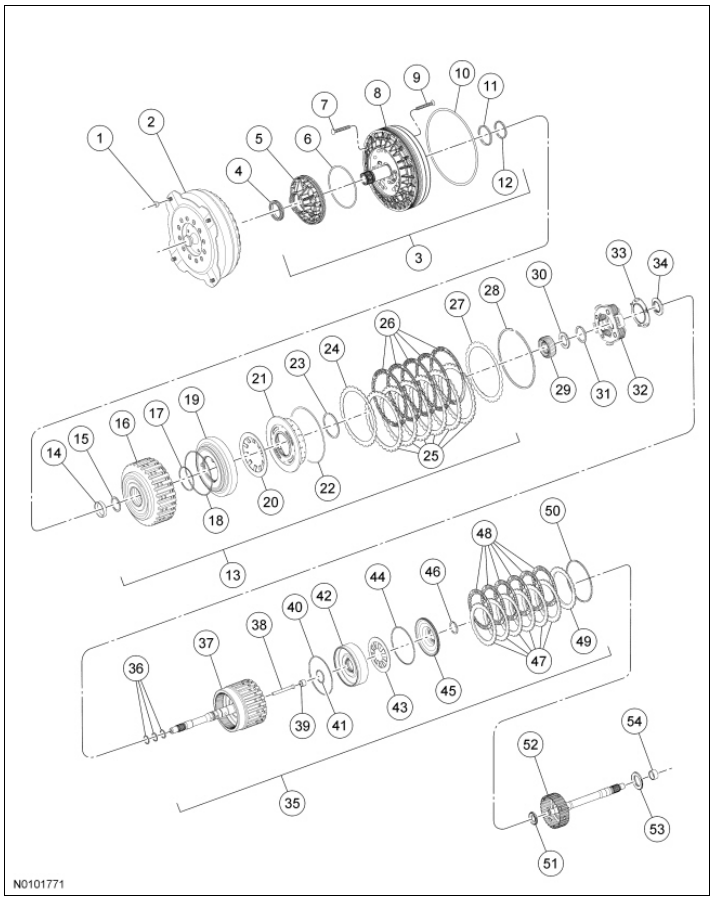
Special Tool(s)

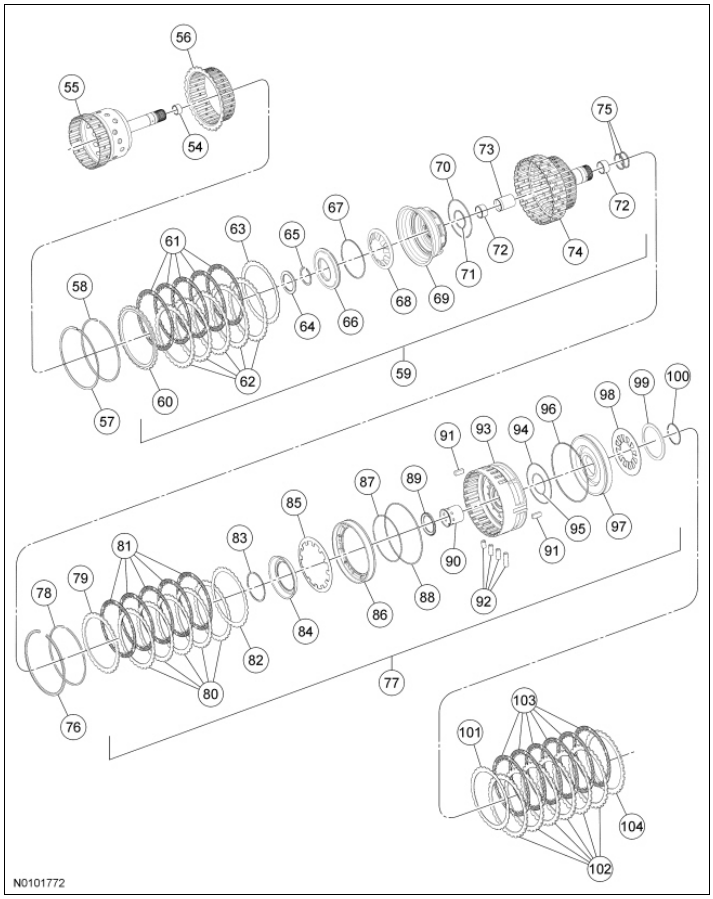
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1360-A	Drawbar (Heavy Duty Threaded) 204-029 (T77F-1176)
 ST2683-A	End Play Gauge, Transmission 307-534
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST3059-A	Installer, Rear Seal 4X4 307-637
 ST2687-A	Installer, Fluid Pump Seal 307-556
	Installer, Front Wheel Hub Oil Seal 205-276 (T88T-1175-AH)
 ST2694-A	Installer, Output Shaft Bearing 307-647
 ST2690-A	Installer, Shifter Fluid Seal 307-559
 ST3060-A	Rear Seal Installer 4X2 307-638
 ST3061-A	Remover/Installer, Rear Bearing 307-639
 ST2691-A	Remover, Transmission Fluid Pump 307-553
 ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)

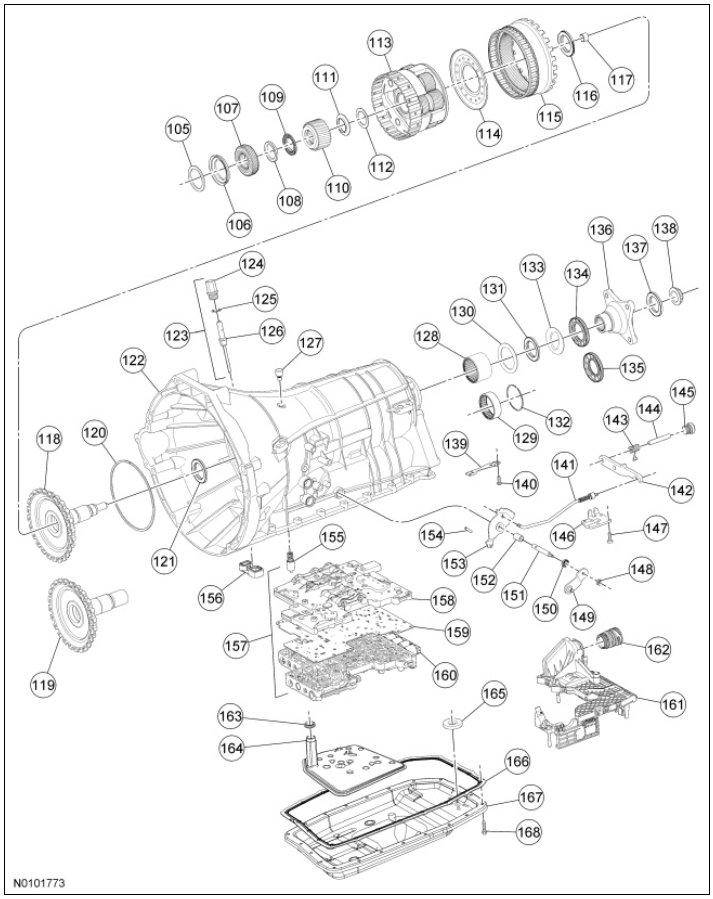
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV
Multi-Purpose Grease Motorcraft® XL-5 (aerosol) and/or CRC® SL3151	ESB-M1C93-B

Disassembled Views







Item	Part Number	Description

1	N800750-S437	Flexplate-to-torque converter nut (4 required)
2	7902	Torque converter
3	7A103	Pump assembly
4	7A248	Front pump oil seal
5	-	Pump body (part of 7A103)
6	7A248	Front pump inner oil seal
7	7N134	Front pump-to-case bolt (13 required)
8	7A103	Front pump assembly
9	W707871-S300	Bolt - attaches pump to pump adapter assembly (11 required)
10	7A248	Front pump outer oil seal
11	7D019	Clutch support fluid seal
12	7L323	Front pump support seal
13	-	Forward clutch assembly (clutch A)
14	-	Forward clutch rear bushing (part of 7A360)
15	7D014	Front pump selective washer
16	7A360	Forward clutch cylinder and hub assembly
17	7A548	Forward clutch inner piston seal
18	7A548	Forward clutch outer piston seal
19	7A262	Forward clutch piston
20	7A480	Forward clutch piston retaining spring
21	7H360	Forward clutch balance piston assembly
22	7A548	Forward clutch balance piston outer seal
23	7H365	Forward clutch balance piston snap ring
24	7E085	Forward clutch cushion spring
25	7E314	Forward clutch steel plates (externally splined) (quantity model dependent)
26	7B164	Forward clutch friction plates (internally splined) (quantity model dependent)
27	7B066	Forward clutch pressure plate
28	7D483	Pressure plate retaining snap ring
29	7D063	Front planetary sun gear (No. 1)
30	7H375	Bearing (T1)
31	-	Front planetary carrier assembly snap ring (part of 7A398)
32	7A398	Front planetary carrier assembly
33	7L339	Plate transmission fluid collector
34	7L495	Bearing (T2)
35	-	Overdrive (O/D) clutch assembly (clutch E)
36	7G091	Turbine shaft seals (4.6L-2 required, 5.4L-3 required)
37	7F207	Input shaft
38	-	Fluid distributor sleeve (part of 7J006)
39	-	Output shaft bushing (part of 7J006)
40	7A548	O/D clutch piston outer seal

41	7A548	O/D clutch piston inner seal
42	7A262	O/D clutch piston
43	7B070	O/D clutch piston spring
44	7A548	Balance piston outer seal
45	7H360	O/D balance piston
46	7C122	Balance piston snap ring
47	7B442	O/D clutch steel plates (externally splined)
48	7B164	O/D clutch friction plates (internally splined)
49	7B066	O/D pressure plate
50	7D483	O/D clutch retaining ring
51	7C096	Bearing (T3)
52	7F351	Intermediate clutch shaft
53	7H375	Bearing (T4)
54	-	Sun gear bushings (part of 7R193) (2 required)
55	7B067	Sun gear hub and shaft assembly
56	7F236	Direct clutch hub
57	7C122	Direct clutch cylinder retaining ring
58	7D483	Direct clutch pressure plate retaining ring
59	-	Direct clutch assembly (clutch B)
60	7B066	Direct clutch pressure plate
61	7B164	Direct clutch friction plates (internally splined) (quantity model dependent)
62	7B442	Direct clutch steel plates (externally splined) (quantity model dependent)
63	7E085	Direct clutch cushion plate
64	7C096	Bearing (T5)
65	7A577	Direct clutch piston retaining ring
66	7A262	Direct clutch balance piston
67	7A548	Direct clutch balance seal
68	7B488	Direct clutch piston return spring
69	-	Direct clutch piston
70	7A548	Direct clutch piston outer seal
71	7C099	Direct clutch piston inner seal
72	-	Direct clutch hub bushings (part of 7F283) (2 required)
73	-	Gear shaft tube sleeve (part of 7F283)
74	7F283	Direct clutch cylinder
75	7D020	Shell cylinder seals (2 required)
76	7D483	Center support retaining ring
77	-	Intermediate clutch assembly (clutch C)
78	7D483	Intermediate clutch pressure plate retaining ring
79	7B066	Intermediate clutch pressure plate
80	7B442	Intermediate clutch steel plates (externally splined) (quantity model dependent)

81	7B164	Intermediate clutch friction plates (internally splined) (quantity model dependent)
82	7E085	Intermediate clutch pressure plate spring
83	7A577	Intermediate clutch retaining ring
84	7B043	Intermediate clutch ring
85	7A480	Intermediate clutch piston spring
86	7E005	Intermediate clutch piston
87	7F225	Intermediate clutch piston inner seal
88	7F224	Intermediate clutch piston outer seal
89	7F373	Bearing (T6)
90	-	Center shaft sleeve (part of support assembly)
91	7B220	Center support keys (2 required)
92	7G199	Center support seals (4 required)
93	-	Support assembly
94	7F225	Low/reverse clutch piston center seal
95	7D404	Low/reverse clutch piston inner seal
96	7D403	Low/reverse clutch piston outer seal
97	7A262	Low/reverse clutch piston
98	7B070	Low/reverse clutch piston return spring
99	7C122	Retainer transmission-snap ring
100	7D483	Low/reverse clutch piston retaining ring
101	7E085	Clutch disc cushion plate
102	7B442	Low/reverse clutch steel plates (externally splined)
103	7B164	Low/reverse clutch friction plates (internally splined)
104	7B066	Low/reverse clutch pressure plate (select fit)
105	7F405	Thrust gear shim (select fit)
106	7C041	Bearing (T7)
107	7D063	Sun gear No. 2
108	7D235	Thrust bearing outer race
109	7D234	Bearing (T8)
110	7D063	Sun gear No. 3
111	7D234	Bearing (T9)
112	-	Bearing race (T9)
113	7D006	Rear planetary carrier assembly
114	-	Fluid collar rear planetary plate (part of 7D006)
115	7A153	Output shaft ring gear assembly
116	7G178	Bearing (T10)
117	7B256	Output shaft bushing (part of 7060)
118	7060	Output shaft park gear assembly (Rear Wheel Drive (RWD))
119	7060	Output shaft park gear assembly (Four-Wheel Drive (4WD))
120	7N194	Output shaft retaining ring
121	7B368	Bearing (T11)

122	7005	Transmission case assembly (model dependent)
123	7A010	Transmission case fluid fill plug assembly
124	7H398	Transmission case fluid fill plug
125	7A010	Transmission case fluid fill seal
126	7A010	Transmission oil level indicator
127	7034	Transmission case vent assembly (model dependent)
128	7A415	Output shaft bearing assembly (RWD)
129	7A415	Output shaft bearing assembly (4WD)
130	7A433	Washer
131	7B368	Bearing (T12)
132	7030	Output shaft bearing snap ring 4WD
133	7N357	Slip plane washer
134	7052	Extension housing seal (RWD)
135	7052	Extension housing seal (4WD)
136	7089	Output shaft flange (RWD)
137	7052	Extension housing flange seal
138	7045	Output shaft flange retaining nut (RWD)
139	7E332	Manual valve detent spring
140	W711235-S300	Manual valve detent spring retaining screw and washer
141	7A232	Park pawl actuating rod
142	7A441	Park pawl
143	7D070	Park pawl return spring
144	7D071	Park pawl shaft
145	7H398	Plug assembly transmission case housing
146	7G101	Park rod actuating plate
147	W711235-S300	Park pawl abutment retaining screw and washer
148	W708455-S441	Manual control lever nut
149	7A256	Manual control lever
150	7B498	Manual control lever shaft seal
151	7C493	Manual control lever shaft
152	7A209	Manual control lever shaft spacer
153	7A115	Manual valve detent lever assembly
154	7G100	Manual valve detent lever retaining pin
155	7H322	Thermal bypass valve
156	7F401	Front pump adapter seal
157	7A100	Main control assembly
158	-	Main control valve body assembly (part of 7A100)
159	7Z490	Main control valve body separator plate
160	-	Lower main control valve body (part of 7A100)
161	-	Transmission Control Module (TCM) (part of 7A100)
162	7G276	Bulkhead connector sleeve
163	-	Transmission fluid filter seal (part of 7A098)

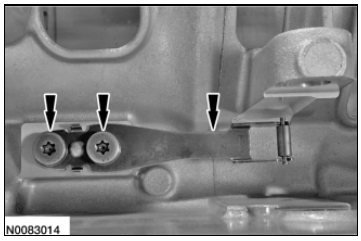
164	7A098	Transmission fluid filter
165	-	Transmission fluid pan magnet
166	7A191	Transmission fluid pan gasket
167	7A194	Transmission fluid pan
168	W500214-S437	Transmission fluid pan bolt

NOTE: Clutch plate quantity is model dependant based on engine displacement:

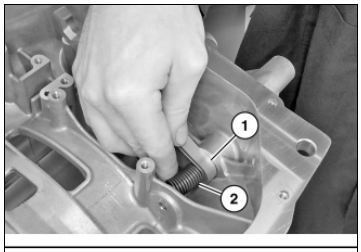
- 4.6L engine (Explorer, Mountaineer, Sport Trac, F-150)
  - ♦ Four friction plates
  - ♦ Five steel plates
- 5.4L engine (Expedition, Navigator, F-150)
  - ♦ Five friction plates
  - ♦ Six steel plates

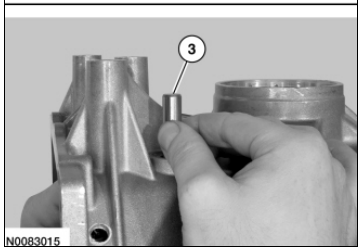
All vehicles

1. Install the detent spring and the 2 bolts.
   - Tighten to 12 Nm (106 lb-in).

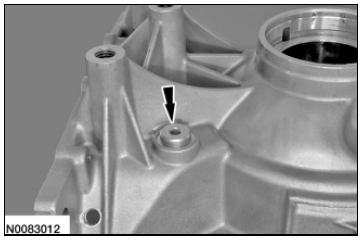


2. Position the park pawl and spring into the case and install the park pawl pin.
   1. Park pawl
   2. Park pawl spring
   3. Park pawl pin





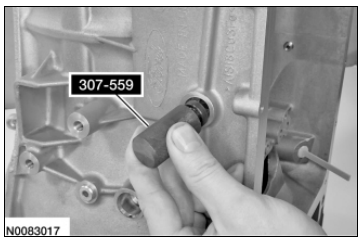
3. Install the park pawl pin bolt.
   - Tighten to 23 Nm (17 lb-ft).



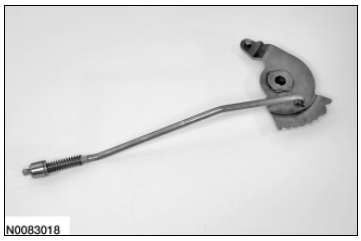
4. Install a new manual control lever shaft seal on the Shifter Fluid Seal Installer 307-559.



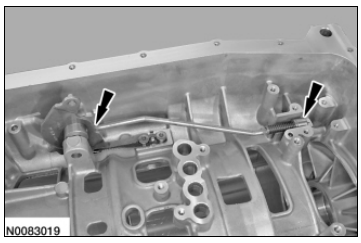
5. Using the Shifter Fluid Seal Installer 307-559, install the manual control lever shaft seal.



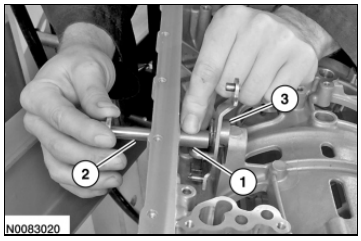
6. Assemble the manual valve detent lever assembly and park pawl actuator rod.



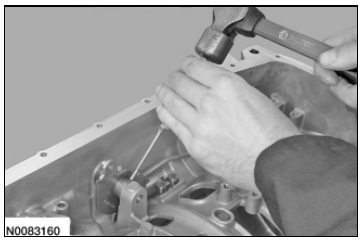
7. Position the detent lever and park pawl actuator rod in the transmission case.



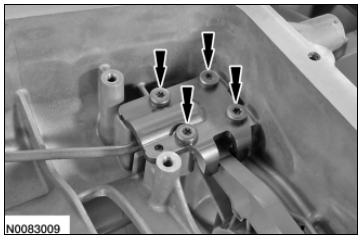
8. Position the manual control lever spacer in place and slide the manual control lever shaft in the case and into the manual lever detent plate.
    1. Manual control lever spacer
    2. Manual control lever shaft
    3. Manual control lever detent plate



9. Align the roll pin hole in the manual control lever detent plate with the roll pin hole in the manual control lever shaft and install a new roll pin using a suitable tool.

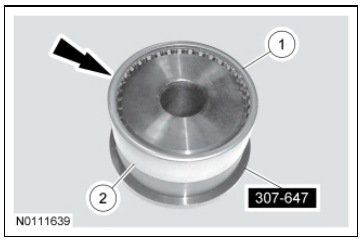


10. Install the park rod actuating plate and the 4 bolts.
    - Tighten to 12 Nm (106 lb-in).

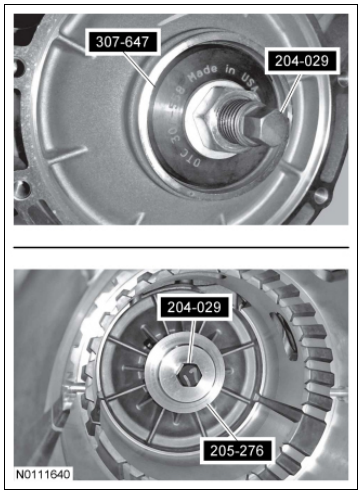


Four-Wheel Drive (4WD) vehicles

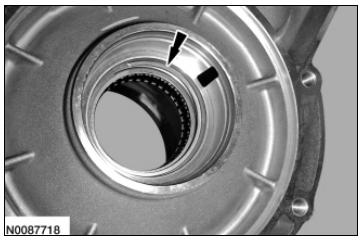
11. If removed, position a new bearing on Needle Bearing Installer 307-647. Install the bearing with the flat bearing surface facing down and the rounded bearing surface facing up so that when installed, the flat surface is on the snap ring side and the rounded surface is on the transmission case side.
    1. Rounded bearing surface facing up
    2. Flat bearing surface facing down



12. Using the Needle Bearing Installer 307-647, the Drawbar 204-029 and the Front Wheel Hub Oil Seal Installer 205-276, install the bearing in the transmission case.

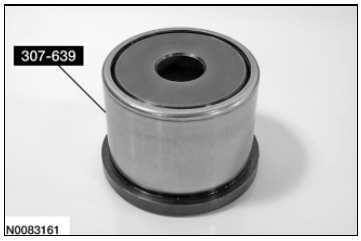


13. Install the snap ring.

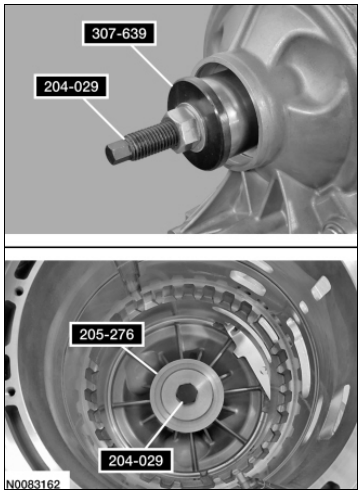


Rear Wheel Drive (RWD) vehicles

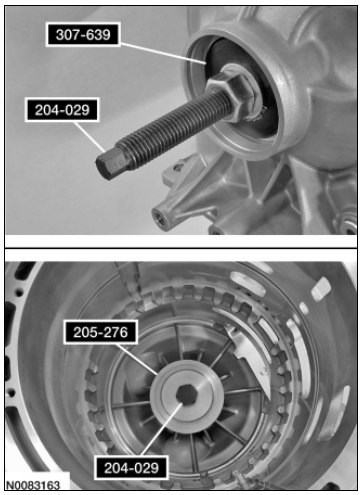
14. Install the bearing on the Rear Bearing Remover/Installer 307-639.



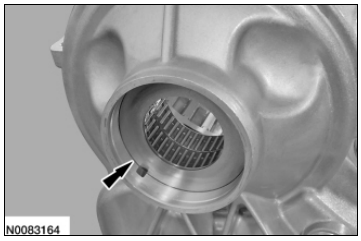
15. Assemble the Front Wheel Hub Oil Seal Installer 205-276 and the Rear Bearing Remover/Installer 307-639 on the Drawbar 204-029 and install the bearing in the transmission case.



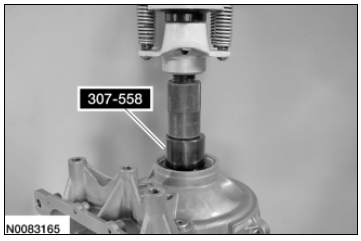
16. Remove the Front Wheel Hub Oil Seal Installer 205-276, the Rear Bearing Remover/Installer 307-639 and the Drawbar 204-029.



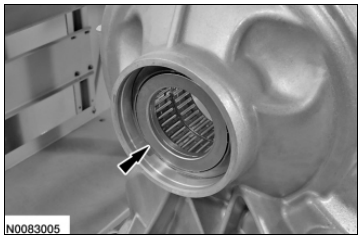
17. Position the thrust bearing spacer in place.



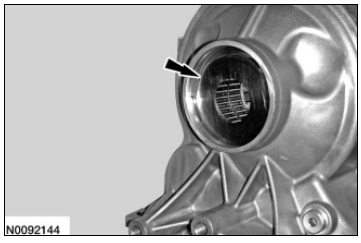
18. Using the Needle Bearing Installer 307-558 and a press, press the thrust bearing spacer in place.



19. Install the T12 thrust bearing.



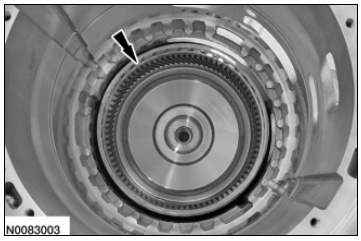
20. Install the slip plane washer.



All vehicles

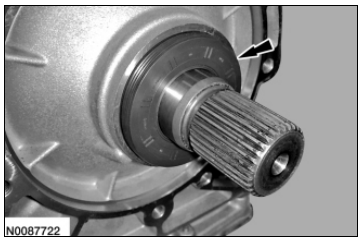
21. Place the transmission in the vertical position.

22. Install the T11 bearing, planet carrier hub and output shaft assembly.

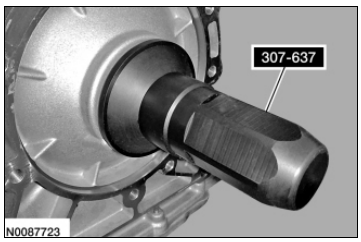


4WD vehicles

23. Position a new output shaft seal in place.

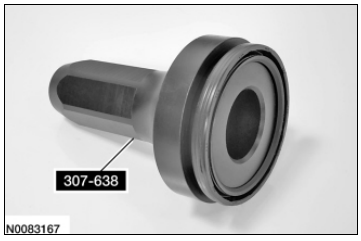


24. Using the Rear Seal 4X4 Installer 307-637, install the output shaft seal.

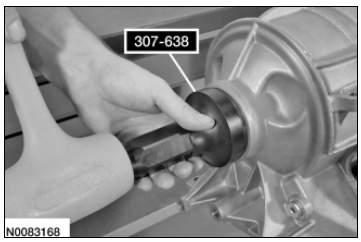


RWD vehicles

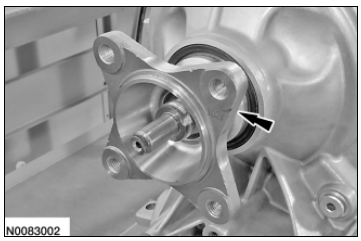
25. Position a new output shaft seal on the Rear Seal Installer 4X2 307-638.



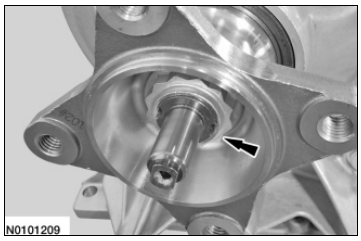
26. Using the Rear Seal Installer 4X2 307-638, install the output shaft seal.



27. Install the output shaft flange and the extension housing flange seal.

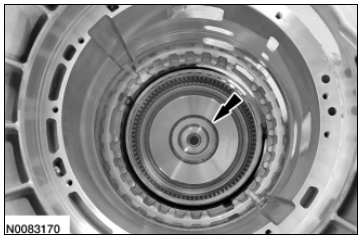


28. Loosely install a new output shaft flange nut.



All vehicles

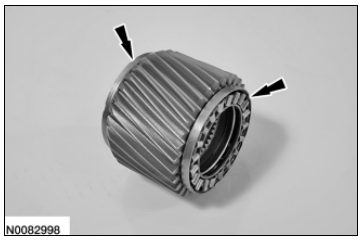
29. Install the T10 bearing and silver shim (caged bearing) on the planet carrier hub and output shaft assembly.



30. Install the T9 roller bearing race in the bottom of the carrier.

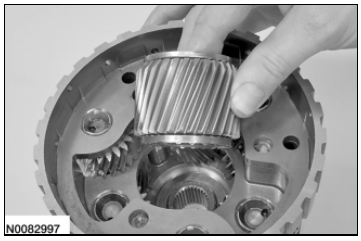


31. Install the top T8 and the bottom T9 roller bearings onto the sun gear.



32. **NOTE:** When installing the sun gear, make sure that the taper edge is facing up toward the torque converter housing.

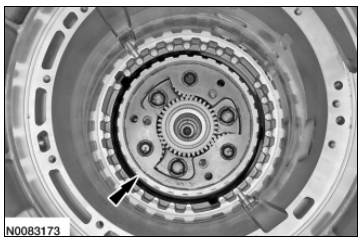
    Install the sun gear into the planet assembly.



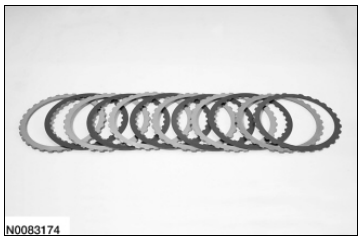
33. Install the low/reverse sun gear and race in the planet carrier.



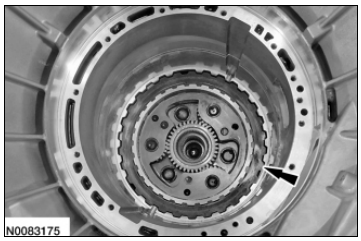
34. Install the planet carrier.



35. Soak the new low/reverse clutch plates in clean automatic transmission fluid.

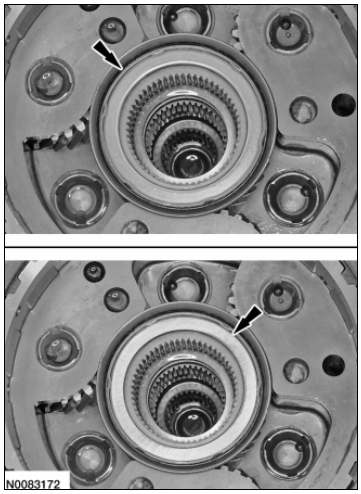


36. Install the low/reverse clutch plates, starting with the pressure plate and alternating between the friction and steel plates and ending with the wave spring plate on the top.



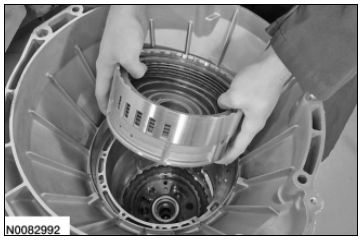
37. **NOTE:** Inspect and install a new thrust bearing as required.

    Install the low/reverse thrust bearing T7 and the select fit thrust gear shim.



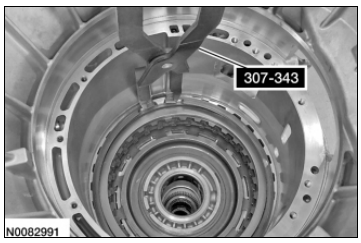
38. **NOTE:** Make sure that when installing the center support the feed holes on the center support are lined up with the feed holes in the case.

    Install the center support into the case.



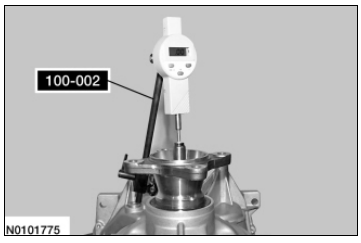
39. **NOTE:** Rotate the case to a horizontal position.

    Using the Retaining Ring Pliers 307-343, install the center support snap ring. Using a suitable tool, be sure the snap ring is fully seated.



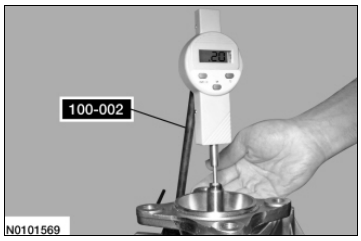
RWD vehicles

40. Install the Dial Indicator Gauge with Holding Fixture 100-002 on the transmission case and position the plunger on the output shaft flange.

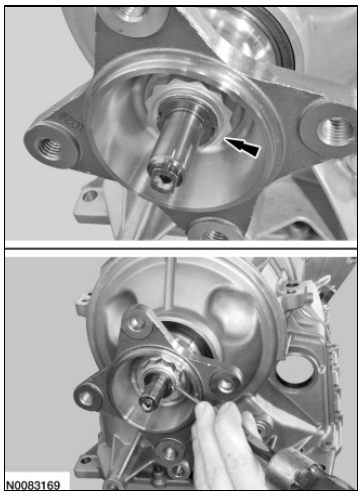


41. Using the Dial Indicator Gauge with Holding Fixture 100-002, lift up on the output shaft flange and record the reading. The reading should be within 0.15-0.35 mm (0.005-0.013 in).

- If the reading is not within the specification, install a different (either thinner or thicker) select fit thrust gear shim.

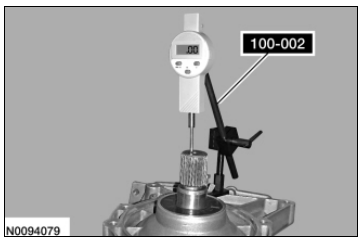


42. Tighten the output shaft flange nut.
    - Tighten to 80 Nm (59 lb-ft).
    - After installing the new output shaft flange nut, stake the slots to prevent it from coming loose.

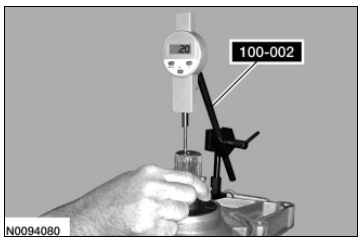


4WD vehicles

43. Install the Dial Indicator Gauge with Holding Fixture 100-002 on the transmission case and position the plunger on the output shaft.

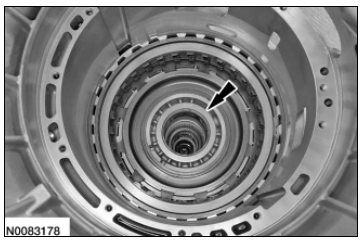


44. Using the Dial Indicator Gauge with Holding Fixture 100-002, lift up on the output shaft and record the reading. The reading should be within 0.15-0.35 mm (0.005-0.013 in).
    - If the reading is not within the specification, install a different (either thinner or thicker) select fit thrust gear shim.

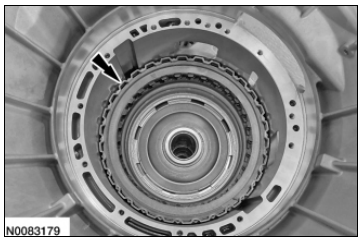


All vehicles

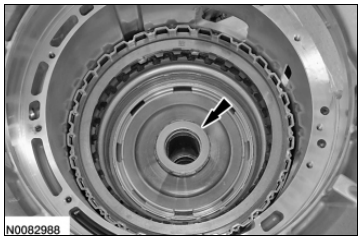
45. Install the T6 thrust bearing.



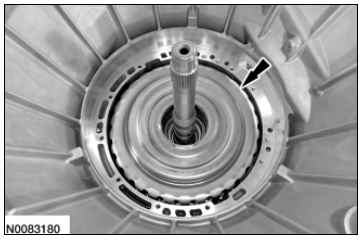
46. Install the direct clutch drum.



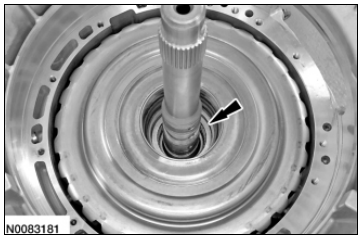
47. Install the T5 bearing on the direct clutch assembly.



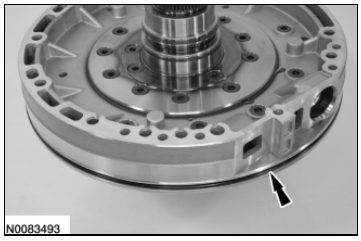
48. Install the forward and overdrive clutch assembly.



49. Install the selective pump washer.



50. If the front pump assembly was not disassembled and assembled, install a new front pump outer diameter O-ring seal and lubricate it with petroleum jelly.



51. Install a new front pump seal on the Fluid Pump Seal Installer 307-556.



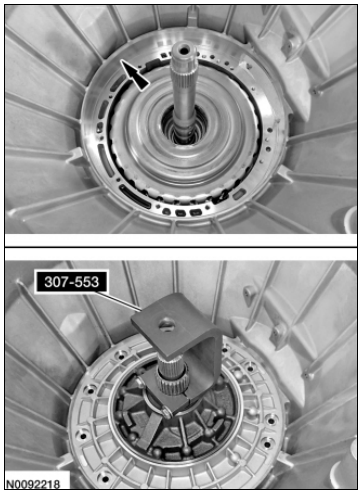
52. Using the Fluid Pump Seal Installer 307-556, install the front pump seal.



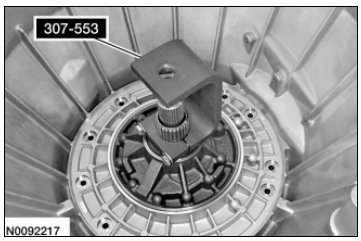
53. Install the Transmission Fluid Pump Remover 307-553 on the front pump.



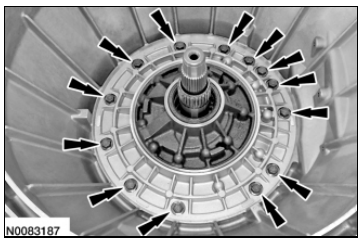
54. Lubricate the transmission case pump bore with petroleum jelly. Using the Transmission Fluid Pump Remover 307-553, position the pump assembly in the case and rotate the pump to insert the pump splines into the front planetary sun gear. Rotate the pump to align the pump-to-case bolts and push the pump into the case.



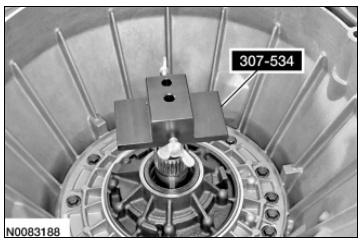
55. Remove the Transmission Fluid Pump Remover 307-553.



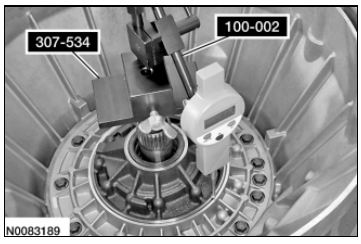
56. Install new front pump bolts with new washers. Tighten the bolts in a crisscross pattern.
    - Tighten to 10 Nm (89 lb-in).



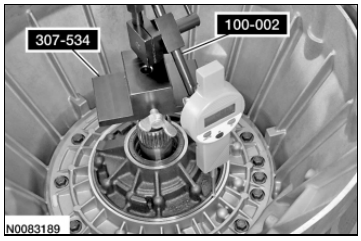
57. Install the Transmission End Play Gauge 307-534 on the input shaft to measure the end play.
    - Tighten the wing nut.



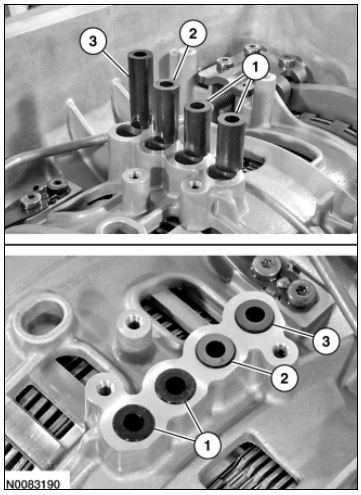
58. Install the Dial Indicator Gauge with Holding Fixture 100-002 on the Transmission End Play Gauge 307-534.
    - Push down on the Transmission End Play Gauge 307-534 and zero out the Dial Indicator Gauge.
    - Lift up on the Transmission End Play Gauge 307-534 and record the measurement on the Dial Indicator Gauge. The measurement should be between 0.2-0.4 mm (0.008-0.015 in). If the measurement is not within specification, install a new selective front pump washer.
    - Measure the original washer, install a thinner or a thicker washer to achieve the correct measurement.



59. Remove the Dial Indicator Gauge with Holding Fixture 100-002 and the Transmission End Play Gauge 307-534.



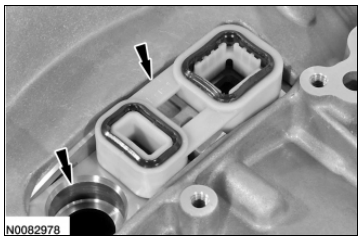
60. Install the 4 rubber feed tubes for the center support.
    1. Black feed tubes
    2. Green feed tube
    3. Blue feed tube



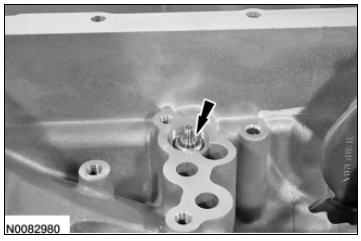
61. **NOTE:** Make sure that the fluid filter seal has been removed. If it has not, use a suitable pick and remove the seal.

    NOTE: Add 0.118L (4 oz) of clean transmission fluid to prime the pump.

    Install the rubber adapter and prime the fluid pump.

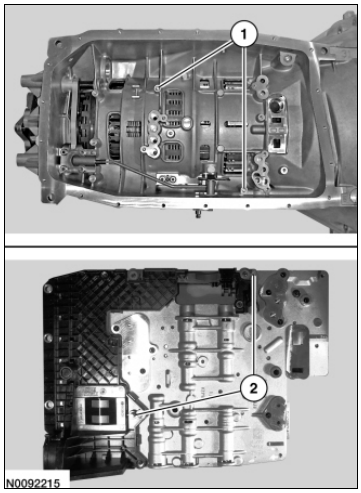


62. Install the thermal bypass valve into the case.



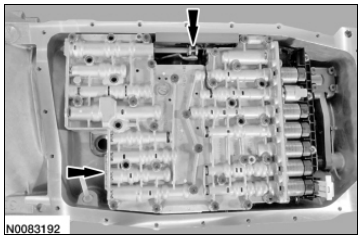
63. Align the mechatronic assembly guide pins in the alignment holes in the transmission case and position the mechatronic assembly in place.
    1. Alignment holes

2. Guide pins



64. **NOTE:** The mechatronic assembly will not lay flush on the case, this is a normal condition with the rubber feed tubes, the bolts will pull the mechatronic assembly down.

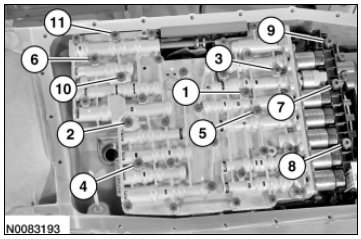
    Slightly lift the mechatronic assembly and align the manual valve in the manual valve linkage and position the mechatronic assembly in place.



65. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the Transmission Control Module (TCM). Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

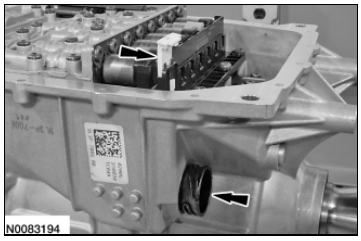
    Install the mechatronic assembly bolts and tighten the bolts in the sequence shown.

    - Tighten to 8 Nm (71 lb-in).

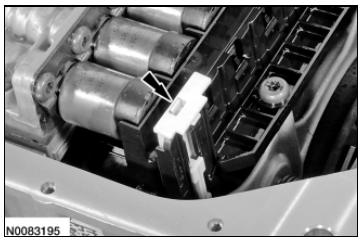


66. ***NOTICE:*** **Do not touch the electrical connector pins or the exposed solenoid tabs on the Transmission Control Module (TCM). Electrostatic discharge may occur and may cause damage to the mechatronic unit.**

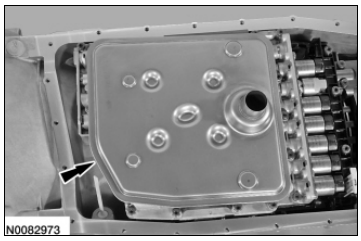
    With the release tab up and unlocked, push the outer shell of the bulkhead electrical connector into the transmission. Make sure that the bulkhead connector is fully seated into the TCM .



67. Press down on the tab and lock the outer shell of the bulkhead electrical connector in place. Make sure that the locking tab is securely locked.

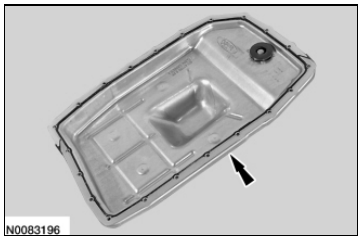


68. Install a new transmission fluid filter.



69. **NOTE:** The fluid pan gasket can be reused if not damaged.

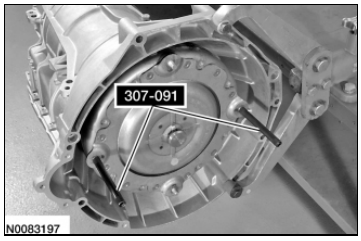
    Install a new transmission fluid pan gasket if required.



70. Install the fluid pan and tighten the bolts in a crisscross pattern.
    - Tighten to 12 Nm (106 lb-in).



71. Using the Torque Converter Handle 307-091, install the torque converter. Remove the Torque Converter Handle 307-091.


307-091
N0083197

Transmission - Four Wheel Drive (4WD)

Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

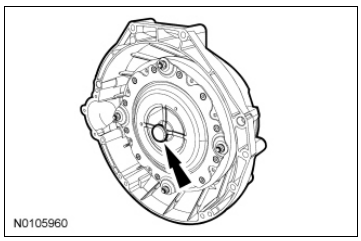
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV
Multi-Purpose Grease Motorcraft® XL-5 (aerosol) and/or CRC® SL3151	ESB-M1C93-B

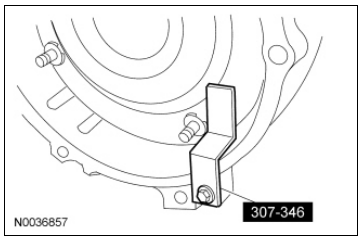
Installation

NOTICE: **Prior to installation of the transmission, the torque converter pilot hub must be lubricated with multi-purpose grease or damage to the torque converter or the engine crankshaft can occur.**

1. Lubricate the torque converter pilot hub with multi-purpose grease.



2. Install the Torque Converter Retainer.



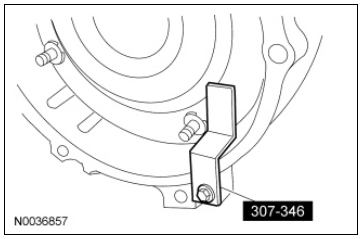
3. ***NOTICE:*** **The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.**

   NOTE: Make sure the transmission jack makes contact on the outer ribs of the transmission fluid pan.

NOTE: Make sure the transmission is securely fastened to the transmission jack.

Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.

4. Remove the Torque Converter Retainer.



5. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

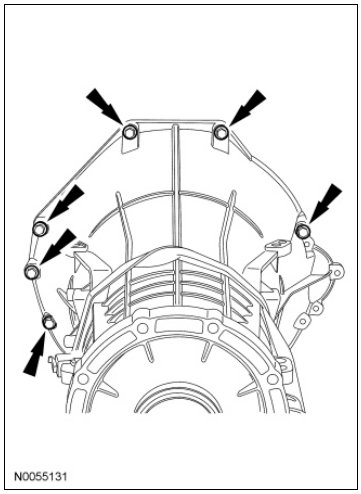
   With the transmission in a horizontal position, move it toward the engine. Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

6. **NOTE:** Install the transmission-to-engine bolts in their correct locations.

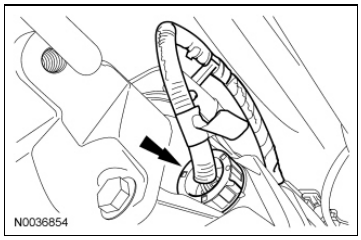
   NOTE: The top 2 transmission-to-engine bolts need to be installed prior to installing the rest of the bolts.

   Install 6 of the remaining 7 transmission-to-engine bolts.

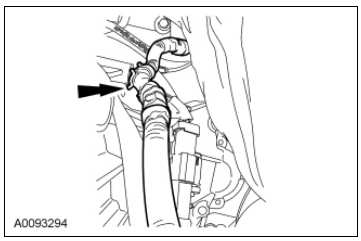
   - Tighten to 48 Nm (35 lb-ft).



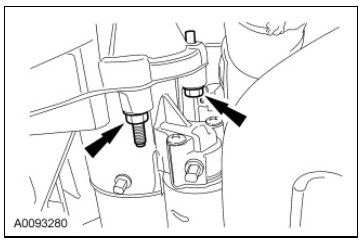
7. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.



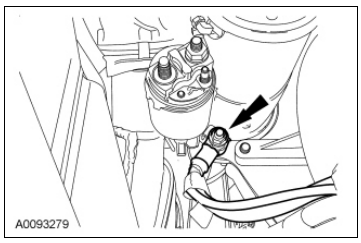
8. Attach the transmission vehicle harness to the top of the transmission.



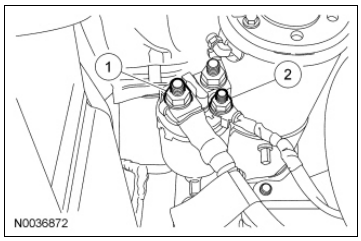
9. Install the starter motor and the 3 starter motor bolts.
   - Tighten to 26 Nm (19 lb-ft).



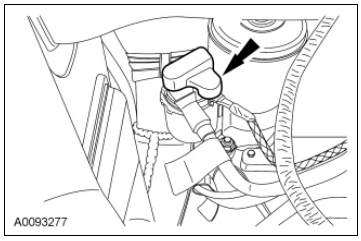
10. Install the ground wire on the stud and install the ground wire nut.
    - Tighten to 23 Nm (17 lb-ft).



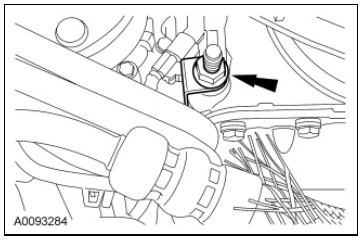
11. Install the starter motor electrical connectors.
    1. Tighten to 12 Nm (106 lb-in).
    2. Tighten to 6 Nm (53 lb-in).



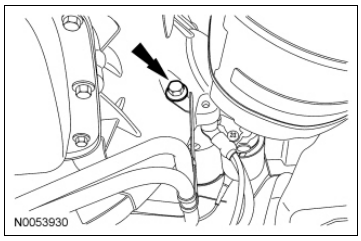
12. Install the plastic starter motor electrical connector cap.



13. Position the transmission fluid cooler tubes in place and install the transmission fluid cooler tube bracket front stud bolt nut.
    - Tighten to 27 Nm (20 lb-ft).



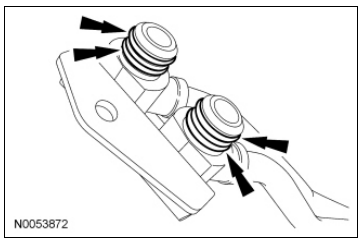
14. Align the transmission fluid cooler tube bracket and install the remaining transmission-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).



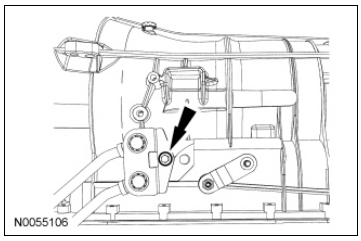
15. **NOTE:** Inspect the case and make sure the old transmission fluid cooler tube O-rings are not stuck in the case.

    NOTE: Install new transmission fluid cooler tube O-rings on the ends of the transmission fluid cooler tubes prior to installing.

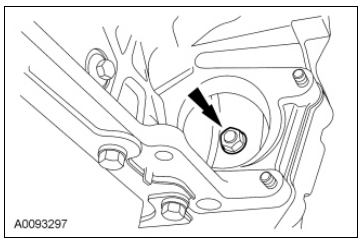
    Install new transmission fluid cooler tube O-rings on the transmission fluid cooler tubes.



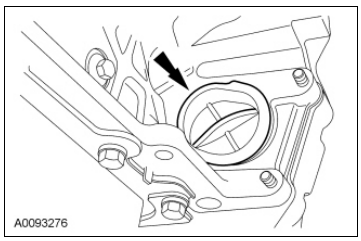
16. Install the transmission fluid cooler tube bracket bolt.
    - Tighten to 23 Nm (17 lb-ft).



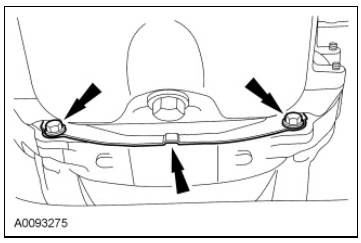
17. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).



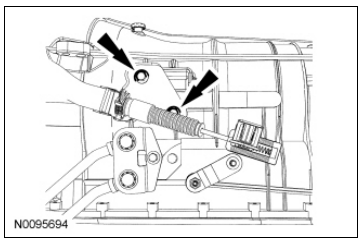
18. Install the rubber access plug.



19. Install the flexplate inspection cover and the flexplate inspection cover bolts.
    - Tighten to 35 Nm (26 lb-ft).



20. Install the selector lever cable bracket and selector lever cable bracket bolts.
    - Tighten to 48 Nm (35 lb-ft).

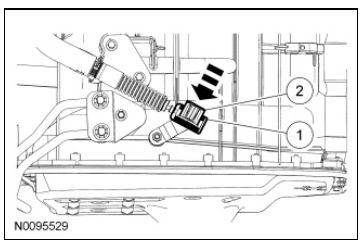


21. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

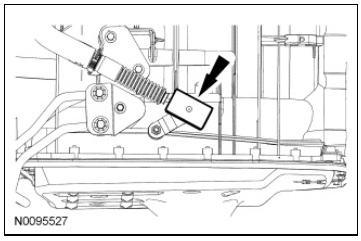
    NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure the selector lever cable end is securely installed onto the manual control lever.

    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual lever and move the locking tab down.

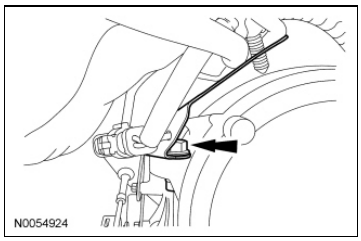
    1. Selector lever cable end
    2. Locking tab
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is securely installed.



22. Install selector lever cable heat shield.



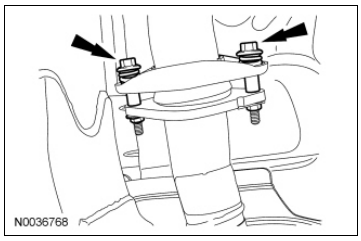
23. Install the fuel line bracket and the rear fuel line bracket bolt.
    - Tighten to 25 Nm (18 lb-ft).



24. ***NOTICE:*** **Prior to installation, inspect theHeated Oxygen Sensor (HO2S) and theCatalyst Monitor Sensor (CMS) wiring harness for damage.**

    Position the dual catalytic converter Y-pipe in place and install the dual catalytic converter Y-pipe bolts and new nuts.

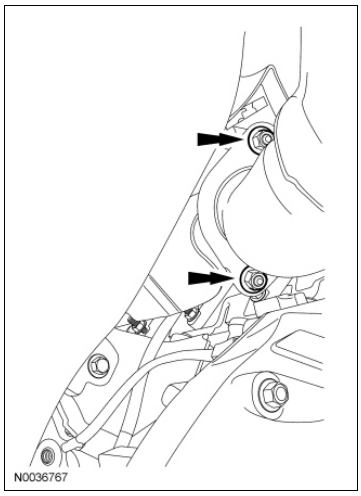
    - Tighten to 40 Nm (30 lb-ft).



25. **NOTE:** LH shown, RH similar.

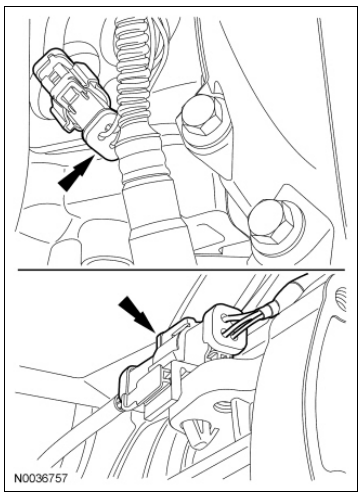
    Install new LH and RH exhaust flange nuts.

    - Tighten to 40 Nm (30 lb-ft).



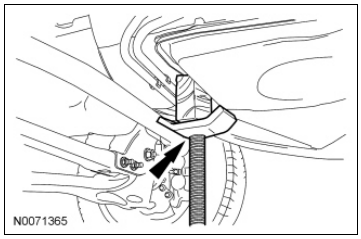
26. **NOTE:** LH shown, RH similar.

    Connect the RH and LH HO2S connectors and the CMS connectors.



27. Install the transmission support crossmember. For additional information, refer to Section 502-02 .

28. Position a jackstand under the transmission, and remove the transmission jack.



29. Install the transfer case. For additional information, refer to Section 308-07B .

30. Connect the battery ground cable. For additional information, refer to Section 414-01 .

31. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

32. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation (PMI) procedure for the PCM. For additional information, refer to Section 418-01 .

33. Fill the transmission with clean transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Transmission - Rear Wheel Drive (RWD)

Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

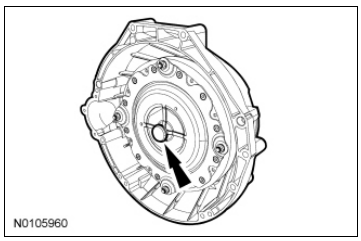
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV
Multi-Purpose Grease Motorcraft® XL-5 (aerosol) and/or CRC® SL3151	ESB-M1C93-B

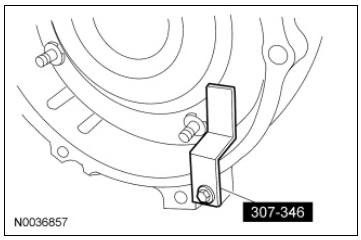
Installation

NOTICE: **Prior to installation of the transmission, the torque converter pilot hub must be lubricated with multi-purpose grease or damage to the torque converter or the engine crankshaft can occur.**

1. Lubricate the torque converter pilot hub with multi-purpose grease.



2. Install the Torque Converter Retainer.



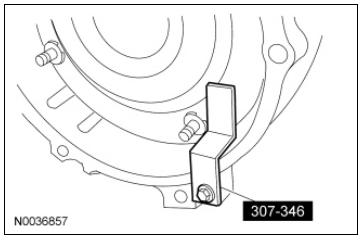
3. ***NOTICE:*** **The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.**

   NOTE: Make sure the transmission jack makes contact on the outer ribs of the transmission fluid pan.

NOTE: Make sure the transmission is securely fastened to the transmission jack.

Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.

4. Remove the Torque Converter Retainer.



5. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

   With the transmission in a horizontal position, move it toward the engine. Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

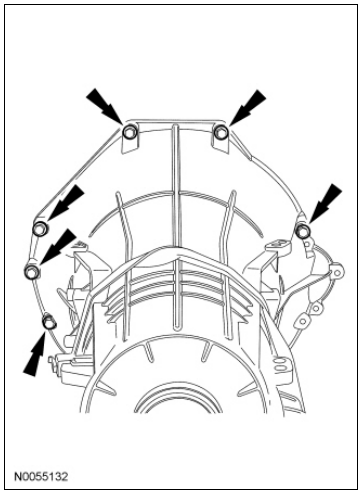
6. **NOTE:** Install the transmission case bolts in their correct locations noted during removal.

   NOTE: The top 2 transmission case bolts need to be installed prior to installing the remaining bolts.

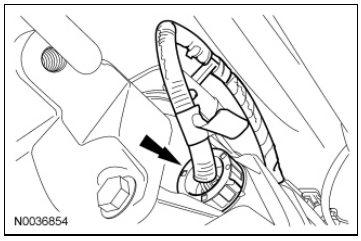
   NOTE: The top left bolt is inserted through the fuel line bracket first, then through the transmission case.

   Install 6 of the remaining 7 transmission-to-engine bolts.

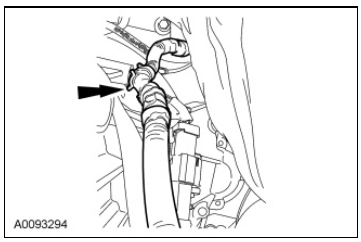
   - Tighten to 48 Nm (35 lb-ft).



7. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.



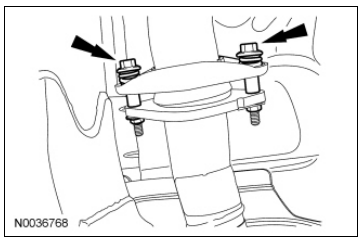
8. Attach the transmission vehicle harness to the top of the transmission.



9. ***NOTICE:*** **Prior to installation, inspect theHeated Oxygen Sensor (HO2S) and theCatalyst Monitor Sensor (CMS) wiring harness for damage.**

   Position the dual catalytic converter Y-pipe in place and install the 2 dual catalytic converter Y-pipe bolts and new nuts.

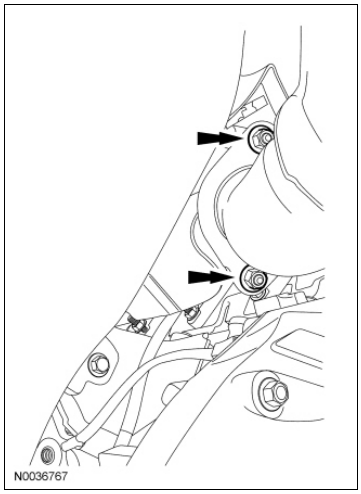
   - Tighten to 40 Nm (30 lb-ft).



10. **NOTE:** LH shown, RH similar.

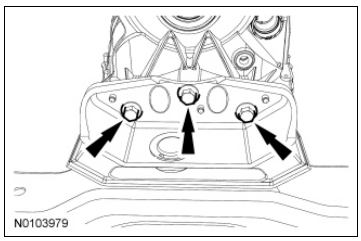
    Install new LH and RH exhaust flange nuts.

    - Tighten to 40 Nm (30 lb-ft).

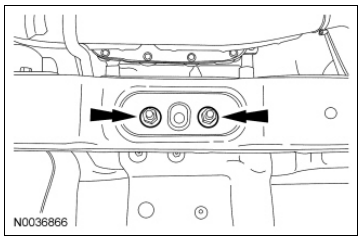


11. Install the transmission insulator and retainer and the 3 transmission insulator and retainer bolts.

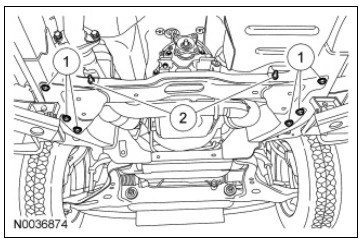
- Tighten to 90 Nm (66 lb-ft).



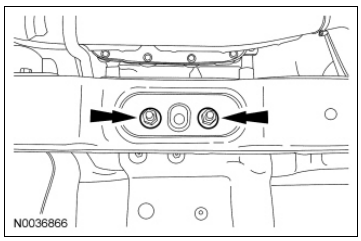
12. Position the crossmember in place and loosely install the transmission insulator and retainer nuts.



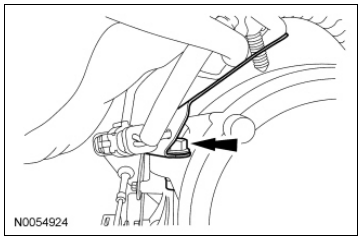
13. Install the 8 transmission crossmember bolts and nuts.
    1. Tighten bolts to 80 Nm (59 lb-ft).
    2. Tighten nuts to 143 Nm (105 lb-ft).



14. Tighten the transmission insulator and retainer crossmember nuts.
    - Tighten to 90 Nm (66 lb-ft).

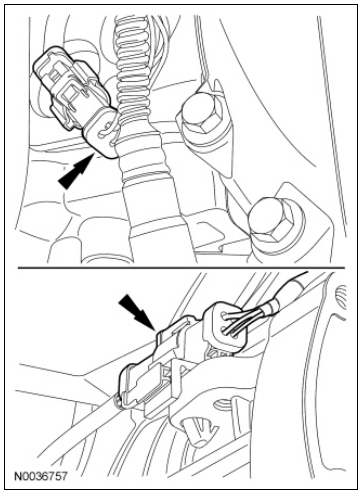


15. Install the fuel line bracket and rear fuel line bracket bolt.
    - Tighten to 25 Nm (18 lb-ft).

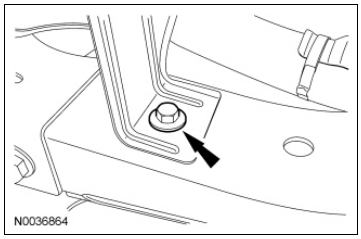


16. **NOTE:** LH shown, RH similar.

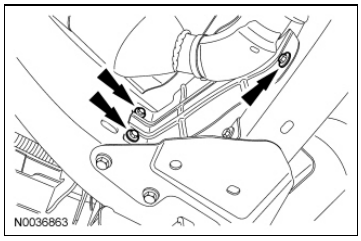
    Connect the RH and LH HO2S connectors and the CMS connectors.



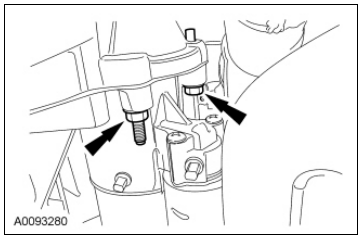
17. Install the LH exhaust heat shield bolt.
    - Tighten to 15 Nm (133 lb-in).



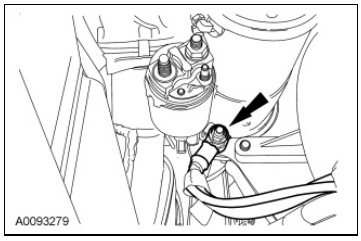
18. If equipped, install the RH exhaust heat shield.
    - Tighten to 15 Nm (133 lb-in).



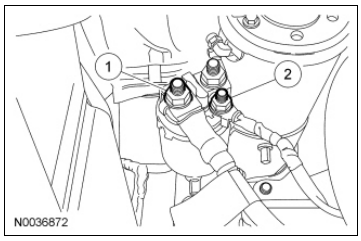
19. Position the starter motor in place and install the 3 starter motor bolts.
    - Tighten to 26 Nm (19 lb-ft).



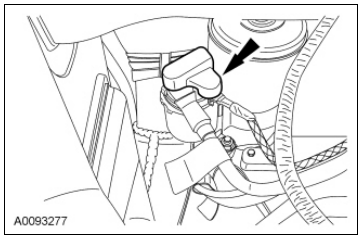
20. Install the ground wire on the stud and install the ground wire nut.
    - Tighten to 23 Nm (17 lb-ft).



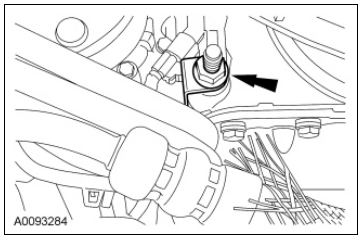
21. Install the starter motor electrical connectors.
    1. Tighten to 12 Nm (106 lb-in).
    2. Tighten to 6 Nm (53 lb-in).



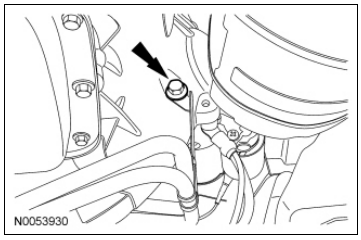
22. Install the plastic starter motor electrical connector cap.



23. Position the transmission fluid cooler tubes in place and install the transmission fluid cooler tube bracket nut.
    - Tighten to 27 Nm (20 lb-ft).



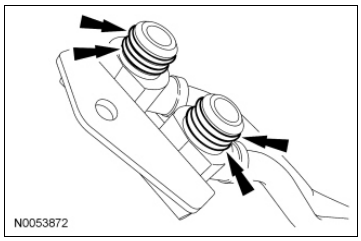
24. Align the transmission fluid cooler tube bracket and install the remaining transmission-to-engine bolt.
    - Tighten to 48 Nm (35 lb-ft).



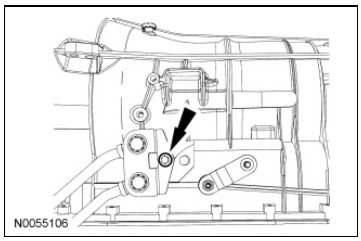
25. **NOTE:** Inspect the case and make sure the old transmission fluid cooler tube O-rings are not stuck in the case.

NOTE: Install new transmission fluid cooler tube O-rings on the ends of the transmission fluid cooler tubes prior to installing.

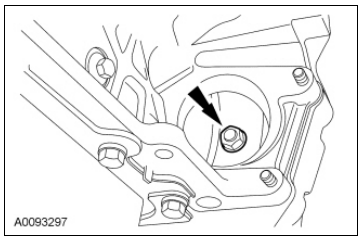
Install new transmission fluid cooler tube O-rings on the transmission fluid cooler tubes.



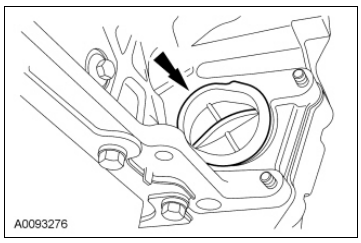
26. Install the transmission fluid cooler tubes and the transmission fluid cooler tube bracket bolt.
    - Tighten to 23 Nm (17 lb-ft).



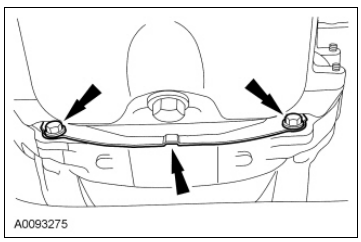
27. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).



28. Install the rubber access plug.

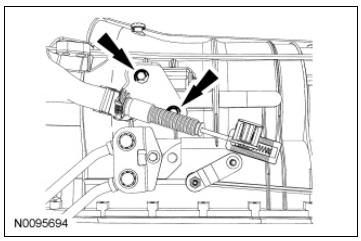


29. Install the flexplate inspection cover and the flexplate inspection cover bolts.
    - Tighten to 35 Nm (26 lb-ft).



30. Install the selector lever cable bracket and selector lever cable bracket bolts.

- Tighten to 48 Nm (35 lb-ft).

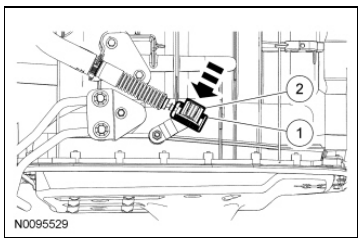


31. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

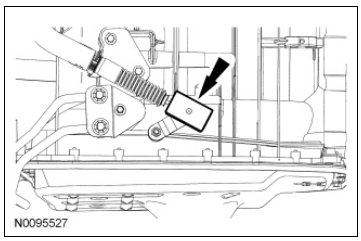
    NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure the selector lever cable end is securely installed onto the manual control lever.

    With the manual lever in NEUTRAL, connect the selector lever cable onto the manual lever and move the locking tab down.

    1. Selector lever cable end
    2. Locking tab
    - Listen for the audible click.
    - Pull back on the selector lever cable to make sure that it is securely installed.



32. Install the selector lever cable heat shield.



33. Install the driveshaft. For additional information, refer to Section 205-01 .

34. Connect the battery ground cable. For additional information, refer to Section 414-01 .

35. Verify that the selector lever cable is correctly adjusted. For additional information, refer to Section 307-05 .

36. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation (PMI) procedure for the PCM. For additional information, refer to Section 418-01 .

37. Fill the transmission with clean transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Material

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	11.7L (12.7 qt) [a]
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV	11.45L (12.10 qt) [b]
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

[a] 5R55S Transmission
[b] 6R80 Transmission

General Specifications

Item	Specification
Transmission Fluid	
NOTICE: The use of any transmission fluids other than specified may result in transmission damage or failure. • Normal maintenance: ♦ Transmission fluid change not necessary, filled for life. • Severe duty maintenance: ♦ 5R55S change	

	the transmission fluid at 48,000 km (30,000 mi) intervals. ♦ 6R80 change the transmission fluid at 240,000 km (150,000 mi) intervals.
Transmission Fluid Capacity	
NOTE: Approximate dry capacity, includes transmission fluid cooler and transmission fluid cooler tubes. Transmission fluid level procedures in this section should be used to determine actual transmission fluid requirements and transmission fluid specification. DO NOT OVERFILL. If it is necessary to add or change transmission fluid, use only transmission fluid that is recommended.	

Torque Specifications

Description	Nm	lb-ft	lb-in

Transmission fluid cooler bolts	7	-	62
Transmission fluid cooler tube bracket assembly-to-case bolt (6R80)	25	18	-
Transmission fluid cooler tube bracket-to-engine nut (5R55S)	25	18	-
Transmission fluid cooler tube bracket-to-engine nut (6R680)	12	-	106
Transmission fluid cooler tube case fitting (5R55S)	56	41	-
Transmission fluid cooler tube nut-to-case fitting (5R55S)	40	30	-
U-joint strap bolts	19	-	168

Transmission Cooling

Vehicles equipped with automatic transmissions have an auxiliary transmission fluid cooler which is mounted in front of the radiator and the A/C condenser. In operation, transmission fluid travels from the transmission to the auxiliary transmission fluid cooler then back to the transmission. The auxiliary transmission fluid cooler transfers heat from the transmission fluid to the outside air.

Transmission Cooling

Inspection and Verification

NOTICE: **When a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, the transmission fluid cooler and/or auxiliary transmission fluid cooler and the transmission fluid cooler tubes must be cleaned and backflushed to keep contaminants from entering the transmission, causing internal damage.**

NOTE: Backflushing and cleaning the transmission fluid cooler tubes, along with following all the normal cleaning and inspection procedures during disassembly and assembly, will keep contaminants from entering the transmission, eliminating a repeat repair. For additional information, refer to Section 307-01A for 5R55S or Section 307-01B for 6R80, Transmission Fluid Cooler Backflushing and Cleaning.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission failure and must be removed from the transmission fluid cooling system before the transmission is put back into use. Install a new transmission fluid cooler and/or auxiliary transmission fluid cooler and backflush the transmission fluid cooler tubes.

When transmission fluid leakage is found in the transmission fluid cooler, install a new transmission fluid cooler.

If the fault is not visually evident, GO to Symptom Chart - Transmission Cooling or GO to Symptom Chart - NVH .

Symptom Chart - Transmission Cooling

Symptom Chart - Transmission Cooling

Symptom Chart - NVH

Symptom Chart - NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Vibration - a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed

- Transmission fluid cooler tubes grounded out
- CHECK the transmission fluid cooler tubes. REPAIR as necessary.

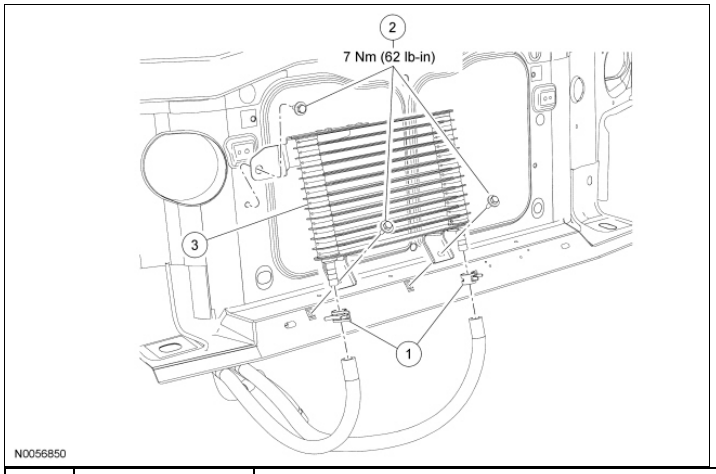
Transmission Fluid Cooler Flow Test - 5R55S

1. Refer to the Transmission Fluid Cooler Flow Test in Section 307-01A .

Auxiliary Transmission Fluid Cooler

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV



Item	Part Number	Description
1	-	Transmission fluid cooler hose constant tension clamps
2	-	Transmission fluid cooler bolts
3	7A095	Transmission fluid cooler

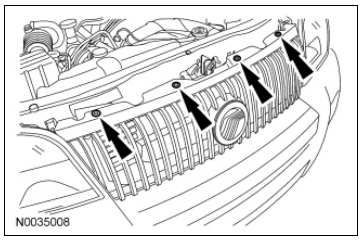
Removal

NOTE: The 5R55S uses MERCON® V Automatic Transmission Fluid.

The 6R80 uses Motorcraft MERCON® LV Automatic Transmission Fluid.

Mountaineer

1. Remove the grille fasteners and the grille. For additional information, refer to Section 501-08 .

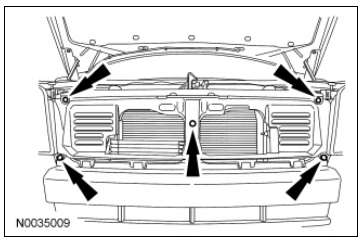


Explorer

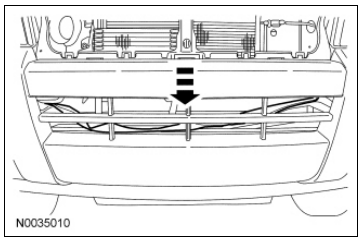
2. Remove the front bumper cover. For additional information, refer to Section 501-19 .

All vehicles

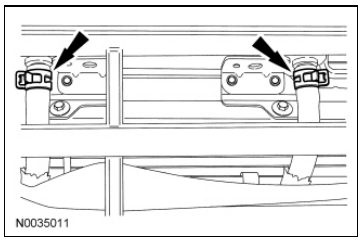
3. Remove the 5 bolts and remove the inner grille air deflector.



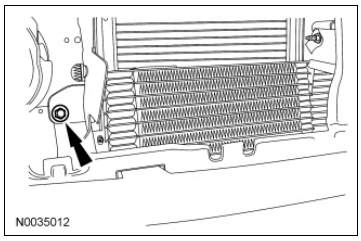
4. Push the lower air deflector down past the transmission fluid cooler.



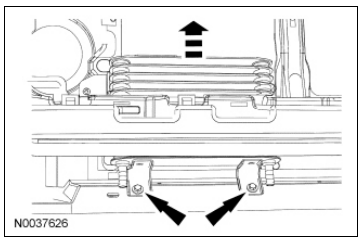
5. Disconnect the transmission fluid cooler hoses.
   - Remove and discard the transmission fluid cooler hoses and the clamps.



6. Remove the upper transmission fluid cooler bolt.



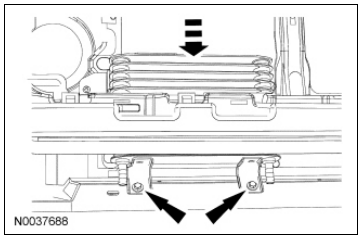
7. Remove the lower transmission fluid cooler bolts and the transmission fluid cooler.



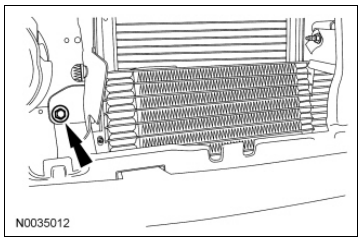
Installation

All vehicles

1. Install the transmission fluid cooler and the lower transmission fluid cooler bolts.
   - Tighten to 7 Nm (62 lb-in).

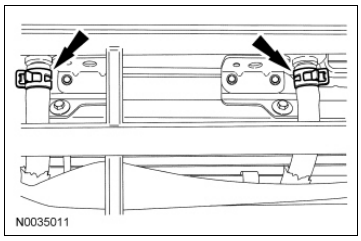


2. Install the upper transmission fluid cooler bolt.
   - Tighten to 7 Nm (62 lb-in).

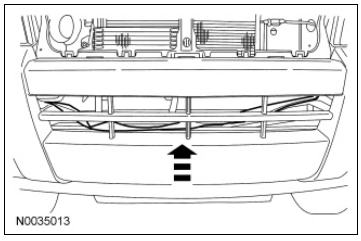


3. **NOTE:** Clean the transmission cooler tube stems with degreaser prior to installing the hoses.

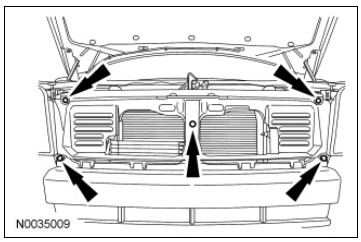
   Using new hoses and clamps, install the new transmission fluid cooler hoses.



4. Push the lower air deflector back into place.

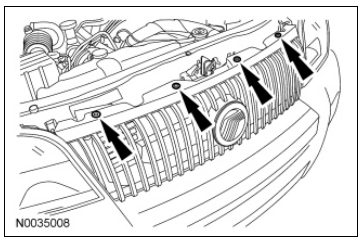


5. Install the inner grille air deflector.



Mountaineer

6. Install the grille and the fasteners. For additional information, refer to Section 501-08 .



Explorer

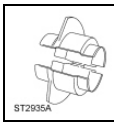
7. Install the bumper cover. For additional information, refer to Section 501-19 .

All vehicles

8. Fill the transmission fluid to the correct level using clean transmission fluid and inspect the leaks. For additional information, refer to Section 307-01A for 5R55S or Section 307-01B for 6R80.

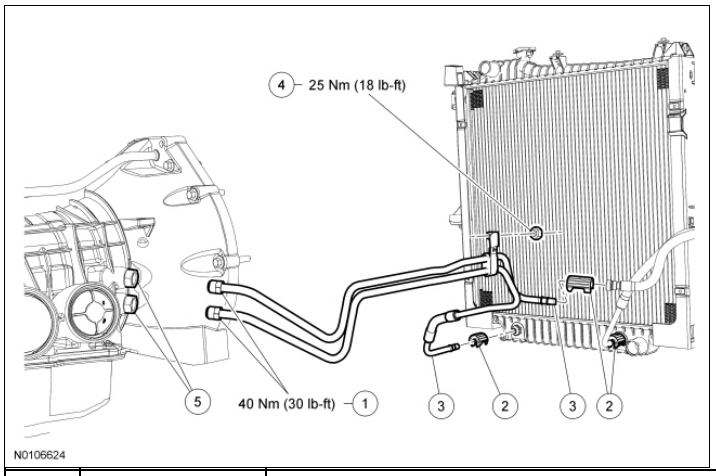
Transmission Fluid Cooler Tubes - 5R55S

Special Tool(s)

 ST2935A	Disconnect Tool, Transmission Cooler Line 307-569

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

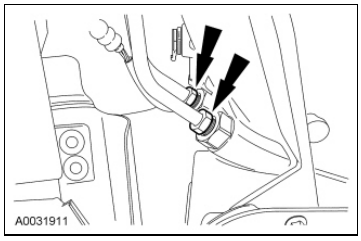


Item	Part Number	Description
1	-	Transmission fluid cooler tube nut-to-case fitting
2	7Z465	Transmission fluid cooler tube secondary latches
3	7R081	Transmission fluid cooler tubes
4	-	Transmission fluid cooler tube bracket-to-engine nut
5	7D273	Transmission fluid cooler tube nut-to-case fittings

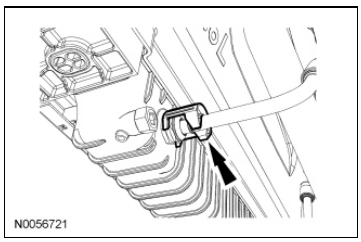
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

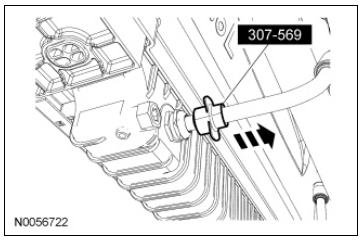
2. Using a backup wrench to hold the case fitting securely, disconnect the transmission fluid cooler tube nut-to-case fittings.



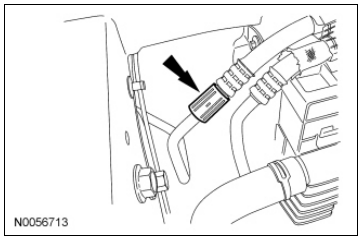
3. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler tube.



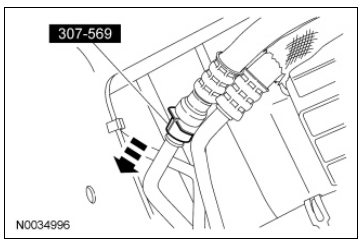
4. Using the Transmission Cooler Line Disconnect Tool, disconnect the quick connect coupler and remove the transmission fluid cooler tube from the radiator.



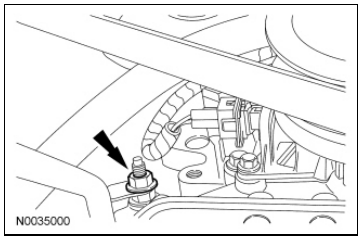
5. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler tube.



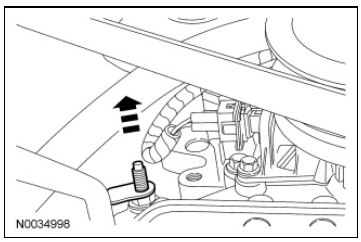
6. Using the Transmission Cooler Line Disconnect Tool, disconnect the quick connect coupler and separate the transmission fluid cooler tube from the transmission fluid cooler hose.



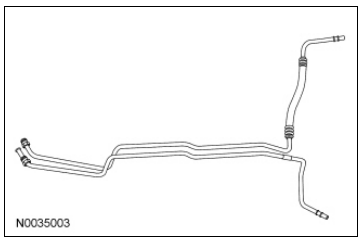
7. Remove the transmission fluid cooler tube bracket-to-engine nut.



8. Remove the transmission fluid cooler tube bracket from the stud.

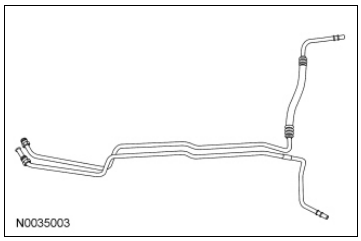


9. Remove the transmission fluid cooler tubes from the vehicle.

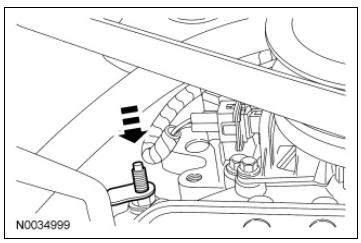


Installation

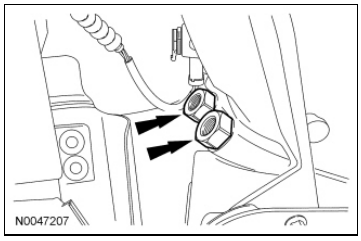
1. Install the transmission fluid cooler tubes into the vehicle.



2. Install the transmission fluid cooler tube bracket onto the stud.



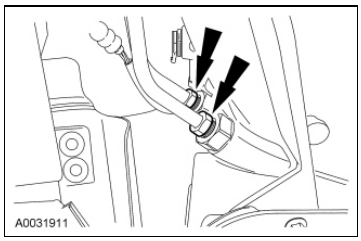
3. Verify the transmission fluid cooler tube case fitting torque.
    - Tighten to 56 Nm (41 lb-ft).



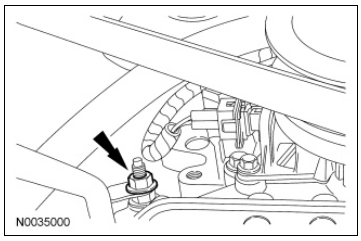
4. ***NOTICE:*** **To prevent cross threading, all transmission fluid cooler tube nuts must be hand-started before being tightened to specification.**

   Using a backup wrench to hold the case fittings securely, install the transmission fluid cooler tube nut-to-case fittings.

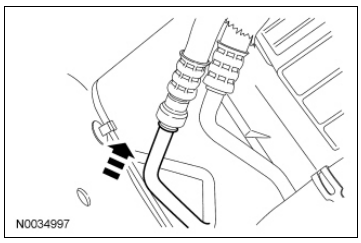
   - Tighten to 40 Nm (30 lb-ft).



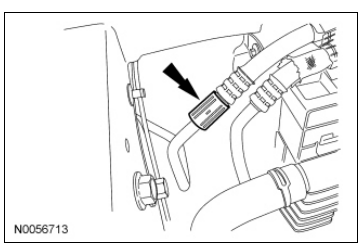
5. Install the transmission fluid cooler tube bracket-to-engine nut.
   - Tighten to 25 Nm (18 lb-ft).



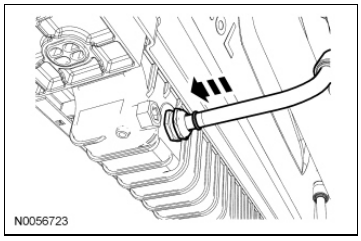
6. Connect the transmission fluid cooler tube to the transmission fluid cooler hose.



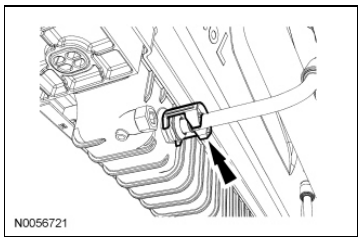
7. Install the transmission fluid cooler tube secondary latch to the transmission fluid cooler tube at the transmission fluid cooler hose.



8. Install the transmission fluid cooler tube to the radiator.



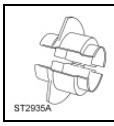
9. Install the transmission fluid cooler tube secondary latch to the transmission fluid cooler tube at the radiator.



10. Fill the transmission to the correct fluid level using clean transmission fluid and inspect for leaks. For additional information, refer to Transmission Fluid Level Check in Section 307-01A .

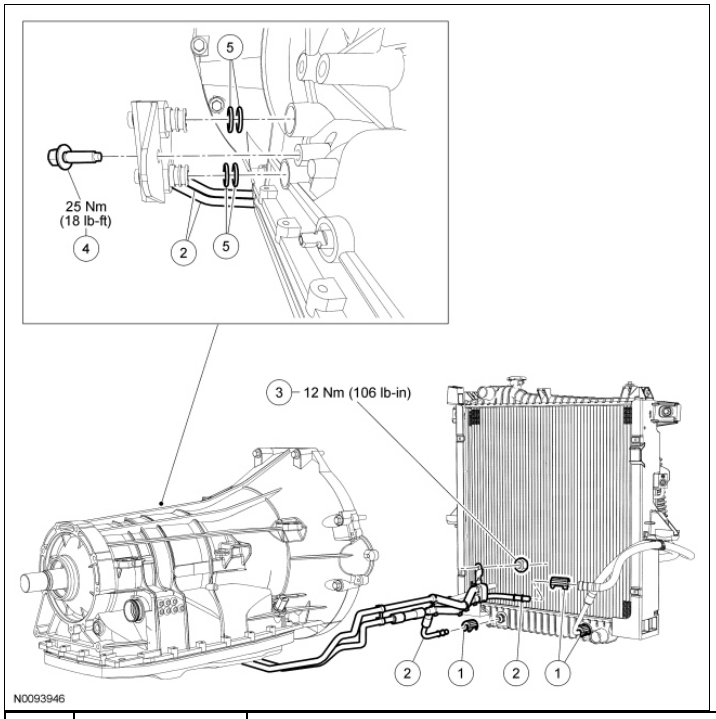
Transmission Fluid Cooler Tubes - 6R80

Special Tool(s)

 ST2935A	Disconnect Tool, Transmission Cooler Line 307-569

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV
Threadlock and Sealer TA-25	WSK-M2G351-A5

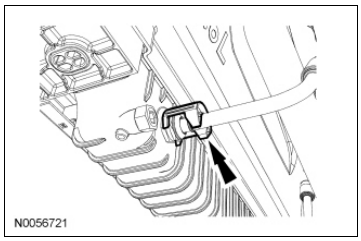


Item	Part Number	Description
1	7Z465	Transmission fluid cooler tube secondary latches
2	7R081	Transmission fluid cooler tubes
3	-	Transmission fluid cooler tube bracket-to-engine nut
4	-	Transmission fluid cooler tube bracket assembly-to-case bolt
5	7J227	Transmission fluid cooler tube O-rings (4 required)

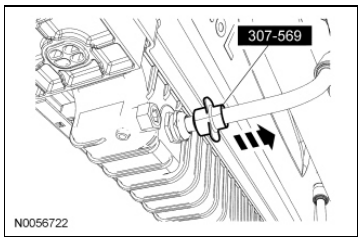
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

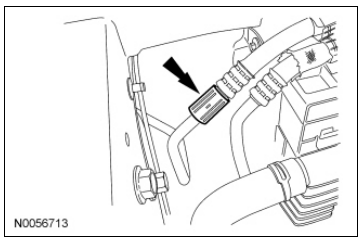
2. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler tube.



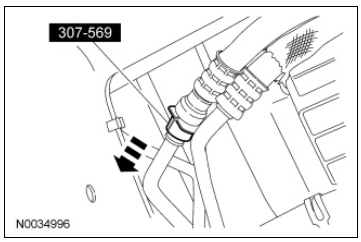
3. Using the Transmission Cooler Line Disconnect Tool, disconnect the quick connect coupler and remove the transmission fluid cooler tube from the radiator.



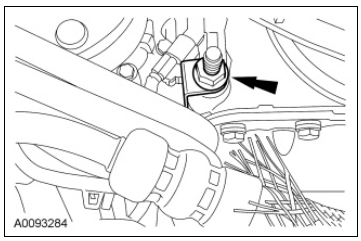
4. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler tube.



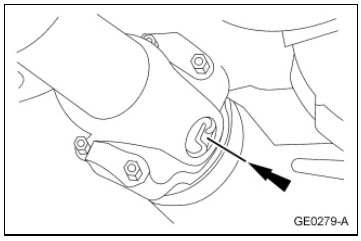
5. Using the Transmission Cooler Line Disconnect Tool, disconnect the quick connect coupler and separate the transmission fluid cooler tube from the transmission fluid cooler hose.



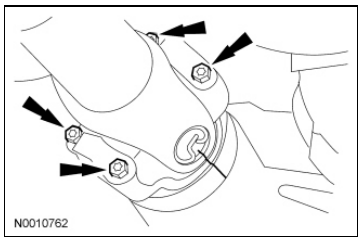
6. Remove the transmission fluid cooler tube bracket-to-engine nut.



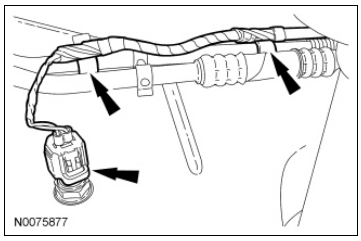
7. If equipped, index-mark the front driveshaft to maintain driveshaft balance.



8. If equipped, remove the 4 U-joint strap bolts and remove the U-joint straps.
   - Discard the bolts.

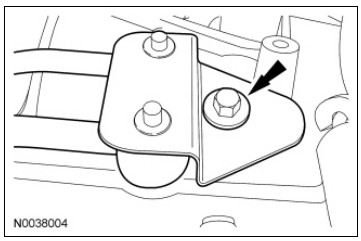


9. Disconnect the engine oil low level sensor electrical connector and harness clips.

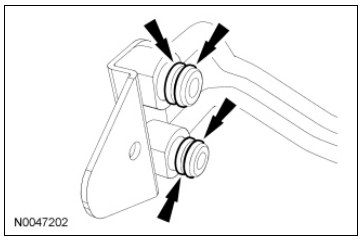


10. **NOTE:** The transmission fluid cooler tube O-rings may remain in the transmission case. Carefully remove them from the case.

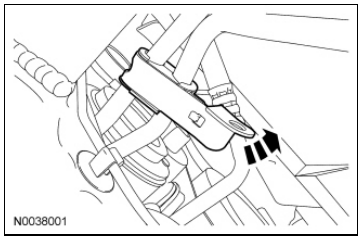
    Remove the transmission fluid cooler tube bracket assembly-to-case bolt and remove the transmission fluid cooler tubes from the transmission.



11. Remove and discard the 4 O-rings from the transmission fluid cooler tube ends.

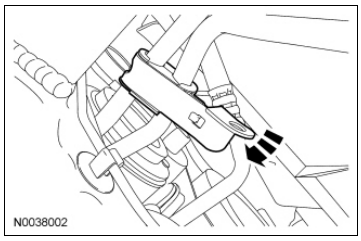


12. Remove the transmission fluid cooler tubes from the vehicle.

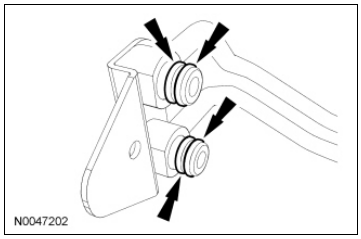


Installation

1. Position the transmission fluid cooler tubes in the vehicle.



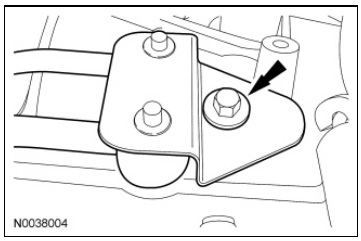
2. Install 4 new O-rings on the transmission fluid cooler tube ends.



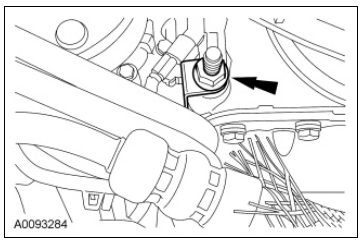
3. **NOTE:** Inspect the transmission case to make sure that the old O-rings are not stuck in the transmission case.

   Position the transmission fluid cooler tubes into the transmission, then install the transmission fluid cooler tube bracket assembly-to-case bolt.

   - Tighten to 25 Nm (18 lb-ft).



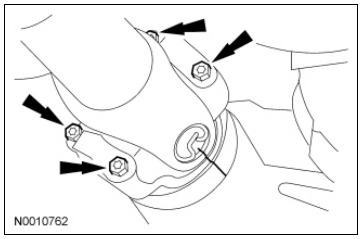
4. Position the transmission fluid cooler tube bracket on the stud and install the transmission fluid cooler tube bracket-to-engine nut.
   - Tighten to 12 Nm (106 lb-in).



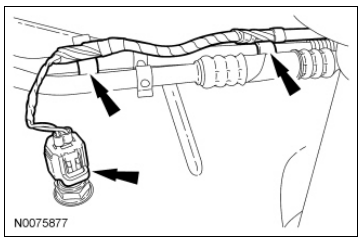
5. **NOTE:** Install new U-joint strap bolts. If new U-joint strap bolts are not available, coat the threads of the original U-joint strap bolts with threadlock and sealer.

   If removed, install the U-joint straps and 4 new U-joint strap bolts.

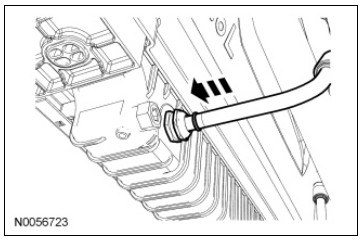
   - Tighten to 19 Nm (168 lb-in).



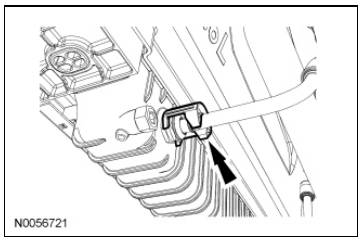
6. Connect the engine oil low level sensor electrical connector and harness clips.



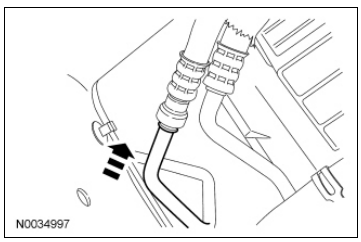
7. Install the transmission fluid cooler tube to the radiator.



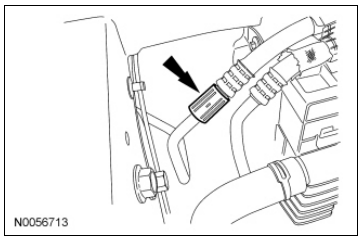
8. Install the transmission fluid cooler tube secondary latch to the transmission fluid cooler tube at the radiator.



9. Connect the transmission fluid cooler tube to the transmission fluid cooler hose.



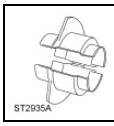
10. Install the transmission fluid cooler tube secondary latch to the transmission fluid cooler tube at the transmission fluid cooler hose.



11. Fill the transmission to the correct fluid level using clean transmission fluid and inspect for leaks. For additional information, refer to Transmission Fluid Level Check in Section 307-01B .

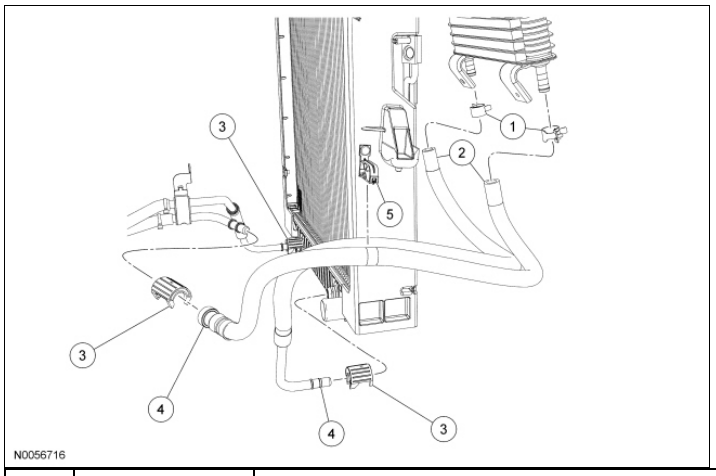
Transmission Fluid Cooler Hoses

Special Tool(s)

 ST2935A	Disconnect Tool, Transmission Cooler Line 307-569

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV



Item	Part Number	Description
1	-	Transmission fluid cooler constant tension hose clamps
2	7B028	Transmission fluid cooler hoses
3	7Z465	Transmission fluid cooler tube secondary latches
4	7890	Transmission fluid cooler hoses
5	7N291	Transmission fluid cooler hose retainer

Removal

NOTE: The 5R55S uses MERCON® V Automatic Transmission Fluid.

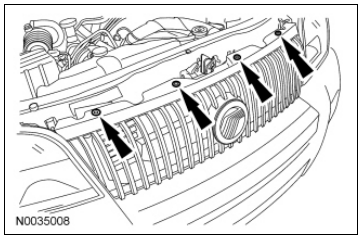
The 6R80 uses Motorcraft MERCON® LV Automatic Transmission Fluid.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Mountaineer

2. Remove the grille fasteners and the grille. For additional information, refer to Section 501-08 .

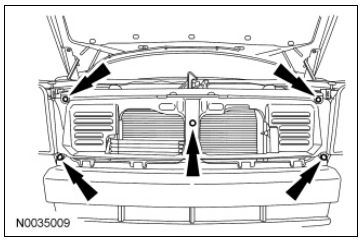


Explorer

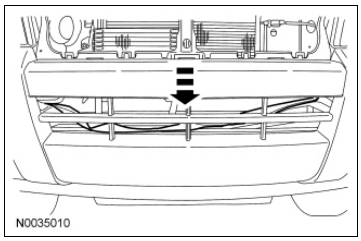
3. Remove the bumper cover. For additional information, refer to Section 501-19 .

All vehicles

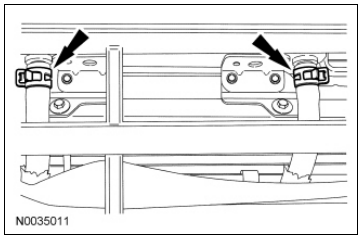
4. Remove the inner grille air deflector.



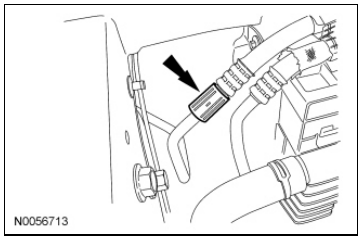
5. Push the lower air deflector down past the transmission fluid cooler.



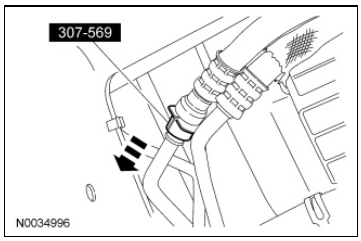
6. Disconnect the transmission fluid cooler hoses.
   - Remove and discard the transmission fluid cooler hoses and the clamps.



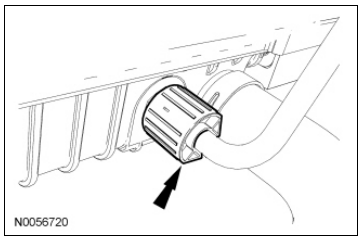
7. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler tube.



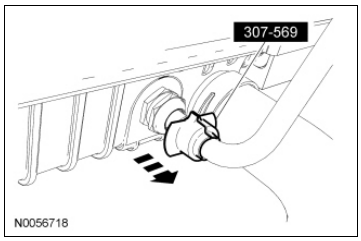
8. Using the Transmission Cooler Line Disconnect Tool, disconnect the quick connect coupler and separate the transmission fluid cooler tube from the transmission cooler hose.



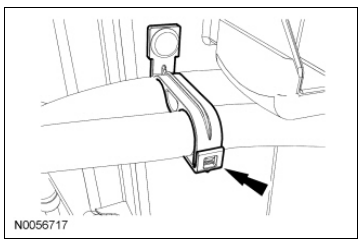
9. Remove the transmission fluid cooler tube secondary latch from the transmission fluid cooler hose.



10. Using the Transmission Cooler Line Disconnect Tool, disconnect the quick connect coupler and remove the transmission fluid cooler hose from the radiator.



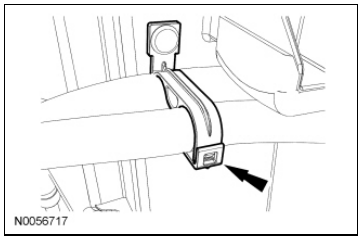
11. Remove the hoses from the retainer.



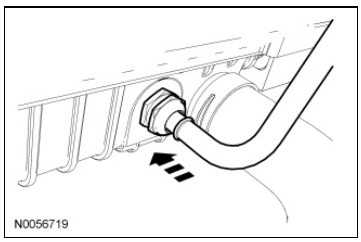
Installation

All vehicles

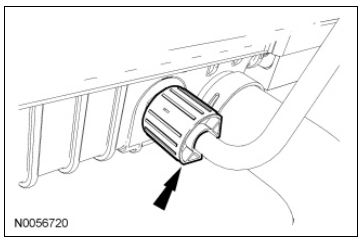
1. Install the hoses into the retainer.



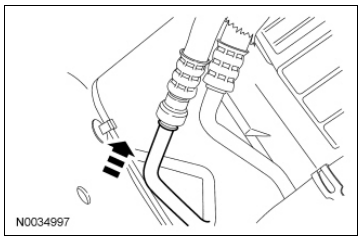
2. Install the transmission fluid cooler hose to the radiator.



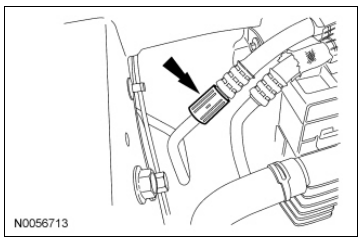
3. Install the transmission fluid cooler tube secondary latch.



4. Install the transmission fluid cooler hose to the transmission fluid cooler tube.

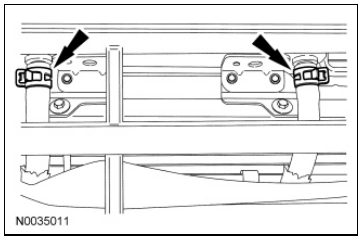


5. Install the transmission fluid cooler tube secondary latch.

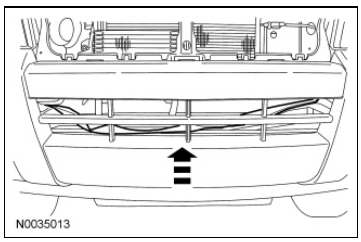


6. **NOTE:** Clean the transmission fluid cooler tube stems with degreaser prior to installing the hoses.

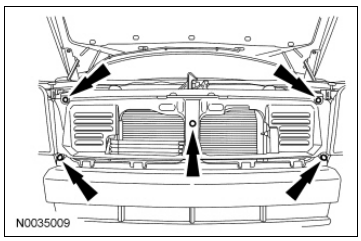
   Using new hoses and clamps, install the new transmission fluid cooler hoses.



7. Push the lower air deflector back into place.

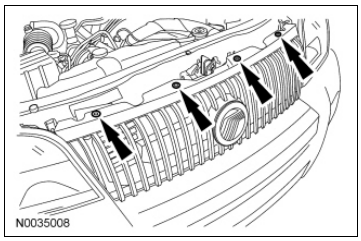


8. Install the inner grille air deflector.



Mountaineer

9. Install the grille and the fasteners. For additional information, refer to Section 501-08 .



Explorer

10. Install the bumper cover. For additional information, refer to Section 501-19 .

All vehicles

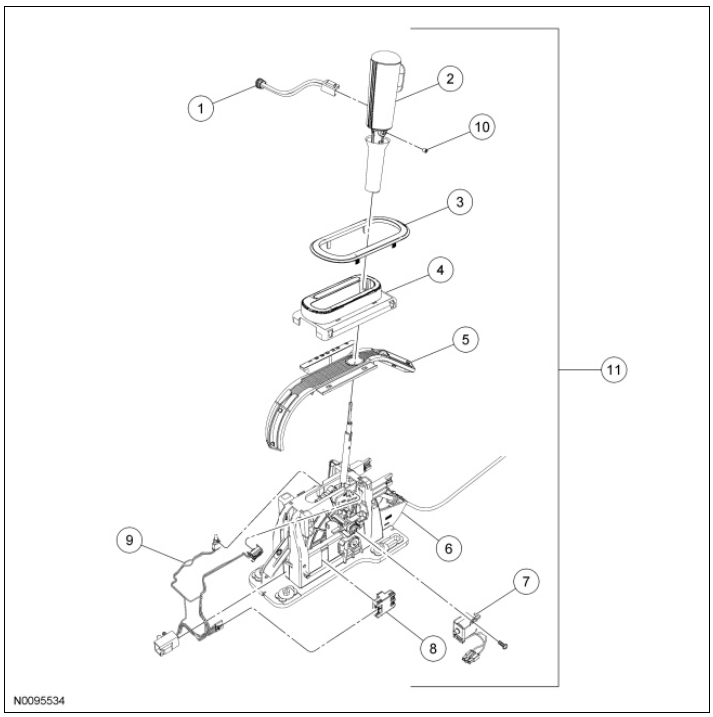
11. Fill the transmission fluid to the correct level using clean transmission fluid and inspect for leaks. For additional information, refer to Section 307-01A for 5R55S or Section 307-01B for 6R80.

Torque Specifications

Description	Nm	lb-ft	lb-in
Selector lever cable bracket screws (5R555)	40	30	-
Selector lever cable bracket screws (6R80)	27	20	-
Selector lever housing nuts	9	-	80
Selector lever knob set screw	3	-	27

External Controls

Transmission Selector Lever - 5R555, 6R80



Item	Part Number	Description
1	7G550	Transmission Control Switch (TCS)
2	7213	Transmission selector lever knob
3	061A16	Transmission selector lever bezel ring
4	7D443	Transmission selector lever housing bezel
5	7C444	Transmission selector lever housing slider
6	7210	Transmission selector lever assembly
7	7E096	Brake Shift Interlock Actuator (BSIA)
8	7J437	BSIA module
9	15A808	Transmission selector lever harness
10	-	Transmission selector lever knob set screw
11	7210	Transmission selector lever assembly

The selector lever cable transfers the transmission operating mode from the selector lever to the transmission. The indicated position of the selector lever is transferred to the transmission through the selector lever linkage, then to the selector lever cable and bracket and down to the manual control lever on the transmission.

Brake Shift Interlock System

The brake shift interlock system prevents moving the selector lever from the PARK position until the brake pedal is applied. The brake shift interlock system consists of a Brake Shift Interlock Actuator (BSIA) mounted on the selector lever. When the ignition switch is in the RUN position and the selector lever is in PARK, the

BSIA is energized when the brake pedal is applied. This will allow the selector lever to be moved from the PARK position.

If the selector lever will not move out of the PARK position with the key in the ON position and the brake pedal applied, it will need to be unlocked manually. For additional information, refer to Brake Shift Interlock Override in this section.

Transmission Control Switch (TCS)

The Transmission Control Switch (TCS) is a momentary contact switch located on the selector lever knob. Pushing the TCS will either disengage or engage the overdrive function of the transmission. If OVERDRIVE is disengaged, the message O/D OFF will illuminate on the Instrument Cluster (IC).

External Controls

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent

Brake Shift Interlock System

The brake shift interlock system prevents moving the selector lever from the PARK position until the brake pedal is applied. The brake shift interlock system consists of a Brake Shift Interlock Actuator (BSIA) mounted on the selector lever. When the ignition switch is in the RUN position and the selector lever is in PARK, the BSIA is energized when the brake pedal is applied. This will allow the selector lever to be moved from the PARK position.

Transmission Control Switch (TCS)

The Transmission Control Switch (TCS) is a momentary contact switch located on the selector lever knob. Pushing the TCS will either disengage or engage the overdrive function of the transmission. If OVERDRIVE is disengaged, the message O/D OFF will illuminate on the Instrument Cluster (IC).

Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical or electrical damage; refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Damaged Brake Shift Interlock Actuator (BSIA) • Damaged Transmission Control Switch (TCS)	• Failed fuse(s): ♦ 20 (10A) ♦ 22 (15A) • Damaged wiring harness • Loose or corroded connections • Failed Transmission Control Indicator Lamp (TCIL)

3. If the fault is not visually evident, determine the symptom. GO to Symptom Chart - Exterior Controls or GO to Symptom Chart - NVH .

Symptom Chart - External Controls

Symptom Chart - External Controls

Symptom Chart - NVH

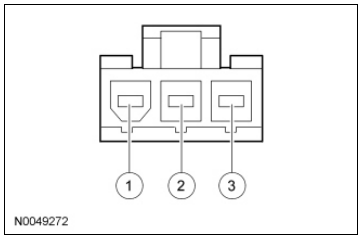
Symptom Chart - NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Vibration - a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed
- Selector lever cable incorrectly routed, grounded out or loose
- CHECK the selector lever cable. REPAIR as necessary. REFER to Selector Lever Cable in this section.
- Rattle, noise, buzz or other noise
- Selector lever loose
- TIGHTEN the selector lever bolt.
- Noisy selector lever
- INSTALL a new selector lever. REFER to Selector Lever in this section.

Electrical Connectors

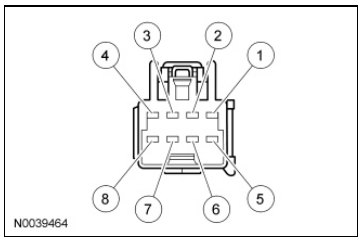
Brake Shift Interlock Actuator (BSIA)



Pin Number	Circuit Description
1	Brake Shift Interlock Actuator (BSIA)
2	Not used

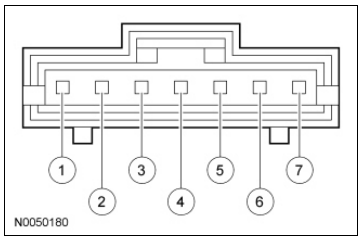
3	BSIA

Brake Shift Interlock C2008



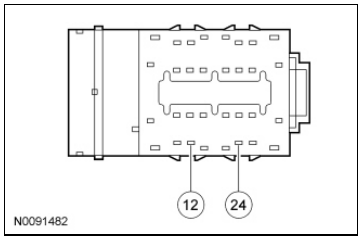
Pin Number	Circuit Description
1	B+ in Start and Run
2	Transmission Control Switch (TCS)/Overdrive (O/D) cancel switch
3	Solenoid key lock (inhibit removal)
4	Neutral switch sense input (6R80 with trailer tow)
5	Neutral switch sense input ground (6R80 with trailer tow)
6	Ground
7	Instrument panel/switch illumination
8	Brake Pedal Position (BPP) switch input

Brake Shift Interlock Actuator (BSIA) Module Connector



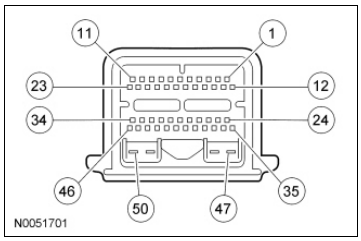
Pin Number	Circuit Description
1	Key out switch
2	Ground
3	Illumination
4	Key out switch
5	Brake
6	B+ in Start and Run
7	Transmission Control Switch (TCS)

Smart Junction Box (SJB) C2280C



Pin Number	Circuit Description
12	B+ in Start and Run
24	Brake On/Off

PCM C175B



Pin Number	Circuit Description
29	Transmission Control Switch (TCS)/Overdrive (O/D) cancel switch

Pinpoint Tests

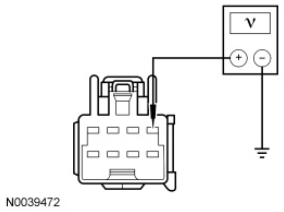
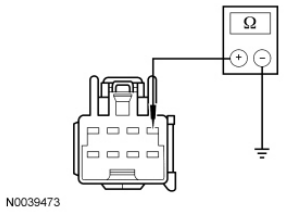
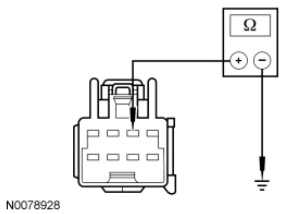
Refer to Wiring Diagrams Cell 29 , Transmission Controls - 5R55S for schematic and connector information.

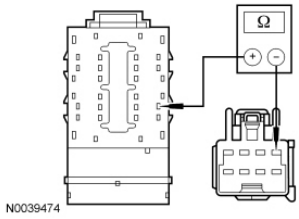
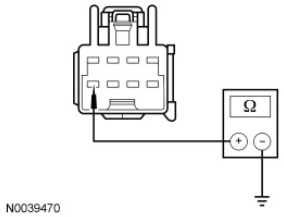
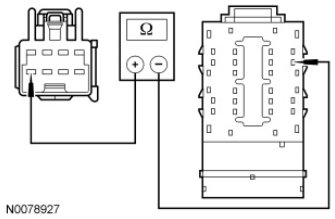
Refer to Wiring Diagrams Cell 30 , Transmission Controls - 6R80 for schematic and connector information.

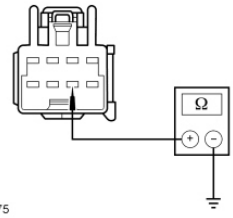
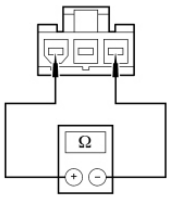
Refer to Wiring Diagrams Cell 37 , Shift Interlock for schematic and connector information.

PINPOINT TEST A: BRAKE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

Test Step	Result / Action to Take
A1 TEST THE BRAKE LIGHTS	
• Apply the brake pedal and view the high mounted stoplamp. • **Did the high mounted stoplamp illuminate?**	**Yes** GO to A2 . **No** REFER to Section 417-01 .
A2 TEST FOR VOLTAGE	

• Disconnect: Brake Shift Interlock C2008. • Ignition ON. • Measure the voltage between brake shift interlock C2008-1, circuit CBP20 (YE/VT), harness side and ground.  N0039472 • **Is the voltage greater than 10 volts?**	**Yes** GO to A7 . **No** GO to A3 .
A3 TEST FUSE 20 (10A)	
• Ignition OFF. • Check fuse: 20 (10A). • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** GO to A4 .
A4 TEST THE CIRCUIT FOR A SHORT TO GROUND	
• Measure the resistance between the brake shift interlock C2008-1, circuit CBP20 (YE/VT), harness side and ground.  N0039473 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A5 . **No** REPAIR circuit CBP20 (YE/VT) for short to ground. TEST the system for normal operation.
A5 TEST THE CIRCUIT FOR A SHORT TO GROUND	
• Disconnect: PCM C175B. • Measure the resistance between the brake shift interlock C2008-2, circuit CET34 (BN/GN), harness side and ground.  N0078928	**Yes** GO to A10 . **No** REPAIR circuit CET34 (BN/GN) for a short to ground. TEST the system for normal operation.

• **Is the resistance greater than 10,000 ohms?**	
A6 TEST THE CIRCUIT FOR AN OPEN	
• Disconnect: Smart Junction Box (SJB) C2280C. • Measure the resistance between the SJB C2280C-12 and the brake shift interlock C2008-1, circuit CBP20 (YE/VT), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A10 . **No** REPAIR circuit CBP20 (YE/VT) for an open. TEST the system for normal operation.
A7 TEST THE CIRCUIT FOR A SHORT TO GROUND	
• Disconnect: Smart Junction Box (SJB) C2280C. • Disconnect: Trailer Brake Control (TBC) Module . • Measure the resistance between the brake shift interlock C2008-8, circuit CCB08 (VT/WH), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A8 . **No** REPAIR circuit CCB08 (VT/WH) for short to ground. TEST the system for normal operation.
A8 TEST THE CIRCUIT FOR AN OPEN	
• Measure the resistance between the brake shift interlock C2008-8, circuit CCB08 (VT/WH) and the SJB C2280C-24, circuit CCB08 (VT/WH).  • **Is the resistance less than 5 ohms?**	**Yes** GO to A9 . **No** REPAIR circuit CCB08 (VT/WH) for an open. TEST the system for normal operation.
A9 CHECK THE CIRCUIT FOR AN OPEN	

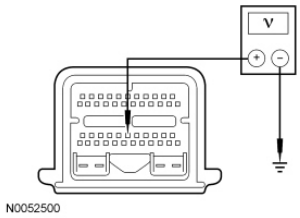
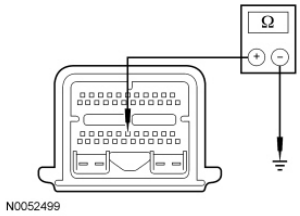
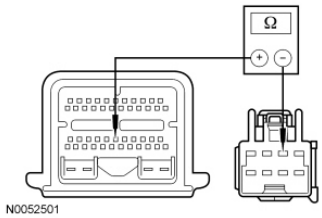
• Measure the resistance between the brake shift interlock C2008-6, circuit GD138 (BK/WH), harness side and ground.  N0039475 • **Is the resistance less than 5 ohms?**	**Yes** GO to A10 . **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
A10 CHECK THE CIRCUITS FOR AN OPEN	
• Disconnect: Brake Shift Interlock Actuator (BSIA) Module Connector. • Measure the resistance between the brake shift interlock C2008, component side, and the BSIA module connector using the following table: **Brake Shift Interlock** / **Circuit** / **BSIA Module** C2008-1 / CBP20 (YE/VT) / Connector pin 6 C2008-2 / CET34 (BN/GN) / Connector pin 7 C2008-6 / GD138 (BK/WH) / Connector pin 2 C2008-8 / CCB08 (VT/WH) / Connector pin 5 • **Are all the measurements less than 5 ohms?**	**Yes** GO to A11 . **No** REPAIR circuit for open. TEST the system for normal operation.
A11 CHECK THE BSIA	
• Disconnect: BSIA . • Measure the resistance between pin 1 and pin 3 of the BSIA .  N0049273 • **Is the resistance between 20 and 30 ohms?**	**Yes** INSTALL a new BSIA module. TEST the system for normal operation. **No** INSTALL a new BSIA . TEST the system for normal operation.

PINPOINT TEST B: SELECTOR LEVER IS OUT OF CORRECT GEAR RELATIONSHIP

Test Step	Result / Action to Take
B1 CHECK THE SELECTOR LEVER LINKAGE	
• Ignition ON. • Apply the brake pedal. • Gain access to the selector lever linkage. • Actuate the selector lever in all ranges. • Observe all linkages during operation. • **Is the linkage damaged?**	**Yes** INSTALL a new selector lever. TEST the system for normal operation. **No** GO to B2 .
B2 CHECK THE SELECTOR LEVER CABLE	
• Check the selector lever cable and bracket installation and tightness. • **Is the selector lever cable correctly installed and adjusted?**	**Yes** VERIFY the selector lever cable adjustment. REFER to Selector Lever Cable Adjustment - 6R80 or Selector Lever Cable Adjustment - 5R55S in this section. ADJUST the selector lever cable if necessary. VERIFY the Transmission Range (TR) sensor for correct adjustment. REFER to Section 307-01A . ADJUST the TR sensor if necessary. GO to B3 . **No** REPAIR as necessary. TEST the system for normal operation.
B3 CHECK THE SELECTOR LEVER LINKAGE/CABLE FOR CORRECT GEAR RELATIONSHIP	
• Apply the brake pedal. • Actuate the selector lever in all ranges. • **Does the indicator match the gear selection?**	**Yes** System OK. TEST the system for normal operation. **No** REFER to Selector Lever Cable Adjustment - 6R80 or Selector Lever Cable Adjustment - 5R55S in this section. TEST the system for normal operation.

PINPOINT TEST C: TCS IS NOT OPERATING CORRECTLY

Test Step	Result / Action to Take
C1 CHECK THE TCS CIRCUIT FOR VOLTAGE	
• Disconnect: PCM C175B. • Inspect for damaged or pushed-out terminals, corrosion or loose wires. Repair as necessary. • Ignition ON. • Measure the voltage between PCM C175B-29, circuit CET34 (BN/GN) and ground while cycling the Transmission Control Switch (TCS) several times.	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** GO to C2 .

 N0052500 • **Does the voltage cycle?**	
C2 CHECK THE CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Brake Shift Interlock C2008. • Inspect for damaged, pushed-out terminals or loose wires. Repair as necessary. • Measure the resistance between PCM C175B-29, circuit CET34 (BN/GN) and ground.  N0052499 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C3 . **No** REPAIR circuit CET34 (BN/GN) for a short to ground. TEST the system for normal operation.
C3 CHECK THE CIRCUIT FOR AN OPEN	
• Measure the resistance between PCM C175B-29, circuit CET34 (BN/GN) and the brake shift interlock C2008-2, harness side.  N0052501 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new TCS . RECONNECT all components. TEST the system for normal operation. **No** REPAIR open in circuit CET34 (BN/GN). RECONNECT all components. TEST the system for normal operation.

Brake Shift Interlock Override

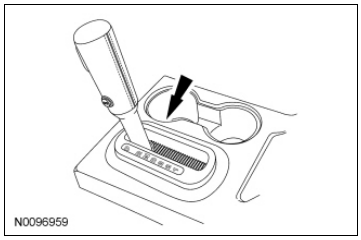
NOTE: If it is necessary to use the Brake Shift Interlock Actuator (BSIA) override procedure to move the selector lever out of the PARK position, it is possible that a fuse has blown and the brake lights are not operational. Before driving the vehicle, verify that the brake lights are working.

This vehicle is equipped with a BSIA feature that prevents the selector lever from being moved out of the PARK position when the ignition is in the ON position until the brake pedal is applied.

If the selector lever cannot be moved out of the PARK position when the ignition is in the ON position and the brake pedal is applied:

1. Apply the park brake and remove the ignition key.

2. Remove the cup holder and locate the access cap and remove.



3. Using a suitable tool, press the brake shift interlock override mechanism on the selector lever assembly, apply the brake pedal, press the button on the selector lever knob and move the selector lever into NEUTRAL.

4. Insert the ignition key into the ignition and start the vehicle.

5. To install, reverse the procedure.

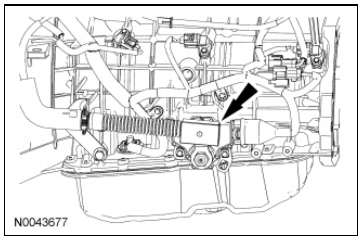
Selector Lever Cable Adjustment - 5R55S

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Place the selector lever in the PARK position.

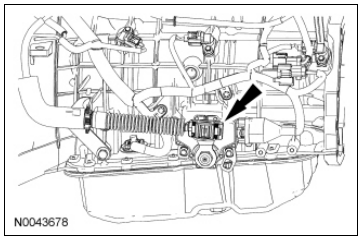
3. Move the selector lever 3 detents. This should be the (D) position.

4. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the boot, then sliding the selector lever cable shield away from the boot.

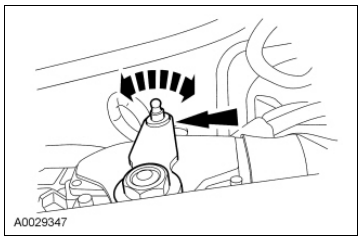


5. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

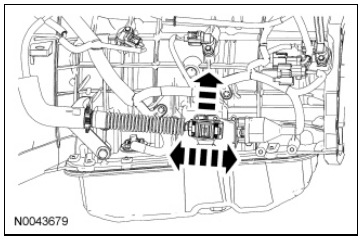
   Disconnect the selector lever cable end from the manual control lever.



6. Rotate the manual control lever clockwise until the travel stops. Then rotate the manual control lever counterclockwise 3 detents. This should be the (D) position.



7. With the selector lever cable end disconnected, unlock the tab on the selector lever cable end by sliding it up.

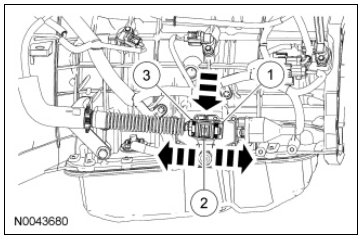


8. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the manual control lever.

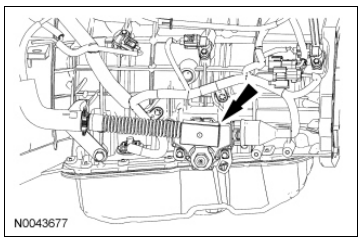
   Carry out the following adjustments on the selector lever cable end and install the selector lever cable end onto the manual control lever:

   1. Make sure that the selector lever cable end slides forward and backward.
   2. Connect the selector lever cable end onto the manual control lever.
   3. Lock the selector lever cable end into place by pressing the lock tab down.



9. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install and secure the selector lever cable shield.



10. Verify that the engine will start in PARK and NEUTRAL. Verify that the reverse lamps will illuminate in the REVERSE position. If not, check the adjustment of the Transmission Range (TR) sensor. For additional information on the TR sensor adjustment, refer to Section 307-01A .

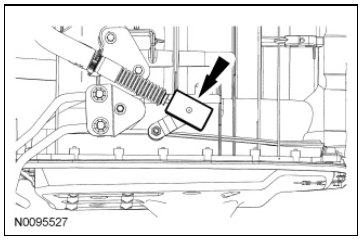
Selector Lever Cable Adjustment - 6R80

1. With the vehicle in NEUTRAL, position the vehicle on a hoist. For additional information, refer to Section 100-02 .

2. Place the selector lever in the PARK position.

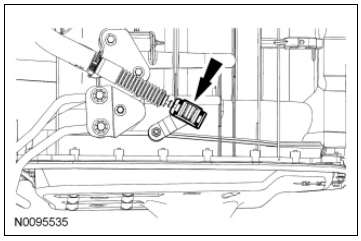
3. Move the selector lever 3 detents. This should be the (D) position.

4. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the boot, then sliding the shield away from the boot.

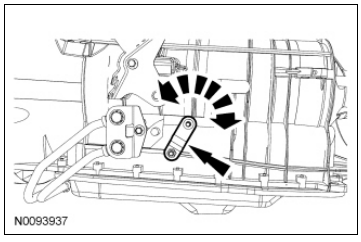


5. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

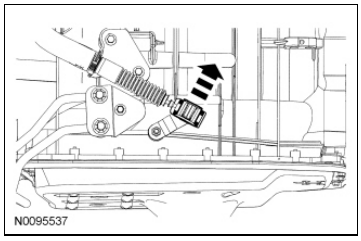
   Disconnect the selector lever cable from the manual control lever.



6. Rotate the manual control lever clockwise until the travel stops. Then rotate the manual control lever counterclockwise 3 detents. This should be the (D) position.



7. With the selector lever cable end disconnected, unlock the tab on the selector lever cable end by sliding it up.

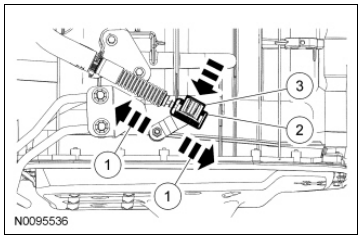


8. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the manual control lever.

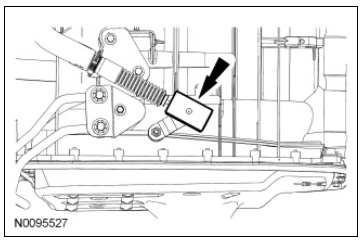
   Carry out the following adjustments on the selector lever cable end and install the selector lever cable end onto the manual control lever:

   1. Make sure that the selector lever cable end slides forward and backward.
   2. Connect the selector lever cable end onto the manual control lever.
   3. Lock the selector lever cable end into place by pressing the lock tab down.

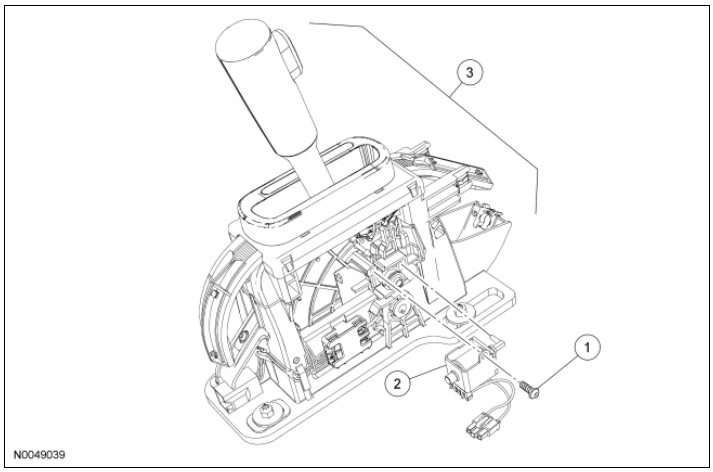


9. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install and secure the selector lever cable shield.



Brake Shift Interlock Actuator

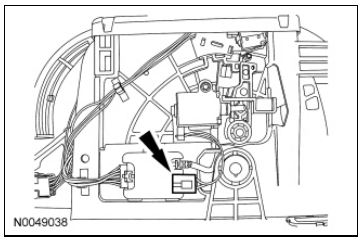


Item	Part Number	Description
1	-	Brake Shift Interlock Actuator (BSIA) screw (part of 7210)
2	7E096	BSIA
3	7210	Selector lever

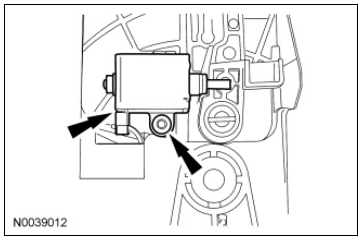
Removal

1. Remove the front floor console. For additional information, refer to Section 501-12 .

2. Disconnect the Brake Shift Interlock Actuator (BSIA) electrical connector.

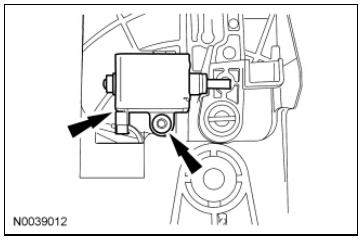


3. Remove the screw and the BSIA .

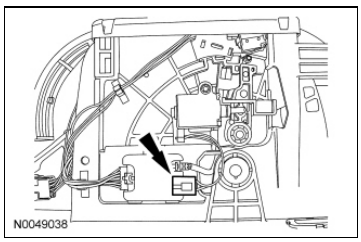


Installation

1. Install the BSIA and the screw.



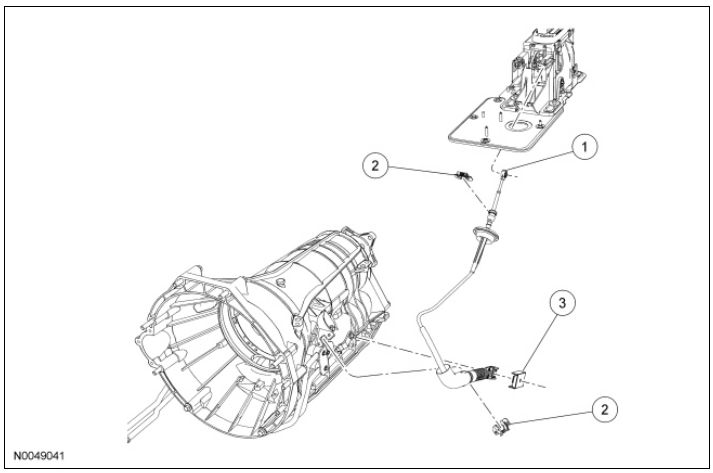
2. Connect the BSIA electrical connector.



3. Install the front floor console. For additional information, refer to Section 501-12 .

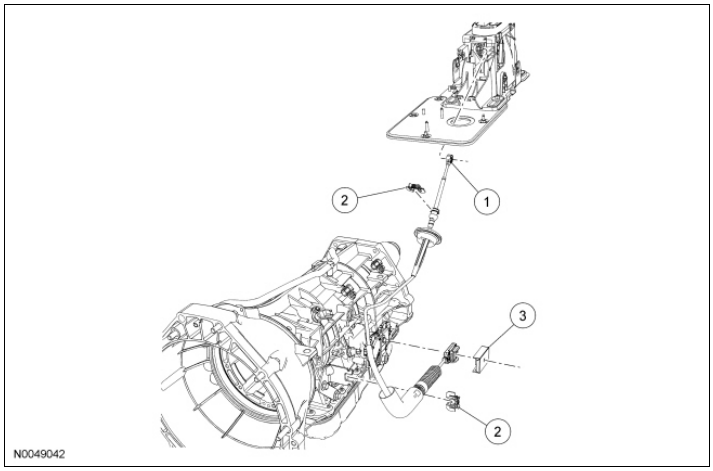
Selector Lever Cable

Vehicles Equipped With a 6R80 Transmission



Item	Part Number	Description
1	7E395	Selector lever cable
2	7H181	Selector lever-to-cable clips
3	7A434	Selector lever cable shield

Vehicles Equipped With a 5R55S Transmission



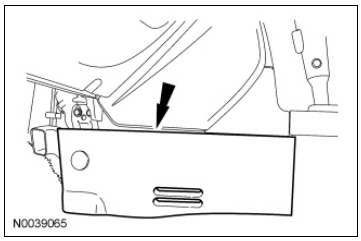
Item	Part Number	Description
1	7E395	Selector lever cable
2	7H181	Selector lever-to-cable clips
3	7A434	Selector lever cable shield

Removal

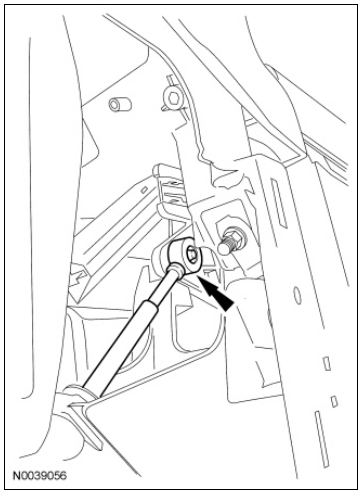
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

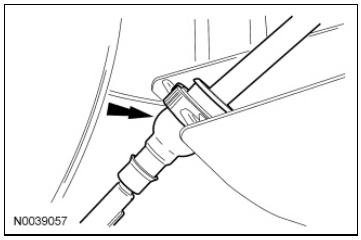
2. Remove the front floor console left side panel.



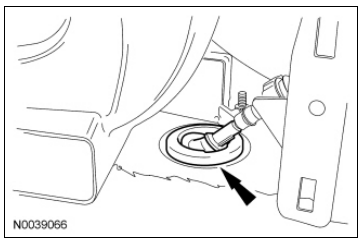
3. With the selector lever in PARK, remove the selector lever cable from the selector lever.



4. Remove the selector lever cable from the selector lever housing.

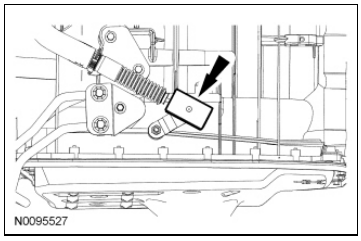


5. Pull the selector lever cable and grommet through the floorpan.



Vehicles equipped with a 6R80 transmission

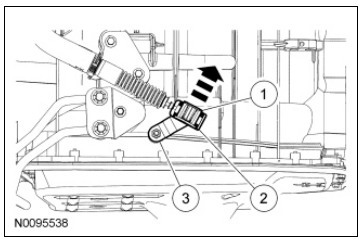
6. Remove the selector lever cable shield by prying on the selector lever shield closest to the boot, then sliding the shield away from the boot.



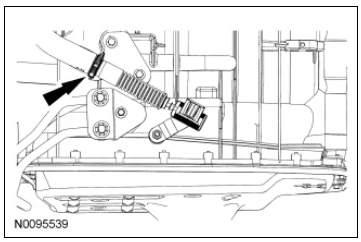
7. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   Unlock the lock tab and disconnect the selector lever cable end from the manual control lever.

   1. Lock tab.
   2. Selector lever cable end.
   3. Manual control lever.

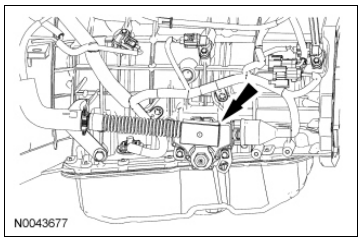


8. Disconnect the selector lever cable from the selector lever cable bracket and remove the selector lever cable.



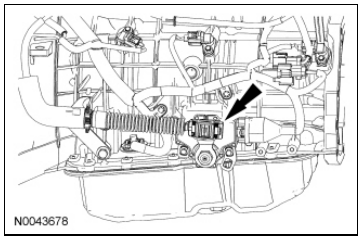
Vehicles equipped with a 5R55S transmission

9. Remove the selector lever cable shield by prying on the side of the selector lever cable shield closest to the boot, then sliding the shield away from the boot.

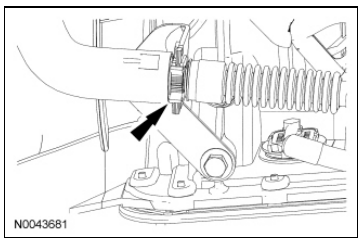


10. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

    Unlock the lock tab and disconnect the selector lever cable end from the manual control lever.



11. Disconnect the selector lever cable from the bracket and remove the selector lever cable.



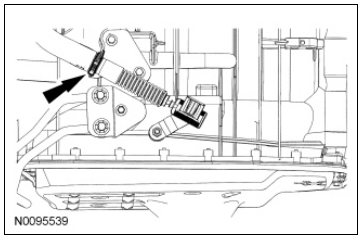
Installation

Vehicles equipped with a 6R80 transmission

1. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the manual control lever.

   Install the selector lever cable into the selector lever cable bracket.

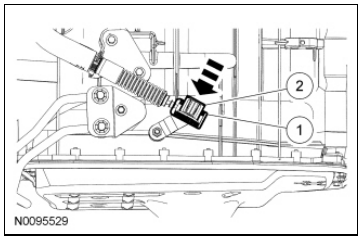


2. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the manual control lever.

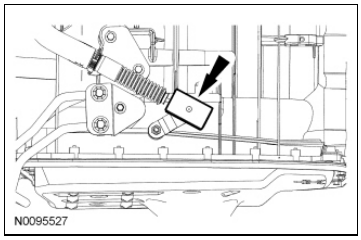
   Install the selector lever cable end onto the manual control lever and lock the tab.

   1. Selector lever cable end.
   2. Lock tab.



3. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install and secure the selector lever cable shield.

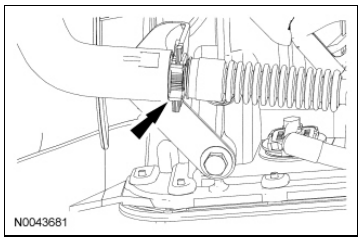


Vehicles equipped with a 5R55S transmission

4. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the manual control lever.

   Install the selector lever cable into the selector lever cable bracket.

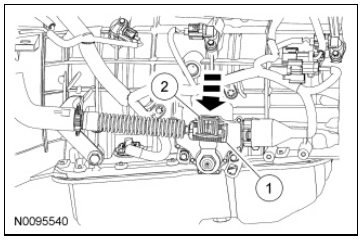


5. ***NOTICE:*** **To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.**

   NOTE: When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the manual control lever. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the manual control lever.

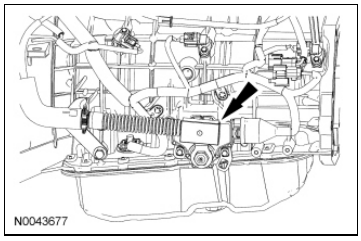
   Install the selector lever cable end onto the manual control lever and lock the tab.

   1. Selector lever cable end.
   2. Lock tab.



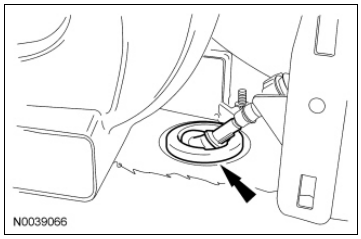
6. **NOTE:** If the selector lever cable shield is loose on the selector lever cable, install a new selector lever cable shield.

   Install and secure the selector lever cable shield.

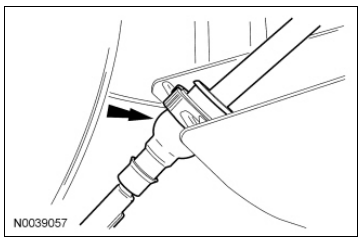


All vehicles

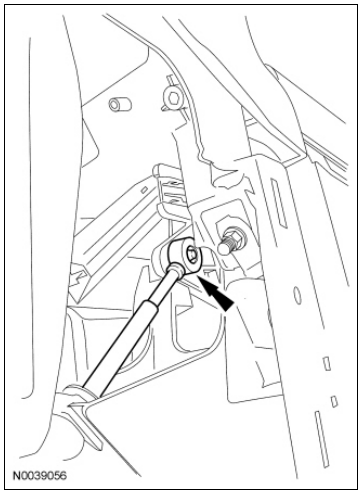
7. Push the selector lever cable and grommet through the floorpan.



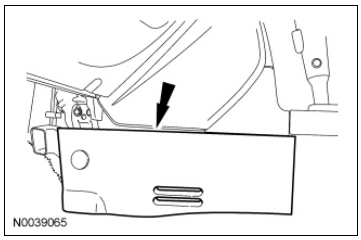
8. Install the selector lever cable onto the selector lever housing.



9. Install the selector lever cable onto the selector lever.

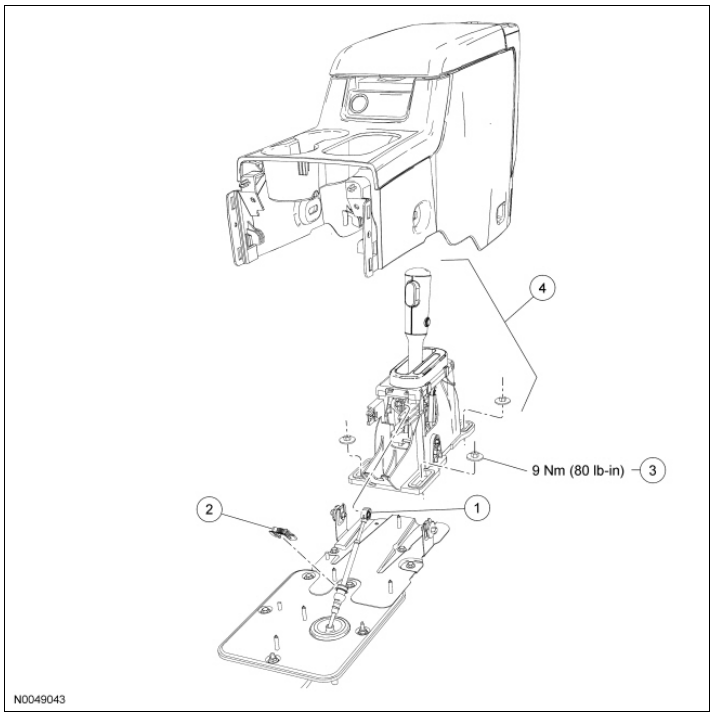


10. Install the front floor console left side panel.



11. Verify the engine will start in PARK and NEUTRAL and the reversing lamps illuminate in REVERSE. If not, readjust the selector lever cable. For additional information, refer to Selector Lever Cable Adjustment - 5R55S or Selector Lever Cable Adjustment - 6R80 in this section.

Selector Lever

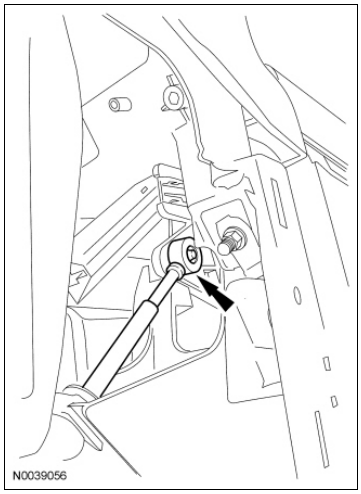


Item	Part Number	Description
1	7E395	Selector lever cable
2	7H181	Selector lever-to-cable clip
3	W710618	Selector lever housing nut
4	7210	Selector lever assembly

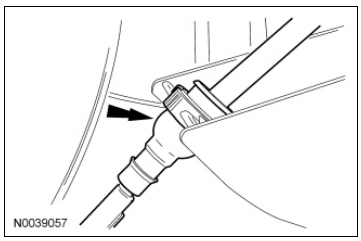
Removal

1. Remove the front floor console. For additional information, refer to Section 501-12 .

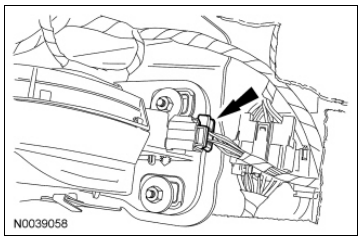
2. Disconnect the selector lever cable from the selector lever.



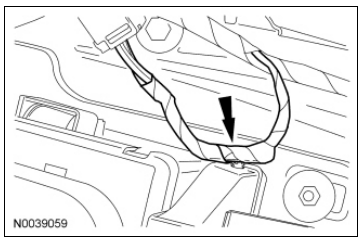
3. Disconnect the selector lever cable from the selector lever housing.



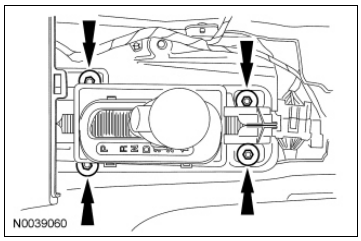
4. Disconnect the selector lever housing electrical connector.



5. Disconnect the wiring harness from the selector lever housing.

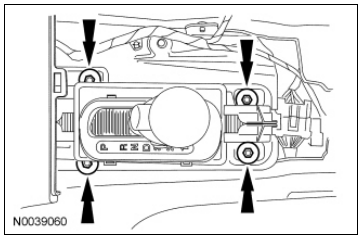


6. Remove the 4 nuts and remove the selector lever housing from the vehicle.

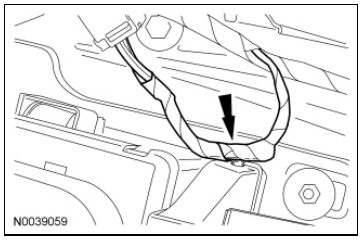


Installation

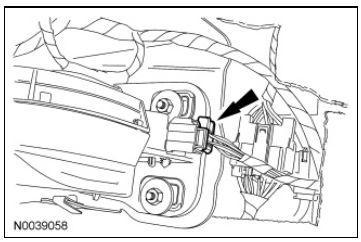
1. Install the selector lever housing.
   - Tighten to 9 Nm (80 lb-in).



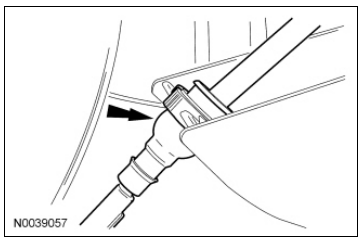
2. Connect the wiring harness to the selector lever housing.



3. Connect the selector lever housing electrical connector.

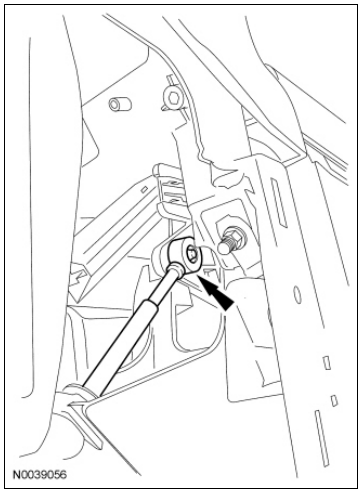


4. Install the selector lever cable onto the selector lever housing.



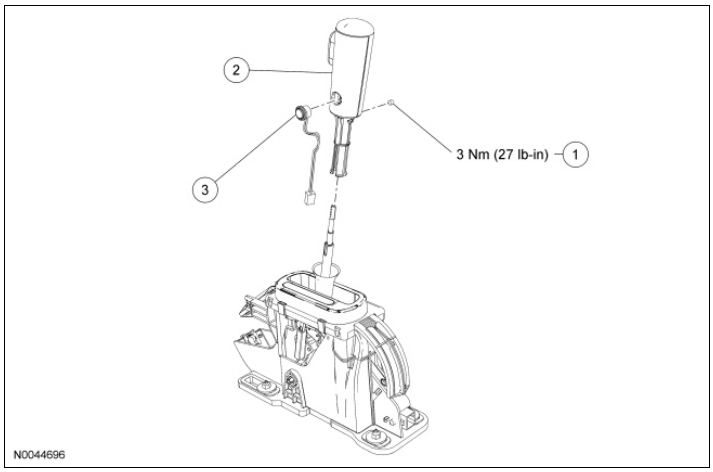
5. **NOTE:** When installing the selector lever cable end, make sure that the selector lever cable end is correctly installed onto the selector housing. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed onto the selector lever housing.

   Install the selector lever cable end onto the selector lever housing.



6. Install the front floor console. For additional information, refer to Section 501-12 .

Transmission Control (TC) Switch



Item	Part Number	Description
1	-	Selector lever knob set screw
2	7213	Selector lever knob
3	7G550	Transmission Control Switch (TCS)

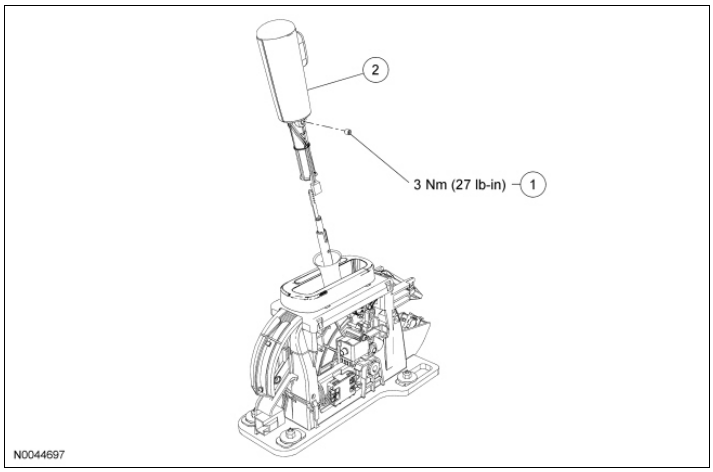
Removal

1. Remove the selector lever knob. For additional information, refer to Selector Lever Knob in this section.
2. Remove the Transmission Control Switch (TCS) from the knob.

Installation

1. Install the TCS into the selector lever knob.
2. Install the selector lever knob. For additional information, refer to Selector Lever Knob in this section.

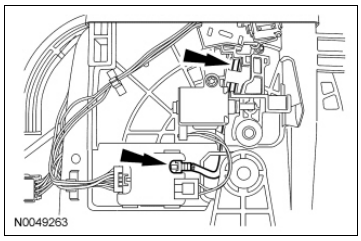
Selector Lever Knob



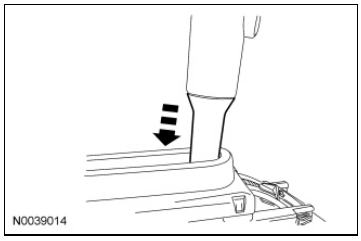
Item	Part Number	Description
1	-	Selector lever knob set screw
2	7213	Selector lever knob

Removal

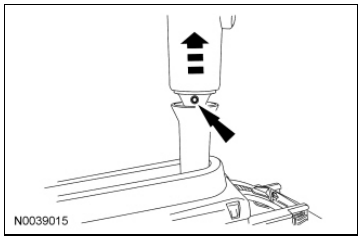
1. Remove the front floor console. For additional information, refer to Section 501-12 .
2. Disconnect the Transmission Control Switch (TCS) electrical connector and feed the wire through the selector lever housing.



3. Slide the selector lever knob lower trim cover downward.



4. Remove the set screw and remove the selector lever knob while routing the TCS harness out of the selector lever housing.

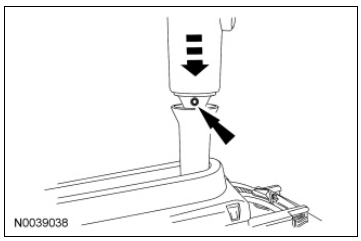


Installation

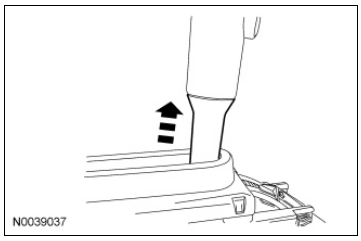
1. ***NOTICE:*** **Do not overtighten the set screw or damage to the selector lever knob may occur.**

   Install the selector lever knob and set screw while routing the TCS harness through the selector lever housing.

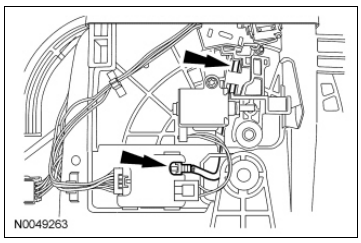
   - Tighten to 3 Nm (27 lb-in).



2. Slide the selector lever knob lower trim cover upward.

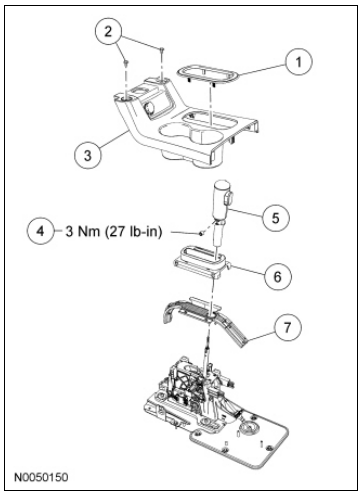


3. Feed the wire through the selector lever housing and connect the TCS electrical connector.



4. Install the front floor console. For additional information, refer to Section 501-12 .

Selector Lever Bezel

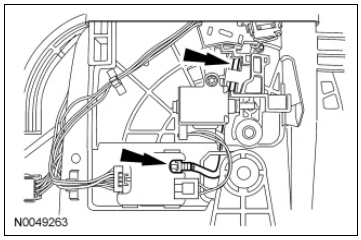


Item	Part Number	Description
1	061A16	Selector lever bezel ring
2	W705796	Front floor console center finish panel screws
3	78045B44	Front floor console center finish panel
4	-	Selector lever knob set screw
5	7213	Selector lever knob
6	7D443	Selector lever bezel
7	7C444	Selector lever housing slider

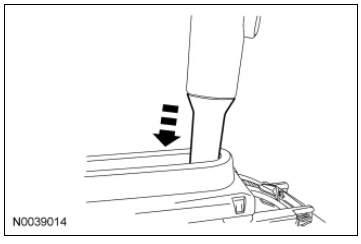
Removal

1. Remove the front floor console. For additional information, refer to Section 501-12 .

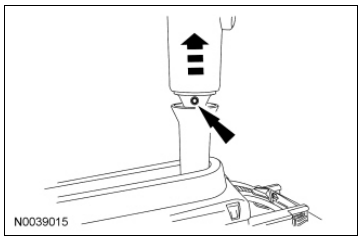
2. Disconnect the Transmission Control Switch (TCS) electrical connector and feed the wire through the selector lever housing.



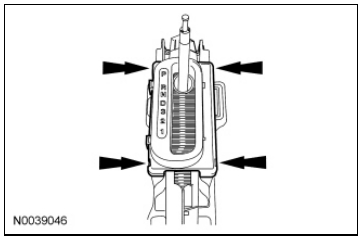
3. Slide the selector lever knob lower trim cover downward.



4. Remove the set screw and remove the selector lever knob while routing the TCS harness out of the selector lever housing.

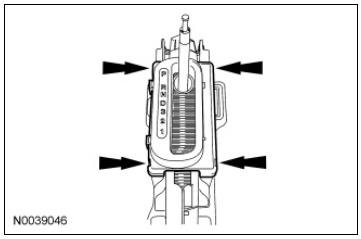


5. Remove the selector lever bezel from the selector lever housing.



Installation

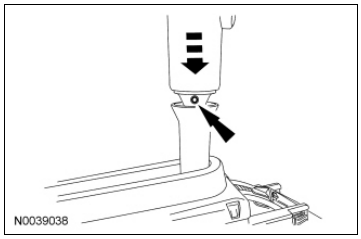
1. Install the selector lever bezel onto the selector lever housing.



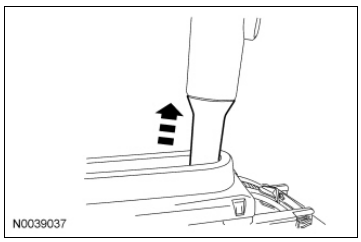
2. ***NOTICE:*** **Do not overtighten the set screw or damage to the selector lever knob may occur.**

   Install the selector lever knob and set screw while routing the TCS harness through the selector lever housing.

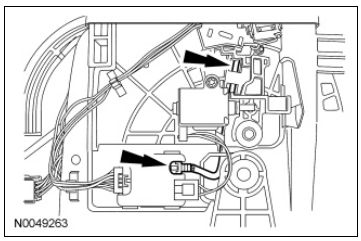
   - Tighten to 3 Nm (27 lb-in).



3. Slide the selector lever lower trim cover upward.



4. Feed the wire through the selector lever housing and connect the TCS electrical connector.



5. Install the front floor console. For additional information, refer to Section 501-12 .

Material

Item	Specification	Fill Capacity
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-

Torque Specifications

Description	Nm	lb-in
Transfer case shift motor bolts	10	89
Transfer case shift motor heat shield bolts	16	142

Four Wheel Drive (4WD) Systems

There are 3 types of Four-Wheel Drive (4WD) operating systems:

- All-Wheel Drive (AWD)
- 1-speed torque-on-demand
- 2-speed torque-on-demand

All-Wheel Drive (AWD)

The AWD system utilizes the following components:

- Transfer case
- Differential (internal to the transfer case)

1-Speed Torque-On-Demand

The 1-speed torque-on-demand system utilizes the following components:

- Transfer case
- Electromagnetic clutch (internal to the transfer case)
- 4X4 control module
- Message center, used to select between AUTO and LOCKED modes.

2-Speed Torque-On-Demand

The automatic 4WD system is a 2-speed torque-on-demand design that utilizes the following components:

- Transfer case
- Electromagnetic clutch (internal to the transfer case)
- 4X4 control module
- Mode Select Switch (MSS), used to select between 4X4 AUTO, 4X4 HIGH and 4X4 LOW modes
- Transfer case shift motor
- Encoder assembly (part of the transfer case shift motor)
- Shift motor sense plate (part of the encoder assembly)

Four Wheel Drive (4WD) Systems - All Wheel Drive (AWD)

Principles of Operation

The automatic, All-Wheel Drive (AWD) transfer case has no external controls. A 2-piece aluminum case houses the assembly. The unit is chain-driven. A differential provides torque to the front and rear transfer case outputs. The differential transmits torque at the ratio of 40% to the front output and 60% to the rear output.

Torque flows through the input shaft to the front planetary gear assembly and then outward to the ring gear and upper output shaft. Torque also flows through the front planetary gear assembly to the overdrive sun gear outward to the upper drive sprocket. The torque flow continues from the upper drive sprocket through the drive chain to the lower drive sprocket and then to the front output shaft. The differential provides the connection between the ring gear and the overdrive sun gear.

Inspection and Verification - All-Wheel Drive (AWD)

1. **NOTE:** Driving habits as well as road and weather conditions should be noted.

   Road test the vehicle to verify the concern, noting the road speed, engine speed and speed range where the vehicle problem is evident.

2. Raise the vehicle on the hoist and position suitable safety floor stands under the vehicle. Refer to Section 100-02 .

3. Run the vehicle at the road speed where the concern exists. Verify the concern:
   - Engine
   - Transmission
   - Front/rear driveline components
   - Front/rear drive axles
   - Front/rear brake systems
   - Front/rear wheels or tires
   - Transfer case

4. Refer to the appropriate Owner's Literature for operating data. Verify the concern as driveline or torsional windup before repairing the transfer case.

5. Check the tires and vehicle load if the problem is clearly driveline windup and not broken parts.

6. If the concern is not visually evident, GO to Symptom Chart - All Wheel Drive (AWD) or GO to Symptom Chart - NVH .

Symptom Chart - All-Wheel Drive (AWD)

Symptom Chart - All-Wheel Drive (AWD)

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

Condition	Possible Sources	Action
• Transfer case whine - noise at all ranges	• Incorrect fluid level or fluid quality	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to Section 308-07B .
	• Worn oil pump	• DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
	• Under-inflated or oversized tires	• CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
• Transfer case growl/rumble - noise at all ranges	• Damaged or worn bearings or planetary gear	• DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case scraping/grating - noise at all ranges	• Excessively stretched drive chain hitting the case	• DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case howl/hum - noise at all ranges or 4X4 only	• Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	• DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to Section 308-07B .

Four Wheel Drive (4WD) Systems - 1-Speed Torque-On-Demand

Special Tool(s)

 ST2574-A	Flex Probe Kit 105-R025D or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The 1-speed torque-on-demand transfer case modes are controlled through the 4X4 control module.

The modes are:

- All-Wheel Drive (AWD) AUTO - torque is supplied to the front and rear driveshafts as needed to maintain traction. AWD AUTO mode can be changed to AWD LOCKED mode by pressing the message center SETUP button; the message AUTO will be selected, press RESET within 4 seconds, then the message LOCKED will be selected and the 4X4 indicator will be illuminated.
- AWD LOCKED - torque is supplied to the front and rear driveshafts constantly and the 4X4 indicator will stay illuminated in the Instrument Cluster (IC). This mode is not recommended for use on dry pavement or hard surfaces. AWD LOCKED mode can be changed to AWD AUTO mode by pressing the message center SETUP button; the message LOCKED will be selected, press RESET within 4 seconds, the message AUTO will be selected and the 4X4 indicator will turn off.

If the transfer case begins to overheat, the system will default to the AUTOLOCK mode. The 4X4 indicator will illuminate in the IC . This condition may clear without any action being taken by the driver. The 4X4 indicator will turn off when the system cools down.

When a problem is detected in the AWD system, the powertrain Malfunction Indicator Lamp (MIL) (wrench indicator) in the IC will illuminate.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Axle shafts and CV joints • Driveshaft and U-joints • Fluid leaks • Matching tire sizes	• Battery Junction Box (BJB) fuses: ♦ 23 (20A) ♦ 26 (20A) • Smart Junction Box (SJB) fuse 18 (10A) • 4X4 control module • Wiring harness • Connector(s) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. **NOTE:** Before carrying out the self-test, make sure that:

   - the ignition is in RUN.
   - all doors are closed.
   - the brake pedal is not pressed.
   - the transmission is not in NEUTRAL.

   Clear the CMDTCs and carry out the self-test diagnostics for the 4X4 control module.

9. If the DTCs retrieved are related to the concern, go to the 4X4 Control Module DTC Chart in this section. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Four Wheel Drive (4WD) or GO to Symptom Chart - NVH .

4X4 Control Module DTC Chart

DTC	Description	Action
B1317	Battery Voltage High	GO to Pinpoint Test A .
B1318	Battery Voltage Low	GO to Pinpoint Test A .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the 4X4 control module self-test. If DTC B1342 is retrieved, INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.
B1555	Ignition Run/Start Circuit Failure	GO to Pinpoint Test B .
P1824	4-Wheel Drive Clutch Relay Circuit Failure	GO to Pinpoint Test C .
P1825	4-Wheel Drive Clutch Relay Open Circuit	GO to Pinpoint Test C .
P1826	4-Wheel Drive Low Clutch Relay Circuit to Battery	GO to Pinpoint Test C .
P1827	4-Wheel Drive Low Clutch Relay Circuit to Ground	GO to Pinpoint Test C .
U1900	CAN Communication BUS Fault - Receive Error	**NOTE:** Do not install a new 4X4 control module as part of repair for 4X4 control module DTC U1900 fault. The 4X4 control module is not the source of the fault when DTC U1900 is present. CARRY OUT the network test to identify the module the 4X4 control module lost communication with. REFER to Section 418-00 to diagnose the module communication.
U2023	Fault Received From External Node	REFER to Section 206-09 to diagnose the wheel speed sensor fault.
U2050	No Application Present	REFER to Section 418-01 .

Symptom Chart - Four-Wheel Drive (4WD)

Symptom Chart - Four-Wheel Drive (4WD)

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for

the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

Condition	Possible Sources	Action
• Transfer case whine - noise at all ranges	• Incorrect fluid level or fluid quality	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to Section 308-07B .
	• Worn oil pump	• DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
	• Under-inflated or oversized tires	• CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
• Transfer case growl/rumble - noise at all ranges	• Damaged or worn bearings or planetary gear	• DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case scraping/grating - noise at all ranges	• Excessively stretched drive chain hitting the case	• DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
• Transfer case howl/hum - noise at all ranges or 4X4 only	• Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	• DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to Section 308-07B .

Pinpoint Tests

Pinpoint Test A: DTC B1317/B1318

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

If the 4X4 control module observes an overpower or underpower voltage condition, DTCs are set and the 4X4 control module may not allow Four-Wheel Drive (4WD) operation.

- DTC B1317 (Battery Voltage High) - When the 4X4 control module detects battery voltage greater than 16 volts for at least 10 seconds, this DTC is set.
- DTC B1318 (Battery Voltage Low) - When the 4X4 control module detects battery voltage less than 9 volts for at least 10 seconds, with the engine running at 1,500 rpm or greater, this DTC is set.

This pinpoint test is intended to diagnose the following:

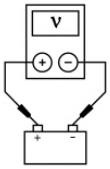
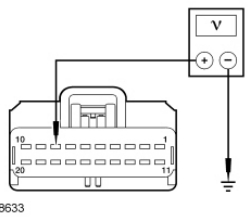
- Fuses
- Wiring, terminals or connectors
- 4X4 control module

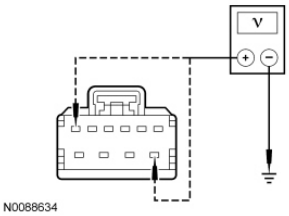
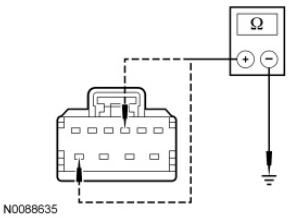
PINPOINT TEST A: DTC B1317/B1318

NOTE: DTC B1317 or B1318 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

NOTE: Carry out a thorough inspection and verification before proceeding with the pinpoint test. Refer to Inspection and Verification in this section.

Test Step	Result / Action to Take
A1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - All CMDTCs . • **Is B1317 or B1318 present in one or more modules AND P0563, P0620, P0625, P0626 or P065B present in the PCM?**	**Yes** REFER to Section 414-00 for diagnosis of the battery and charging system. **No** GO to A2 .
A2 CHECK BATTERY CONDITION	
• Ignition OFF. • Refer to Section 414-01 and carry out the Battery - Condition Test in the Diagnosis and Testing portion of this section. • **Does the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). TEST the system for normal operation. If the battery passed the condition test and did not require a recharge, GO to A3 . **No** INSTALL a new battery. REFER to Section 414-01 . CLEAR all CMDTCs . TEST the system for normal operation.
A3 CHECK THE CHARGING SYSTEM	

VOLTAGE	
NOTE: Do not allow the engine rpm to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine rpm has gone above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Start the engine. • Measure the voltage of the battery: ♦ For DTC B1317, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes. ♦ For DTC B1318, turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes.  AJ0210-A • **Is the battery voltage between 13-15.2 volts?**	**Yes** For DTC B1318, GO to A4 . For DTC B1317, INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR all CMDTCs . REPEAT the self-test. **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation.
A4 CHECK POWER TO 4X4 CONTROL MODULE	
• Ignition OFF. • Disconnect: 4X4 Control Module C281A and C281B. • Ignition ON. • Measure the voltage between 4X4 control module C281A-8, circuit CBP18 (GY/OG), harness side and ground.  N0088633 • Measure the voltage between 4X4 control module C281B-6, circuit SBB23 (WH/RD), harness side and ground; and between 4X4 control module C281B-7, circuit SBB26 (YE/RD), harness side and ground.	**Yes** GO to A5 . **No** VERIFY the Smart Junction Box (SJB) fuse18 (10A) and Battery Junction Box (BJB) fuse(s) 23 (20A) and 26 (20A) are OK, REPAIR the circuit in question. If SJB and BJB fuse(s) are not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR all CMDTCs . REPEAT the self-test.

 • **Is the voltage greater than 10 volts?**	
A5 CHECK GROUND CIRCUITS TO 4X4 CONTROL MODULE FOR AN OPEN	
• Ignition OFF. • Measure the resistance between 4X4 control module C281B-3, circuit GD145 (BK/BU), harness side and ground; and between 4X4 control module C281B-10, circuit GD138 (BK/WH) harness side and ground. ♦ Repeat this measurement while wiggling the harness.  • **Is the resistance less than 5 ohms?**	**Yes** GO to A6 . **No** REPAIR the circuit. CLEAR all CMDTCs . REPEAT the self-test.
A6 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
• Ignition OFF. • Check the harness and component side connectors for: ♦ corrosion. ♦ pushed-out/bent pins. • Connect the 4X4 control module and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR all CMDTCs . REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all CMDTCs . REPEAT the self-test.

Pinpoint Test B: DTC B1555

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The 4X4 control module receives ignition switch position status from the hard-wired run/start input to 4X4 control module pin 8 and the ignition switch position status message is communicated by the Instrument Cluster (IC) over the High Speed Controller Area Network (HS-CAN). The ignition switch position status message originates from the Smart Junction Box (SJB) which communicates the ignition switch position

status over the Medium Speed Controller Area Network (MS-CAN) to the IC which acts as a gateway module, transferring the ignition switch status message from MS-CAN to HS-CAN . For information regarding network messaging, refer to Section 418-00 .

- DTC B1555 (Ignition Run/Start Circuit Failure) - If the ignition switch is not in RUN for the self-test, this code will set.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Ignition switch and/or circuitry
- HS-CAN

PINPOINT TEST B: DTC B1555

Test Step	Result / Action to Take
B1 CARRY OUT NETWORK TEST	
• Ignition ON. • Connect the scan tool. • Carry out a network test. • **Did the network test pass?**	**Yes** GO to B2 . **No** REFER to Section 418-00 to diagnose the network concern.
B2 CHECK 4X4 INDICATOR PROVE-OUT	
• Carry out the 4X4 control module self-test. • **Are any 4X4 control module DTCs present?**	**Yes** For DTC B1555, GO to B3 . For all other DTCs, REFER to the 4X4 Control Module DTC Chart in this section. **No** The system is functioning correctly.
B3 CHECK THE 4X4 CONTROL MODULE IGNITION SWITCH STATUS PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S) ♦ Ignition Switch - Run Position (IGN_R)	**Yes** The system is functioning correctly. **No** If the IGN_R/S PID did not match, CHECK SJB fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the self-test. If the IGN_O/U, IGN_A, IGN_S or IGN_R PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.

• **Do the ignition switch PIDs match the ignition switch positions?**	

Pinpoint Test C: The Vehicle Does Not Shift Between All-Wheel Drive (AWD) AUTO and AWD LOCKED Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of All-Wheel Drive (AWD) selection from the message center. The 4X4 control module then controls the electric clutch. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

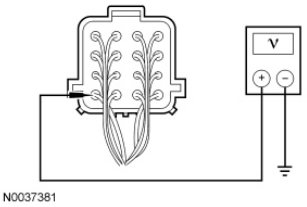
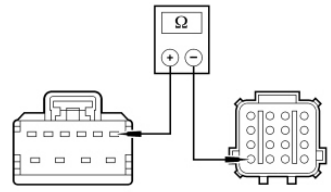
DTC Description	Fault Trigger Condition
• P1824 - 4-Wheel Drive Clutch Relay Circuit Failure	Short to ground on clutch output line sensed by 4X4 control module C281B pin 1 or overtemperature condition on clutch coil circuit detected.
• P1825 - 4-Wheel Drive Clutch Relay Open Circuit	Open circuit on clutch output line sensed by 4X4 control module C281B pin 1.
• P1826 - 4-Wheel Drive Low Clutch Relay Circuit to Battery	Short to battery on clutch output line sensed by 4X4 control module C281B pin 1.
• P1827 - 4-Wheel Drive Low Clutch Relay Circuit to Ground	Short to ground on clutch output line sensed by 4X4 control module C281B pin 1.

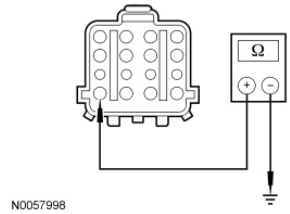
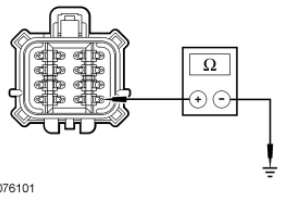
This pinpoint test is intended to diagnose the following:

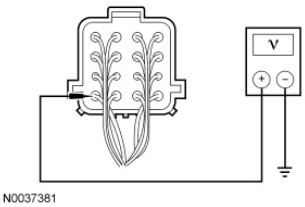
- 4X4 indicator
- Transfer case
- 4X4 control module
- Wiring, terminals or connectors
- Transfer case clutch
- Ignition switch and/or circuitry
- High Speed Controller Area Network (HS-CAN)
- Instrument Cluster (IC)

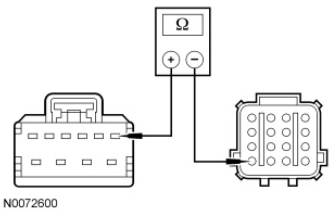
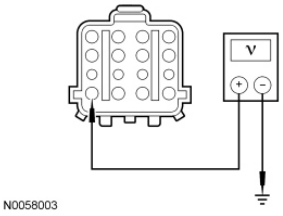
PINPOINT TEST C: THE VEHICLE DOES NOT SHIFT BETWEEN ALL-WHEEL DRIVE (AWD) AUTO AND AWD LOCKED CORRECTLY

Test Step	Result / Action to Take
C1 CHECK 4X4 INDICATOR PROVE-OUT	
• Ignition OFF. • Start the vehicle while observing the 4X4 indicator prove-out. • **Did the 4X4 indicator prove out?**	**Yes** GO to C2 . **No** CHECK the IC for faults. REFER to Section 413-01 . TEST the system for normal operation.
C2 CHECK THE POWERTRAIN MIL	
• Start the engine. • Observe the powertrain Malfunction Indicator Lamp (MIL). • **Does the powertrain MIL illuminate?**	**Yes** GO to C3 . **No** GO to C4 .
C3 CARRY OUT THE SELF-TEST	
• Enter the following diagnostic mode on the scan tool: Self Test - 4X4 Control Module. • Using the scan tool, carry out the Network Test. • **Did the 4X4 control module self-test complete and yield any DTCs?**	**Yes** GO to C4 . **No** If no communication, REFER to Section 418-00 to diagnose no communication with the 4X4 control module. CHECK the IC for faults. REFER to Section 413-01 . TEST the system for normal operation.
C4 CHECK FOR 4X4 INDICATOR ILLUMINATION	
• Select AWD LOCKED. • **Does the 4X4 indicator illuminate?**	**Yes** GO to C5 . **No** GO to C21 .
C5 CHECK FOR WIND-UP IN AWD LOCKED MODE	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to C13 . **No** GO to C6 .
C6 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at Wide Open Throttle (WOT), with the transfer case in AWD LOCKED mode, Key ON Engine OFF (KOEO).	**Yes** GO to C7 . **No** GO to C11 .

• **Does the 4WDCPWMST PID indicate 98% clutch at WOT ?**	
C7 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN) USING THE PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND	
• Use the CLCH_SOL active command to energize the transfer case clutch to 100%. • Measure the voltage by carefully back-probing transfer case C350-16, circuit CCF03 (GY/BN), component side and ground.  N0037381 • **Is the voltage greater than 8.5 volts?**	**Yes** END the CLCH_SOL active command. GO to C10 . **No** END the CLCH_SOL active command. GO to C8 .
C8 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Transfer Case C350. • Disconnect: 4X4 Control Module C281B. • Measure the resistance between 4X4 control module C281B-1, circuit CCF03 (GY/BN), harness side and transfer case C350-16, circuit CCF03 (GY/BN), harness side.  N0072600 • **Is the resistance less than 5 ohms?**	**Yes** GO to C9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C9 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO GROUND	
• Measure the resistance between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.	**Yes** GO to C10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0057998 • **Is the resistance greater than 10,000 ohms?**	
C10 CHECK THE TRANSFER CASE CLUTCH COIL	
• Measure the resistance between transfer case C350 pin 16, circuit CCF03 (GY/BN), component side and ground.  N0076101 • **Is the resistance between 2-4 ohms?**	**Yes** The system is functioning correctly. **No** REPAIR the transfer case. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test.
C11 CHECK THE TP STATUS (TPI) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is Accelerator Pedal Position (APP) as communicated by the PCM via HS-CAN . • Slowly move the accelerator pedal from closed throttle to WOT and observe the TPI PID, KOEO . • **Does the TPI PID vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to C12 . **No** CHECK the APP sensor and/or PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. CLEAR the DTCs. REPEAT the self-test.
C12 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to C7 . **No** CHECK the ABS for faults. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test.
C13 CHECK THE 4X4 INDICATOR IN AWD AUTO MODE	
• Select AWD AUTO. • **Does the 4X4 indicator turn off?**	**Yes** GO to C14 .

	No GO to Pinpoint Test D .
C14 CHECK FOR WIND-UP IN 4X4 AUTO MODE	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to C15 . **No** The AWD drive system is operating correctly.
C15 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at closed throttle, KOEO . • **Does the 4WDCPWMST PID indicate approximately 2 to 4% clutch application at closed throttle?**	**Yes** GO to C16 . **No** GO to C19 .
C16 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN) USING THE PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND	
• Use the CLCH_SOL active command to energize the transfer case clutch to 4%. • Measure the voltage by carefully back-probing transfer case C350-16, circuit CCF03 (GY/BN), component side and ground.  N0037381 • **Is the voltage approximately 0.2-0.4 volt?**	**Yes** END the active command. CHECK the transfer case. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test. **No** END the active command. GO to C17 .
C17 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Transfer Case C350. • Disconnect: 4X4 Control Module C281B. • Measure the resistance between 4X4 control module C281B-1, circuit CCF03 (GY/BN), harness side and transfer case C350-16, circuit CCF03 (GY/BN), harness side.	**Yes** GO to C18 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0072600 • **Is the resistance less than 5 ohms?**	
C18 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO BATTERY	
• Ignition ON. • Measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.  N0058003 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.
C19 CHECK THE TP STATUS (TPI) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is APP as communicated by the PCM via HS-CAN . • Slowly move the accelerator pedal from closed throttle to WOT and observe the TPI PID, KOEO . • **Does the throttle output PID vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to C20 . **No** CHECK the APP sensor and/or PCM for faults. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. CLEAR the DTCs. REPEAT the self-test.
C20 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to C16 . **No** CHECK the ABS for faults. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test.
C21 CHECK THE IGNITION SWITCH STATUS PIDs	
	Yes GO to C22 .

• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S) ♦ Ignition Switch - Run Position (IGN_R) • **Do the ignition switch PIDs match the ignition switch positions?**	**No** If the IGN_R/S PID did not match, CHECK Smart Junction Box (SJB) fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the self-test. If the IGN_O/U, IGN_A, IGN_S or IGN_R PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.
C22 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID WITH AWD LOCKED MODE SELECTED	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID. • **Does the 4WDCPWMST PID value equal 10%?**	**Yes** CHECK the IC . REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The 4X4 Indicator Does Not Operate Correctly/Does Not Operate

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The Four-Wheel Drive (4WD) system status is transmitted to the Instrument Cluster (IC) from the 4X4 control module through the High Speed Controller Area Network (HS-CAN) to the powertrain Malfunction Indicator Lamp (MIL). A steady indicator displays if the vehicle is in All-Wheel Drive (AWD) LOCKED mode, according to the driver selection. A 4WD system fault condition will illuminate the powertrain MIL . The powertrain MIL includes other general powertrain system failures. For information about HS-CAN , refer to Section 418-00 .

This pinpoint test is intended to diagnose the following:

- IC
- 4WD system fault
- HS-CAN circuits
- 4X4 control module

PINPOINT TEST D: THE 4X4 INDICATOR DOES NOT OPERATE CORRECTLY/DOES NOT OPERATE

Test Step	Result / Action to Take
D1 CHECK THE 4X4 INDICATOR PROVE-OUT	

• Ignition ON. • Observe the 4X4 indicator in the IC . • **Does the 4X4 indicator prove out correctly?**	**Yes** GO to D2 . **No** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation.
D2 CHECK THE IGNITION SWITCH STATUS PID	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S) ♦ Ignition Switch - Run Position (IGN_R) • **Do the ignition switch PIDs match the ignition switch positions?**	**Yes** GO to D3 . **No** If the IGN_R/S PID did not match, CHECK Smart Junction Box (SJB) fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the self-test. If the IGN_O/U, IGN_A, IGN_S or IGN_R PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.
D3 CHECK FOR DTCs	
• Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to D4 .
D4 CHECK FOR INCORRECT 4X4 INDICATOR ILLUMINATION	
• Select AWD AUTO. • Observe the IC . • **Does the 4X4 indicator illuminate?**	**Yes** GO to D5 . **No** GO to D6 .
D5 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID.	**Yes** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation. **No** GO to Pinpoint Test C .

• **Does the 4WDCPWMST PID read approximately 2% at closed throttle?**	
D6 CHECK THE 4X4 INDICATOR	
• Select AWD LOCKED. • Observe the IC . • **Does the 4X4 indicator illuminate?**	**Yes** CHECK the AWD system. GO to Pinpoint Test G . **No** GO to Pinpoint Test C .

Pinpoint Test E: Straightline Driveline Wind-Up

Normal Operation

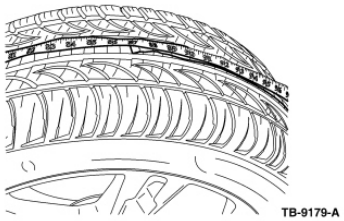
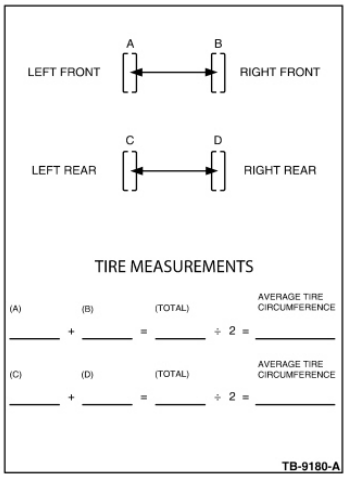
In order for the All-Wheel Drive (AWD) system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

This pinpoint test is intended to diagnose the following:
- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST E: STRAIGHTLINE DRIVELINE WIND-UP

NOTE: AWD LOCKED is not intended for driving on hard/dry surfaces.

Test Step	Result / Action to Take
E1 VERIFY THE CONCERN	
• Drive the vehicle and shift from AWD AUTO to AWD LOCKED. There should be minimal wind-up in 4H mode during straightline maneuvers, (wind-up in turns is normal; AWD LOCKED is not intended for driving on hard/dry surfaces). • **Is excessive wind-up present?**	**Yes** GO to E2 . **No** RETURN the vehicle to the customer. ADVISE about correct AWD system operation and normal vehicle behavior.
E2 ISOLATE TRANSFER CASE	
• Disconnect all wiring going to the transfer case and road test. • **Is excessive wind-up present?**	**Yes** CARRY OUT the AWD Functional Test. GO to Pinpoint Test F . **No** CONNECT the transfer case wiring and GO to E3 .
E3 CHECK FOR MATCHING WHEEL AND TIRE SIZES	
• Check the wheel and tire sizes. • **Do the 4 wheel and tire sizes match?**	**Yes** GO to E4 .

	No ADVISE the customer that AWD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
E4 CHECK TIRE INFLATION PRESSURE	
• Check the inflation pressure in each tire. Refer to Vehicle Certification (VC) label. • **Are the tire inflation pressures correct?**	**Yes** GO to E5 . **No** ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that AWD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
E5 CHECK THE TIRE CIRCUMFERENCE	
• Using a tailor's tape or flexible measuring tape, measure the circumference of all 4 tires and record the measurements.  TB-9179-A • Calculate the average of the circumference of the 2 front tires and 2 rear tires.  TB-9180-A • **Is the difference between the 2 averages or the side to side measurements greater than 13 mm (0.5 in)?**	**Yes** REPLACE the smallest circumference tire(s) and REMEASURE tire averages. REFER to Section 204-04 for additional information. **No** GO to E6 .
E6 CHECK THE FRONT AND REAR AXLE RATIOS	

• Check that front and rear axle ratios match. Refer to Section 205-00 . • **Do the front and rear axle ratios match?**	**Yes** RETURN the vehicle to the customer and ADVISE about correct AWD usage and normal vehicle behavior. **No** CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to Section 205-02 and Section 205-03 .

Pinpoint Test F: All-Wheel Drive (AWD) System Functional Test

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When the vehicle is operating in All-Wheel Drive (AWD) LOCKED mode, the front and rear driveshafts rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the AWD system to operate correctly, each wheel/tire assembly must have matching sizes, and the front and rear axle ratios must match.

This pinpoint test is intended to diagnose the following:
- 4X4 indicator
- 4X4 control module
- Transfer case and related components
- Wheel/tire assemblies

PINPOINT TEST F: AWD SYSTEM FUNCTIONAL TEST

NOTE: AWD LOCKED mode is not intended for driving on hard/dry surfaces.

Test Step	Result / Action to Take
F1 CHECK THE AWD LOCKED INDICATOR PROVE-OUT	
• Ignition ON. • **Does the 4X4 indicator illuminate at prove out?**	**Yes** GO to F2 . **No** CHECK the Instrument Cluster (IC). REFER to Section 413-01 . TEST the system for normal operation.
F2 CHECK THE AWD AUTO OPERATION	
• Select AWD AUTO. • **Is the 4X4 indicator off?**	**Yes** GO to F5 . **No** GO to F3 .
F3 CHECK FOR DTCs	
• Connect the scan tool.	**Yes** REFER to the 4X4 Control Module DTC

• Carry out the 4X4 control module self-test. • **Are DTCs present?**	Chart in this section for diagnosis. **No** GO to F4 .
F4 CHECK FOR WIND-UP IN AWD AUTO	
• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test C . **No** GO to Pinpoint Test D .
F5 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID. • **Does the 4WDCPWMST PID indicate approximately 2-4% clutch application at closed throttle?**	**Yes** GO to F6 . **No** GO to Pinpoint Test C .
F6 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to F7 . **No** VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS for faults. REFER to Section 206-09 . TEST the system for normal operation.
F7 CHECK THE TP STATUS (TPI) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is Accelerator Pedal Position (APP) as communicated by the PCM via High Speed Controller Area Network (HS-CAN). • Slowly move throttle from closed throttle to Wide Open Throttle (WOT) and observe the TPI PID, Key ON Engine OFF (KOEO).	**Yes** GO to F8 . **No** CHECK the APP sensor and/or PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. TEST the system for normal operation.

• **Does the TPI PID value vary between 0 at closed throttle and 255 at WOT ?**	
F8 CHECK FOR WIND-UP IN TURNS ON THE THROTTLE	
• Drive the vehicle on a dry, hard surface, executing turns while applying the throttle. • **Is wind-up present?**	**Yes** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation. **No** GO to F9 .
F9 CHECK THE AWD LOCKED OPERATION	
• Select AWD LOCKED. • **Does the 4X4 indicator illuminate correctly?**	**Yes** GO to F10 . **No** GO to F11 .
F10 CHECK FOR AWD LOCKED WIND-UP	
• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to F13 . **No** GO to Pinpoint Test C .
F11 CHECK FOR DTCs	
• Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to F12 .
F12 CHECK FOR WIND-UP IN AWD LOCKED WHILE APPLYING THE THROTTLE	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test D . **No** GO to Pinpoint Test C .
F13 CHECK THE AWD AUTO OPERATION	
• Select AWD AUTO. • **Does the 4X4 indicator turn off?**	**Yes** The AWD system is operating correctly. **No** GO to F14 .
F14 CHECK FOR DTCs	
• Carry out the 4X4 control module self-test. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section. **No** GO to F15 .
F15 CHECK FOR WIND-UP IN AWD AUTO	

• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test D . **No** GO to Pinpoint Test C .

Pinpoint Test G: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straight Line

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When the vehicle is operating in All-Wheel Drive (AWD) LOCKED mode, the front and rear driveshafts rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the AWD system to operate correctly, each wheel/tire assembly must have matching sizes and the front and rear axle ratios must match.

This pinpoint test is intended to diagnose the following:

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST G: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHT LINE

NOTE: All-Wheel Drive (AWD) LOCKED mode is not intended for driving on hard/dry surfaces.

Test Step	Result / Action to Take
G1 VERIFY THE CONCERN	
• Test drive the vehicle on a straight stretch of road in AWD AUTO mode. • Drive the vehicle through turns and parking lot maneuvers. • **Does the vehicle bind, pulsate or shudder?**	**Yes** If the problem occurs in AWD AUTO mode, GO to G2 ; in AWD LOCKED mode, binding is a normal condition. **No** GO to Pinpoint Test F .
G2 CHECK THE 4X4 INDICATOR	
• Review the test drive notes. • **Did the 4X4 indicator or the powertrain Malfunction Indicator Lamp (MIL) illuminate?**	**Yes** If the powertrain MIL is illuminated, GO to G4 . If the 4X4 indicator stayed illuminated, GO to G3 . **No** GO to G5 .
G3 VERIFY THE FAULT	
• Review the test drive notes. • **Was AWD LOCKED selected when the indicators were**	**Yes** The system is functioning correctly. **No**

illuminated?	The fault may have been caused by an intermittent, uncommanded or autolock shift. GO to Pinpoint Test F .
G4 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to G5 .
G5 VERIFY THE CONCERN	
• Ignition OFF. • Disconnect: Transfer Case C350. • Test drive the vehicle on a straight stretch of road and in turns, and shift the transfer case through each mode. Record any fault conditions. • **Is the concern present?**	**Yes** **Vehicles with limited slip rear differential:** The condition may be normal and no repair action is necessary. CHECK the rear axle to verify. REFER to Section 205-02 . TEST the system for normal operation. **Vehicles without limited slip rear differential:** INSPECT the driveline components for damage or wear. REFER to Inspection and Verification in this section. TEST the system for normal operation. **No** GO to G6 .
G6 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Ignition OFF. • Connect: Transfer Case C350. • Ignition ON. • Clear the 4X4 control module DTCs. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at closed throttle, Key ON Engine OFF (KOEO). • **Is the 4WDCPWMST PID greater than 10%?**	**Yes** GO to G7 . **No** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation.
G7 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD)	**Yes** GO to G8 . **No** VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS for faults. REFER to Section 206-09 . TEST the system for normal operation.

♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	
G8 CHECK THE TP STATUS (TPI) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is Accelerator Pedal Position (APP) as communicated by the PCM via High Speed Controller Area Network (HS-CAN). • Slowly move throttle from closed throttle to Wide Open Throttle (WOT) and observe the TPI PID, KOEO . • **Does the TPI PID value vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to G9 . **No** CHECK the APP sensor and/or PCM for faults. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. TEST the system for normal operation.
G9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT	
• With the vehicle in the NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Rotate the front driveshaft by hand. • **Does the front driveshaft rotate freely (does it require less than 45 Nm (33 lb-ft) to rotate)?**	**Yes** GO to Pinpoint Test C . **No** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation.

Four Wheel Drive (4WD) Systems - 2-Speed Torque-On-Demand

Special Tool(s)

 ST2574-A	Flex Probe Kit 105-R025D or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

The vehicle is equipped with an automatic electronic-shift system that allows the operator to choose between 3 different Four-Wheel Drive (4WD) modes. The operator can switch between 4X4 AUTO and 4X4 HIGH at any speed. To engage or disengage 4X4 LOW modes, the vehicle speed must be less than 3 km/h (2 mph) and the transmission must be in NEUTRAL.

Wheel slip is sensed by monitoring the average front and rear wheel speeds. Based on steering wheel angle, Accelerator Pedal Position (APP) and wheel slip, a Pulse-Width Modulation (PWM) signal is transmitted to the transfer case as torque is required.

The 4X4 control module will provide the ABS with current clutch duty cycle and whether or not ABS may command the clutch duty cycle.

The brake subsystem sends the following information signals to the 4WD system:

- Occurrences of brake events and failures. Refer to Section 206-09 .
- Steering wheel angle status. Refer to Section 206-09 .
- Wheel speeds. Refer to Section 206-09 .

A concern with any of the above listed brake system signals will affect operation of the 4WD system.

The APP output signal is provided to the 4X4 control module from the PCM. This signal is used by the 4X4 control module in controlling the transfer case clutch. The transfer case shift motor sense plate, an integral part of the assembly, informs the 4X4 control module of the transfer case position.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the range fork within the transfer case between the HIGH range (4X4 AUTO and 4X4 HIGH modes) and low range (4X4 LOW) positions.

The 4X4 control module varies the torque sent to the front driveline by controlling the transfer case clutch. At rest and under cruising conditions, the 4X4 control module activates the transfer case clutch a minimum duty

cycle (percentage of time the clutch is turned on), which allows for the slight difference between the front and rear driveshafts which normally occurs when negotiating a corner on dry pavement. Under any of the following conditions, the 4X4 control module will increase the duty cycle in order to prevent or control slip.

- Slip is detected
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature inputs:

- Mode Select Switch (MSS)
- Steering wheel angle
- Transmission range indicator (transmitted from the Transmission Control Module (TCM))
- Wheel speed (transmitted from the ABS module)
- APP information (transmitted from the PCM)

Feature outputs:

- PWM signal to transfer case clutch
- 4WD message center indicators
- Transfer case shift motor outputs

Shifts between 4X4 AUTO mode and 4X4 HIGH modes can be made at any speed. Listed below are the inputs and outputs needed by the 4X4 control module to execute a change between any of these modes.

Feature inputs:

- APP information (transmitted from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs
- 4WD message center indicators
- PWM signal to transfer case clutch

When shifting into or out of 4X4 LOW mode, the 4X4 control module requires that the vehicle speed is less than 3 km/h (2 mph) and the transmission is in NEUTRAL.

Feature inputs:

- APP information (transmitted from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed signal (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs
- 4WD message center indicators
- PWM signal to transfer case clutch

Neutral Tow

The neutral tow feature is a program embedded in the 4X4 control module, which must be activated by a dealer technician. The neutral tow feature disengages the wheels from the powertrain by shifting the transfer case to the NEUTRAL position. This allows the vehicle to be towed with all 4 wheels on the ground. To activate the neutral tow feature, the dealer technician must access the 4X4 control module through the scan tool and data link connector. Once communication is achieved, the technician can request the neutral tow feature be enabled. The technician must also install the neutral tow indicator lamp (and neutral position sensor for vehicles equipped with 4.6L), in order for the feature to be activated.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Axle shafts and CV joints • Driveshaft and U-joints • Fluid leaks • Matching tire sizes • Transfer case shift motor	• Battery Junction Box (BJB) fuses: ♦ 23 (20A) ♦ 26 (20A) • Smart Junction Box (SJB) fuse 18 (10A) • 4X4 control module • Wiring harness • Encoder contact plate • Connector(s) • Circuitry • Mode Select Switch (MSS)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** TheVehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.

- verify the scan tool operation with a known good vehicle.
- refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. **NOTE:** Before carrying out the self-test, make sure that:

   - the ignition is in RUN.
   - all doors are closed.
   - the brake pedal is not pressed.
   - the transmission is not in NEUTRAL.

   Clear the CMDTCs and carry out the self-test diagnostics for the 4X4 control module.

9. If the DTCs retrieved are related to the concern, go to the 4X4 Control Module DTC Chart in this section. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Four Wheel Drive (4WD) or GO to Symptom Chart - NVH .

4X4 Control Module DTC Chart

DTC	Description	Action
B1317	Battery Voltage High	GO to Pinpoint Test H .
B1318	Battery Voltage Low	GO to Pinpoint Test H .
B1319	Driver Door Ajar Circuit Failure	GO to Pinpoint Test O .
B1322	Driver Door Ajar Circuit Short to Ground	GO to Pinpoint Test O .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the 4X4 control module self-test. If DTC B1342 is retrieved, INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.
B1555	Ignition Run/Start Circuit Failure	GO to Pinpoint Test I .
C1729	Transfer Case Unable to Transition Between 4H and 4L	GO to Pinpoint Test K .
C1970	4X4 Low Mode Switch LED Short to Battery	GO to Pinpoint Test K .
C1971	4X4 Low Mode Switch LED Circuit Failure	GO to Pinpoint Test K .
P1707	Transfer Case Neutral or Park/Neutral Indication Circuit	GO to Pinpoint Test O .
P1812	4-Wheel Drive Mode Select Circuit Failure	GO to Pinpoint Test K .
P1815		GO to Pinpoint Test K .

	4-Wheel Drive Mode Select Short Circuit to Ground	
P1816	Transmission Neutral Safety Switch Circuit Failure	GO to Pinpoint Test O .
P1819	Transmission Neutral Safety Switch Short Circuit to Ground	GO to Pinpoint Test O .
P1824	4-Wheel Drive Clutch Relay Circuit Failure	GO to Pinpoint Test J .
P1825	4-Wheel Drive Clutch Relay Open Circuit	GO to Pinpoint Test J .
P1826	4-Wheel Drive Low Clutch Relay Short Circuit to Battery	GO to Pinpoint Test J .
P1827	4-Wheel Drive Low Clutch Relay Short Circuit to Ground	GO to Pinpoint Test J .
P1849	Transfer Case Contact Plate 'A' Short Circuit to Ground	GO to Pinpoint Test K .
P1853	Transfer Case Contact Plate 'B' Short Circuit to Ground	GO to Pinpoint Test K .
P1857	Transfer Case Contact Plate 'C' Short Circuit to Ground	GO to Pinpoint Test K .
P1861	Transfer Case Contact Plate 'D' Short Circuit to Ground	GO to Pinpoint Test K .
P1867	Transfer Case Contact Plate General Circuit Failure	GO to Pinpoint Test K .
P1891	Transfer Case Contact Plate Ground Return Open Circuit	GO to Pinpoint Test K .
U1900	CAN Communication BUS Fault - Receive Error	**NOTE:** Do not install a new 4X4 control module as part of repair for 4X4 control module DTC U1900 fault. The 4X4 control module is not the source of the fault when DTC U1900 is present CARRY OUT the network test to identify the module communication was lost with. REFER to Section 418-00 to diagnose the module communication.
U2023	Fault Received From External Node	REFER to Section 206-09 to diagnose the wheel speed sensor fault.
U2050	No Application Present	REFER to Section 418-01 .

Smart Junction Box (SJB) DTC Chart

DTC	Description	Source	Action
B1895	Driver's/Passenger's Door Ajar Output Circuit Failure	Smart Junction Box (SJB)	GO to Pinpoint Test O .
B1896	Driver's/Passenger's Door Ajar Output Circuit Short to Battery	SJB	GO to Pinpoint Test O .
All Other DTCs	-	SJB	REFER to Section 419-10 .

Symptom Chart - Four-Wheel Drive (4WD)

Symptom Chart - Four-Wheel Drive (4WD)

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Transfer case whine - noise at all ranges
- Incorrect fluid level or fluid quality
- CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to Section 308-07B .
- Worn oil pump
- DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
- Under-inflated or oversized tires
- CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
- Transfer case growl/rumble - noise at all ranges
- Damaged or worn bearings or planetary gear
- DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
- Transfer case scraping/grating - noise at all ranges

- Excessively stretched drive chain hitting the case
- DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
- Transfer case howl/hum - noise at all ranges or 4X4 only
- Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear
- DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to Section 308-07B .

Pinpoint Tests

Pinpoint Test H: DTC B1317/B1318

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

If the 4X4 control module observes an overpower or underpower voltage condition, DTCs are set and the 4X4 control module may not allow Four-Wheel Drive (4WD) operation.

- DTC B1317 (Battery Voltage High) - When the 4X4 control module detects battery voltage greater than 16 volts for at least 10 seconds, this DTC is set.
- DTC B1318 (Battery Voltage Low) - When the 4X4 control module detects battery voltage less than 9 volts for at least 10 seconds, with the engine running at 1,500 rpm or greater, this DTC is set.

This pinpoint test is intended to diagnose the following:

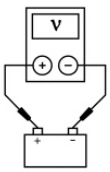
- Fuses
- Wiring, terminals or connectors
- 4X4 control module

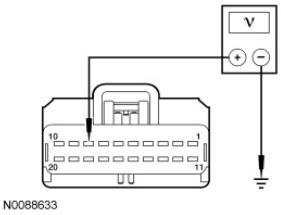
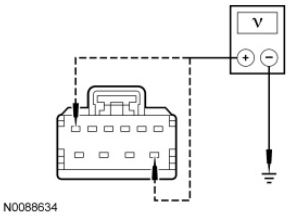
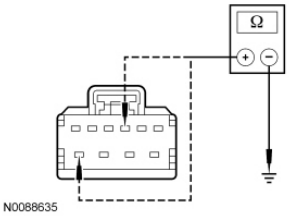
PINPOINT TEST H: DTC B1317/B1318

NOTE: DTC B1317 or B1318 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

NOTE: Carry out a thorough inspection and verification before proceeding with the pinpoint test. Refer to Inspection and Verification in this section.

Test Step	Result / Action to Take
H1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self Test - All CMDTCs .	**Yes** REFER to Section 414-00 for diagnosis of the battery and charging system.

• **Is B1317 or B1318 present in one or more modules AND P0563, P0620, P0625, P0626 or P065B present in the PCM?**	**No** GO to H2 .
H2 CHECK BATTERY CONDITION	
• Ignition OFF. • Refer to Section 414-01 and carry out the Battery - Condition Test. • **Does the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). TEST the system for normal operation. If the battery passed the condition test and did not require a recharge, GO to H3 . **No** INSTALL a new battery. REFER to Section 414-01 . CLEAR all CMDTCs . TEST the system for normal operation.
H3 CHECK THE CHARGING SYSTEM VOLTAGE	
NOTE: Do not allow the engine rpm to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine rpm has gone above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Start the engine. • Measure the voltage of the battery: ♦ For DTC B1317, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes. ♦ For DTC B1318, turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes.  AJ0210-A • **Is the battery voltage between 13-15.2 volts?**	**Yes** For DTC B1318, GO to H4 . For DTC B1317, INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR all CMDTCs . REPEAT the self-test. **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation.
H4 CHECK POWER TO 4X4 CONTROL MODULE	

• Ignition OFF. • Disconnect: 4X4 Control Module C281A and C281B. • Ignition ON. • Measure the voltage between 4X4 control module C281A-8, circuit CBP18 (GY/OG), harness side and ground.  N0088633 • Measure the voltage between 4X4 control module C281B-6, circuit SBB23 (WH/RD), harness side and ground; and between 4X4 control module C281B-7, circuit SBB26 (YE/RD), harness side and ground.  N0088634 • **Is the voltage greater than 10 volts?**	**Yes** GO to H5 . **No** VERIFY Smart Junction Box (SJB) fuse 18 (10A) and Battery Junction Box (BJB) fuse(s) 23 (20A) and 26 (20A) are OK, REPAIR the circuit in question. If SJB and BJB fuse(s) are not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR all CMDTCs . REPEAT the self-test.
H5 CHECK GROUND CIRCUITS TO 4X4 CONTROL MODULE FOR AN OPEN	
• Ignition OFF. • Measure the resistance between 4X4 control module C281B-3, circuit GD145 (BK/BU), harness side and ground; and between 4X4 control module C281B-10, circuit GD138 (BK/WH), harness side and ground. ♦ Repeat this measurement while wiggling the harness.  N0088635 • **Is the resistance less than 5 ohms?**	**Yes** GO to H6 . **No** REPAIR the circuit. CLEAR all CMDTCs . REPEAT the self-test.

H6 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
• Ignition OFF. • Check the harness and component side connectors for: ♦ corrosion. ♦ pushed-out/bent pins. • Connect the 4X4 control module and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR all CMDTCs . REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all CMDTCs . REPEAT the self-test.

Pinpoint Test I: DTC B1555

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The 4X4 control module receives ignition switch position status from the hard-wired run/start input to 4X4 control module pin 8 and the ignition switch position status message communicated by the Instrument Cluster (IC) over the High Speed Controller Area Network (HS-CAN). The ignition switch position status message originates from the Smart Junction Box (SJB) which communicates the ignition switch position status over the Medium Speed Controller Area Network (MS-CAN) to the IC which acts as a gateway module, transferring the ignition switch status message from MS-CAN to HS-CAN . For information regarding network messaging, refer to Section 418-00 .

- DTC B1555 (Ignition Run/Start Circuit Failure) - If the ignition switch is not in RUN for the self test, this code will set.

This pinpoint test is intended to diagnose the following:
- Fuse
- Wiring, terminals or connectors
- Ignition switch and/or circuitry
- HS-CAN

PINPOINT TEST I: DTC B1555

Test Step	Result / Action to Take
I1 CARRY OUT NETWORK TEST	
• Ignition ON. • Connect the scan tool. • Carry out a network test. • **Did the network test pass?**	**Yes** GO to I2 . **No** REFER to Section 418-00 to diagnose the network concern.
I2 CHECK 4X4 INDICATOR PROVE-OUT	
	Yes For DTC B1555, GO to I3 . For all other DTCs, REFER to the

• Carry out the 4X4 control module self-test. • **Are any 4X4 control module DTCs present?**	4X4 Control Module DTC Chart in this section. **No** The system is functioning correctly.
I3 CHECK THE 4X4 CONTROL MODULE IGNITION SWITCH STATUS PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S) ♦ Ignition Switch - Run Position (IGN_R) • **Do the ignition switch PIDs match the ignition switch positions?**	**Yes** The system is functioning correctly. **No** If the IGN_R/S PID did not match, CHECK SJB fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the self-test. If the IGN_O/U, IGN_A, IGN_S or IGN_R PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.

Pinpoint Test J: The Vehicle Does Not Shift Between 4X4 AUTO and 4X4 HIGH Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of Four-Wheel Drive (4WD) selection from the Mode Select Switch (MSS). The 4X4 control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

DTC Description	Fault Trigger Conditions
• DTC P1824 - 4-Wheel Drive Clutch Relay Circuit Failure	Hard short to ground on clutch output line sensed by 4X4 control module C281B pin 1 or overtemperature condition on clutch coil circuit detected.
• DTC P1825 - 4-Wheel Drive Clutch Relay Open Circuit	Open circuit on clutch output line sensed by 4X4 control module C281B pin 1.

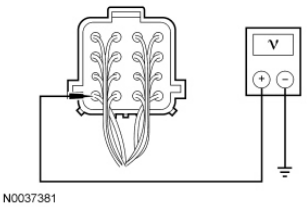
• DTC P1826 - 4-Wheel Drive Low Clutch Circuit to Battery	Short to battery on clutch output line sensed by 4X4 control module C281B pin 1.
• DTC P1827 - 4-Wheel Drive Low Clutch Circuit to Ground	Soft short to ground on clutch output line sensed by 4X4 control module C281B pin 1.

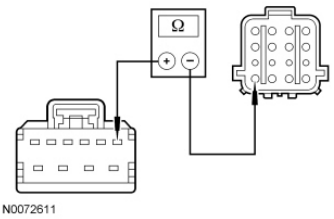
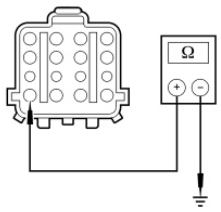
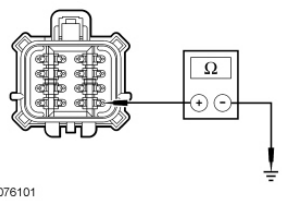
This pinpoint test is intended to diagnose the following:

- 4X4 indicators
- Transfer case
- 4X4 control module
- Wiring, terminals or connectors
- Transfer case clutch
- Ignition switch and/or circuitry
- High Speed Controller Area Network (HS-CAN)
- Instrument Cluster (IC)

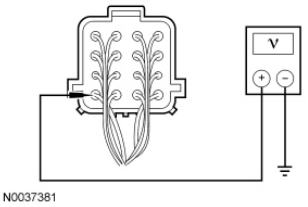
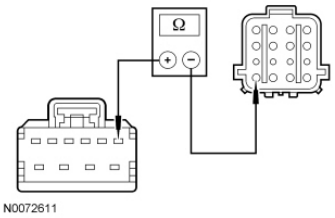
PINPOINT TEST J: THE VEHICLE DOES NOT SHIFT BETWEEN 4X4 AUTO AND 4X4 HIGH CORRECTLY

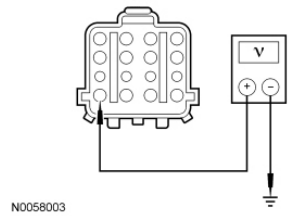
Test Step	Result / Action to Take
J1 CHECK THE 4X4 INDICATORS PROVE-OUT	
• Ignition OFF. • Start the vehicle while observing the 4X4 indicators prove out. • **Did the indicators prove out?**	**Yes** GO to J2 . **No** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation.
J2 CHECK THE POWERTRAIN MIL	
• Start the engine. • Observe the powertrain Malfunction Indicator Lamp (MIL). • **Does the powertrain MIL illuminate?**	**Yes** GO to J3 . **No** GO to J4 .
J3 CARRY OUT THE 4X4 CONTROL MODULE SELF-TEST	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Did the self-test complete?**	**Yes** GO to J4 . **No** REFER to Section 418-00 to diagnose no communication with the 4X4 control module. TEST the system for normal operation.
J4 REVIEW THE SELF-TEST	
• Review the self-test results. • **Were on-demand DTCs retrieved?**	**Yes** GO to J5 . **No** CHECK the IC . REFER to Section 413-01 .

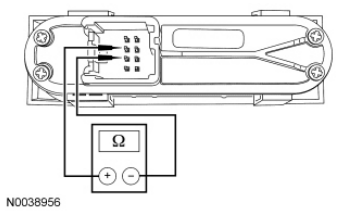
	TEST the system for normal operation.
J5 CHECK FOR 4X4 INDICATOR ILLUMINATION	
• Select 4X4 HIGH. • **Does the 4X4 indicator illuminate?**	**Yes** GO to J6 . **No** GO to J22 .
J6 CHECK FOR WIND-UP IN 4X4 HIGH	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to J14 . **No** GO to J7 .
J7 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at Wide Open Throttle (WOT), with the transfer case in 4X4 HIGH, Key ON Engine OFF (KOEO). • **Does the 4WDCPWMST PID indicate 98% clutch at WOT ?**	**Yes** GO to J8 . **No** GO to J12 .
J8 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN) USING THE PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND	
• Use the scan tool CLCH_SOL active command to energize the transfer case clutch to 100%. • Measure the voltage by carefully back-probing transfer case C350-16, circuit CCF03 (GY/BN), component side and ground.  N0037381 • **Is the voltage greater than 8.5 volts?**	**Yes** END the CLCH_SOL active command. GO to J11 . **No** END the CLCH_SOL active command. GO to J9 .
J9 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN	

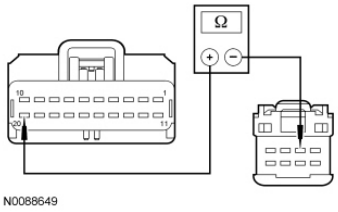
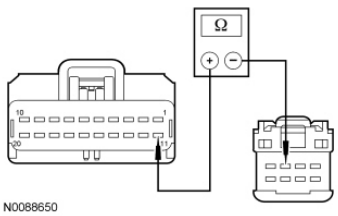
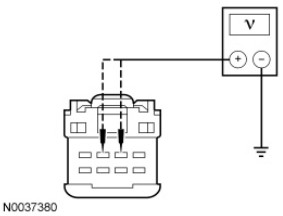
• Ignition OFF. • Disconnect: Transfer Case C350. • Disconnect: 4X4 Control Module C281B. • Measure the resistance between 4X4 control module C281B-1, circuit CCF03 (GY/BN), harness side and transfer case C350-16, circuit CCF03 (GY/BN), harness side.  N0072611 • **Is the resistance less than 5 ohms?**	**Yes** GO to J10 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J10 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO GROUND	
• Measure the resistance between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.  N0057992 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to J11 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J11 CHECK THE TRANSFER CASE CLUTCH COIL	
• Measure the resistance between transfer case C350 pin 16, circuit CCF03 (GY/BN), component side and ground.  N0076101 • **Is the resistance between 2-4 ohms?**	**Yes** The system is functioning correctly. **No** REPAIR the transfer case. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test.
J12 CHECK THE TP STATUS (TPI) PID	

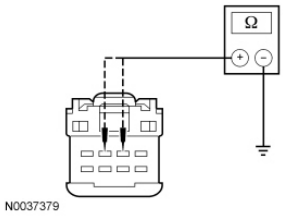
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is Accelerator Pedal Position (APP) as communicated by the PCM via HS-CAN . • Slowly move the accelerator pedal from closed throttle to WOT and observe the TPI PID, KOEO . • **Does the TPI PID vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to J13 . **No** CHECK the APP sensor and/or PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. CLEAR the DTCs. REPEAT the self-test.
J13 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to J8 . **No** CHECK the ABS for faults. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test.
J14 CHECK THE 4X4 INDICATOR IN 4X4 AUTO	
• Select 4X4 AUTO. • **Does the 4X4 indicator turn off?**	**Yes** GO to J15 . **No** GO to Pinpoint Test L .
J15 CHECK FOR WIND-UP IN 4X4 AUTO	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to J16 . **No** The 4WD drive system is operating correctly.
J16 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at closed throttle, KOEO . • **Does the 4WDCPWMST PID indicate 2-4% clutch application at closed throttle?**	**Yes** GO to J17 . **No** GO to J20 .

J17 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN) USING THE PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND	
• Use the scan tool CLCH_SOL active command to energize the transfer case clutch to 4%. • Measure the voltage by carefully back-probing transfer case C350-16, circuit CCF03 (GY/BN), component side and ground.  N0037381 • **Is the voltage approximately 0.2-0.4 volt?**	**Yes** END the CLCH_SOL active command. CHECK the transfer case. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test. **No** END the CLCH_SOL active command. GO to J18 .
J18 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Transfer Case C350. • Disconnect: 4X4 Control Module C281A. • Measure the resistance between 4X4 control module C281B-1, circuit CCF03 (GY/BN), harness side and transfer case C350-16, circuit CCF03 (GY/BN), harness side.  N0072611 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to J19 .
J19 CHECK CIRCUIT CCF03 (GY/BN) FOR A SHORT TO BATTERY	
• Ignition ON. • Measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.

 N0058003 • **Is any voltage present?**	
J20 CHECK THE TP STATUS (TPI) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is APP as communicated by the PCM via HS-CAN . • Slowly move the accelerator pedal from closed throttle to WOT and observe the TPI PID, KOEO . • **Does the TPI PID vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to J21 . **No** CHECK the APP sensor and/or PCM for faults. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. CLEAR the DTCs. REPEAT the self-test.
J21 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	**Yes** GO to J17 . **No** CHECK the ABS for faults. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test.
J22 CHECK THE IGNITION SWITCH STATUS PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S) ♦ Ignition Switch - Run Position (IGN_R)	**Yes** GO to J23 . **No** If the IGN_R/S PID did not match, CHECK Smart Junction Box (SJB) fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the self-test. If the IGN_O/U, IGN_A, IGN_S or IGN_R

• **Do the ignition switch PIDs match the ignition switch positions?**	PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.
J23 CHECK THE 4WD SWITCH STATUS (4WDINP_SW) PID IN 4X4 HIGH	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDINP_SW PID while switching to 4X4 HIGH. • **Does the 4WDINP_SW PID indicate 4W Auto/Hi?**	**Yes** GO to J24 . **No** GO to J25 .
J24 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID WITH THE MSS IN 4X4 HIGH	
• Monitor the 4WDCPWMST PID while switching to 4X4 HIGH. • **Does the 4WDCPWMST PID read 2-10% at closed throttle?**	**Yes** CHECK the IC . REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test. **No** GO to J6 .
J25 CHECK THE MSS	
• Ignition OFF. • Disconnect: MSS C284. • **NOTE:** The MSS is a momentary switch, the button must be pressed and held when measuring resistance of the MSS . • Measure the resistance between MSS C284 pin 2 and pin 3, component side while pressing and holding each switch position button. Refer to the following chart: **MSS Position** / **Resistance (± 1%)** 4X4 AUTO — 39 ohms 4X4 HIGH — 237 ohms 4X4 LOW — 536 ohms  N0038956 • **Are the resistances within the specified values?**	**Yes** GO to J26 . **No** INSTALL a new MSS . REFER to Mode Select Switch (MSS) in this section. CLEAR the DTCs. REPEAT the self-test.

J26 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN	
• Disconnect: 4X4 Control Module C281A. • Measure the resistance between 4X4 control module C281A-20, circuit RCF13 (WH/BN), harness side and MSS C284-2, circuit RCF13 (WH/BN), harness side.  • Measure the resistance between 4X4 control module C281A-11, circuit CCF13 (WH/BU), harness side and MSS C284-3, circuit CCF13 (WH/BU), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to J27 . **No** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.
J27 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between MSS C284-2, circuit RCF13 (WH/BN), harness side and ground; and between MSS C284-3, circuit CCF13 (WH/BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to J28 .
J28 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO	

GROUND	
• Ignition OFF. • Measure the resistance between MSS C284-2, circuit RCF13 (WH/BN), harness side and ground; and between MSS C284-3, circuit CCF13 (WH/BU), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Vehicle Does Not Shift Between 4X4 AUTO and 4X4 LOW Correctly

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of Four-Wheel Drive (4WD) selection from the Mode Select Switch (MSS). The 4X4 control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

DTC Description	Fault Trigger Conditions
• DTC C1729 - Transfer Case Unable to Transition Between 4H and 4L	Failure to reach designated motor position within allotted time after multiple retries.
• DTC C1970 - 4X4 Low Mode Switch LED Short to Battery	4L (4X4 LOW) LED short to battery sensed by 4X4 control module C281A pin 18.
• DTC C1971 - 4X4 Low Mode Switch LED Circuit Failure	4L (4X4 LOW) LED short to ground sensed by 4X4 control module C281A pin 18.
• DTC P1812 - 4-Wheel Drive Mode Select Circuit Failure	Open circuit or short to battery sensed by the 4X4 control module C281A pin 11 or proper mode not selected for self-test.
• DTC P1815 - 4-Wheel Drive Mode Select Short Circuit to Ground	Short to ground sensed by 4X4 control module C281A pin 11.

• DTC P1849 - Transfer Case Contact Plate 'A' Short Circuit to Ground	Motor encoder POS1 short to ground sensed at 4X4 control module C281A pin 1, checked when new 4WD mode is selected.
• DTC P1853 - Transfer Case Contact Plate 'B' Short Circuit to Ground	Motor encoder POS2 short to ground sensed at 4X4 control module C281A pin 2, checked when new 4WD mode is selected.
• DTC P1857 - Transfer Case Contact Plate 'C' Short Circuit to Ground	Motor encoder POS3 short to ground sensed at 4X4 control module C281A pin 3, checked when new 4WD mode is selected.
• DTC P1861 - Transfer Case Contact Plate 'D' Short Circuit to Ground	Motor encoder POS4 short to ground sensed at 4X4 control module C281A pin 4, checked when new 4WD mode is selected.
• DTC P1867 - Transfer Case Contact Plate General Circuit Failure	General motor encoder fault, invalid motor position detected when new 4WD mode is selected or during a motor movement.
• DTC P1891 - Transfer Case Contact Plate Ground Return Open Circuit	Open circuit on motor encoder position return line sensed at 4X4 control module C281A pin 16.

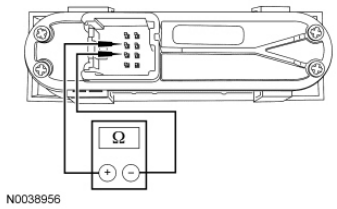
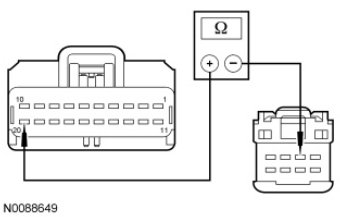
This pinpoint test is intended to diagnose the following:

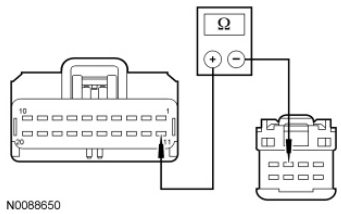
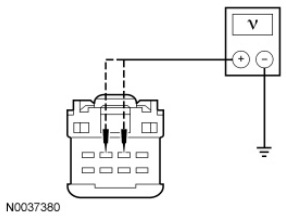
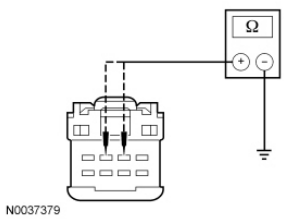
- Wiring, terminals or connectors
- Fuses
- 4X4 LOW indicator
- 4X4 LOW LED
- MSS
- Transfer case
- Transfer case shift motor
- 4X4 control module
- ABS module
- High Speed Controller Area Network (HS-CAN)

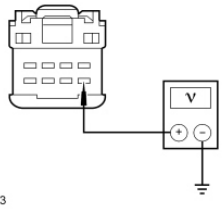
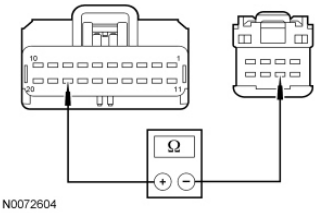
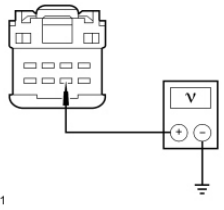
PINPOINT TEST K: THE VEHICLE DOES NOT SHIFT BETWEEN 4X4 AUTO AND 4X4 LOW CORRECTLY

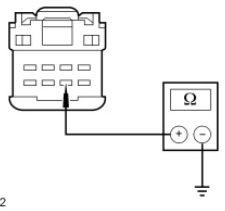
Test Step	Result / Action to Take
K1 CHECK FOR DTCs	
• Ignition ON. • Connect the scan tool. • Carry out the self-test. • **Are DTCs retrieved?**	**Yes** If C1729, GO to K27 . If C1970, GO to K15 . If C1971, GO to K16 . If P1812, GO to K9 . If P1815, GO to K12 . If P1849, P1853, P1857 or P1861, GO to K26 . If P1867 or P1891, GO to K24 . **No**

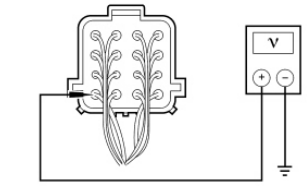
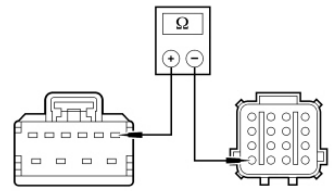
	GO to K2 .
K2 MONITOR THE 4X4 LOW LED SWITCH	
• Select 4X4 LOW: ♦ press the brake pedal. ♦ vehicle at rest. ♦ transmission in NEUTRAL. • Monitor the 4X4 LOW LED. • **Does the 4X4 LOW LED blink then stay illuminated?**	**Yes** GO to K3 . **No** GO to K4 .
K3 VERIFY THE 4X4 LOW LED STATE	
• Monitor the 4X4 LOW LED. • **Does the 4X4 LOW LED continue blinking?**	**Yes** GO to K4 . **No** GO to K8 .
K4 VERIFY THE 4X4 LOW LED STATE	
• Monitor the 4X4 LOW LED. • **Does the 4X4 LOW LED illuminate constantly?**	**Yes** GO to K5 . **No** GO to K17 .
K5 MONITOR THE 4X4 LOW INDICATOR (CLUSTER)	
• Monitor the 4X4 LOW Instrument Cluster (IC) indicator. • **Is the 4X4 LOW IC indicator illuminated?**	**Yes** GO to K6 . **No** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation.
K6 CHECK FOR WIND-UP IN TURNS ON THROTTLE	
• Drive the vehicle on a dry, hard surface, executing turns while applying the throttle. • **Is wind-up present?**	**Yes** GO to K7 . **No** GO to K18 .
K7 CHECK FOR GEAR REDUCTION	
• While driving the vehicle, monitor the engine rpm and vehicle speed. • **Does the engine rpm and vehicle speed indicate that the vehicle is in 4X4 LOW (high rpm at low vehicle speed)?**	**Yes** The system is functioning correctly. **No** GO to K22 .
K8 CHECK THE IGNITION SWITCH STATUS PIDs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S)	**Yes** GO to K9 . **No** If the IGN_R/S PID did not match, CHECK Smart Junction Box (SJB) fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the

♦ Ignition Switch - Run Position (IGN_R) • **Do the ignition switch PIDs match the ignition switch positions?**	self-test. If the IGN_O/U, IGN_A, IGN_S or IGN_R PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.
K9 CHECK THE MSS	
• Ignition OFF. • Disconnect: MSS C284. • **NOTE:** The MSS is a momentary switch, the button must be pressed and held when measuring resistance of the MSS . • Measure the resistance between MSS C284 pin 2 and pin 3, component side while pressing and holding each switch position button. Refer to the following chart: **MSS Position** / **Resistance (± 1%)** 4X4 AUTO — 39 ohms 4X4 HIGH — 237 ohms 4X4 LOW — 536 ohms  • **Are the resistances within the specified values?**	**Yes** GO to K10 . **No** INSTALL a new MSS . REFER to Mode Select Switch (MSS) in this section. CLEAR the DTCs. REPEAT the self-test.
K10 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN	
• Disconnect: 4X4 Control Module C281A. • Measure the resistance between 4X4 control module C281A-20, circuit RCF13 (WH/BN), harness side and MSS C284-2, circuit RCF13 (WH/BN), harness side.  	**Yes** GO to K11 . **No** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

• Measure the resistance between 4X4 control module C281A-11, circuit CCF13 (WH/BU), harness side and MSS C284-3, circuit CCF13 (WH/BU), harness side.  • **Are the resistances less than 5 ohms?**	
K11 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between MSS C284-2, circuit RCF13 (WH/BN), harness side and ground; and between MSS C284-3, circuit CCF13 (WH/BU), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to K12 .
K12 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: MSS C284. • Measure the resistance between MSS C284-2, circuit RCF13 (WH/BN), harness side and ground; and between MSS C284-3, circuit CCF13 (WH/BU), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to K13 . **No** REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.
K13 CHECK MSS LED CIRCUIT CBP18 (GY/OG) FOR VOLTAGE	

• Ignition ON. • Measure the voltage between MSS C284-5, circuit CBP18 (GY/OG), harness side and ground.  N0037393 • **Is the voltage greater than 8 volts?**	**Yes** GO to K14 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
K14 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: 4X4 Control Module C281A. • Measure the resistance between 4X4 control module C281A-18, circuit CCF06 (BU/GN), harness side and MSS C284-6, circuit CCF06 (BU/GN), harness side.  N0072604 • **Is the resistance less than 5 ohms?**	**Yes** GO to K15 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
K15 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between MSS C284-6, circuit CCF06 (BU/GN), harness side and ground.  N0037391 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to K16 .
K16 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR A SHORT TO GROUND	

• Ignition OFF. • Measure the resistance between MSS C284-6, circuit CCF06 (BU/GN), harness side and ground.  N0037392 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new MSS . REFER to Mode Select Switch (MSS) in this section. CLEAR the DTCs. REPEAT the self-test.
K17 CHECK THE NEUTRAL SAFETY SWITCH (NTRL_SW) AND WHEEL SPEED PIDs DURING 4X4 LOW SHIFT	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • A. Monitor the 4X4 control module NTRL_SW PID while shifting the transmission to NEUTRAL. • Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • B. Monitor the following ABS wheel speed PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD) ♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • **A. Does the 4X4 control module NTRL_SW PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?** **B. Does any ABS wheel speed PID indicate 0 km/h (0 mph)?**	**Yes** If all 5 PIDs are accurate, GO to K24 . **No** **A.** REFER to Section 307-01A or Section 307-01B for further diagnosis of the Transmission Range (TR) sensor and the HS-CAN . CLEAR the DTCs. REPEAT the self-test. **B.** REFER to Section 206-09 for further diagnosis of the ABS and the HS-CAN . CLEAR the DTCs. REPEAT the self-test.
K18 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at Wide Open Throttle (WOT), with the transfer case in 4X4 LOW, Key ON Engine OFF (KOEO). • **Does the 4WDCPWMST PID indicate 98% clutch application at WOT ?**	**Yes** GO to K19 . **No** GO to K21 .
K19 CHECK FOR VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN) USING THE PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND	

• Use the CLCH_SOL active command to cycle the transfer case clutch to 98%. • Measure the voltage by carefully back-probing transfer case C350-16, circuit CCF03 (GY/BN), component side and ground.  N0037381 • **Is the voltage greater than 9 volts?**	**Yes** END the CLCH_SOL active command. CHECK the transfer case. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test. **No** END the CLCH_SOL active command. GO to K20 .
K20 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Transfer Case C350. • Disconnect: 4X4 Control Module C281B. • Measure the resistance between 4X4 control module C281B-1, circuit CCF03 (GY/BN), harness side and transfer case C350-16, circuit CCF03 (GY/BN), harness side.  N0072600 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
K21 CHECK THE TP STATUS (TPI) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is Accelerator Pedal Position (APP) as communicated by the PCM via HS-CAN . • Slowly move throttle from closed throttle to WOT and observe the TPI PID, KOEO . • **Does the TPI PID value vary between 0 at closed throttle and 255 at WOT ?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** CHECK the APP sensor and/or the PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. CLEAR the DTCs. REPEAT the self-test.
K22 CHECK THE CONTACT PLATE ENCODER PIDs IN 4X4 LOW	

- Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module.
- Using the active command contact plate power (PLATE_PWR) to energize the transfer case motor contact plate position return circuit.
- **NOTE:** Plate PIDs are momentarily monitored when switching positions.
- With the MSS in 4X4 LOW, monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs. Refer to the following chart:

Contact Plate Position PID	MSS 4WD AUTO/4X4 HIGH	MSS 4X4 LOW
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Do the contact plate position PIDs indicate that the transfer case shift motor is in 4X4 LOW?**

Yes
GO to K23 .

No
GO to K24 .

K23 CHECK THE TRANSFER CASE SHIFT MOTOR

- Remove the transfer case shift motor from the transfer case.
- Rotate the shift cam through all positions.
- **Does the transfer case shift cam rotate with difficulty (is the force required to rotate the cam greater than 45 Nm [33 lb-ft])?**

Yes
REPAIR the transfer case. REFER to Section 308-07B . CLEAR the DTCs. REPEAT the self-test.

No
INSTALL a new transfer case shift motor. REFER to Transfer Case Shift Motor in this section. CLEAR the DTCs. REPEAT the self-test.

K24 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR AN OPEN

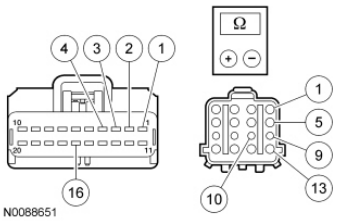
- Ignition OFF.
- Disconnect: Transfer Case C350.
- Disconnect: 4X4 Control Module C281A.
- Measure the resistance of the following circuits between 4X4 control module C281A, harness side and transfer case C350, harness side:

Circuit	C281A	C350
C281A-16	RCF09 (BN/WH)	C350-10

Yes
GO to K25 .

No
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C281A-4	CCF17 (WH/OG)	C350-13
C281A-3	CCF16 (VT/GN)	C350-9
C281A-2	CCF15 (BN/YE)	C350-1
C281A-1	CCF14 (GN/OG)	C350-5

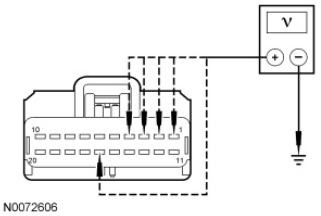


- **Are the resistances less than 5 ohms?**

K25 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between the following circuits at the 4X4 control module C281A, harness side and ground:

Circuit	C281A
RCF09 (BN/WH)	16
CCF17 (WH/OG)	4
CCF16 (VT/GN)	3
CCF15 (BN/YE)	2
CCF14 (GN/OG)	1

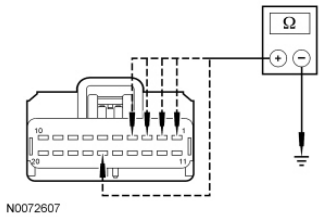
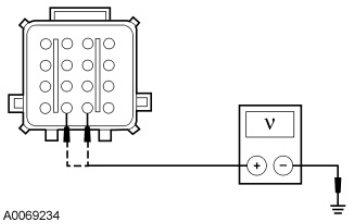


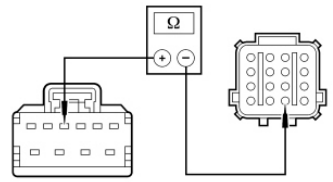
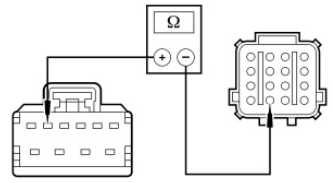
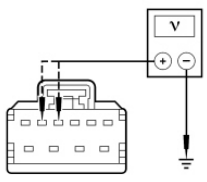
- **Is any voltage present?**

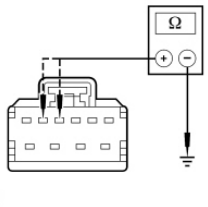
Yes
REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

No
GO to K26 .

K26 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO GROUND

• Ignition OFF. • Disconnect: 4X4 Control Module C281A. • Measure the resistance between the following circuits at 4X4 control module C281A, harness side and ground: **Circuit** / **C281A** RCF09 (BN/WH) / 16 CCF17 (WH/OG) / 4 CCF16 (VT/GN) / 3 CCF15 (BN/YE) / 2 CCF14 (GN/OG) / 1  N0072607 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to K27 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
K27 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR POWER DURING ACTIVE COMMANDS	
• Ignition OFF. • Connect: 4X4 Control Module C281A. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Command the Clockwise Relay Control (CW_RELAY) active command ON and OFF and measure the voltage between transfer case C350-15, circuit CCF07 (BN/GN), harness side and ground. Command the Counterclockwise Relay Control (CCW_RELAY) active command ON and OFF and measure the voltage between transfer case C350-14, circuit CCF08 (GY/OG), harness side and ground.  A0069234 • **Are the voltages 10 volts or greater while the corresponding active commands are on?**	**Yes** INSTALL a new transfer case shift motor. CLEAR the DTCs. REPEAT the self-test. **No** GO to K28 .

K28 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: 4X4 Control Module C281B. • Measure the resistance between transfer case C350-14, circuit CCF08 (GY/OG), harness side and 4X4 control module C281B-4, circuit CCF08 (GY/OG), harness side.  N0088652 • Measure the resistance between transfer case C350-15, circuit CCF07 (BN/GN), harness side and 4X4 control module C281B-5, circuit CCF07 (BN/GN), harness side.  N0088653 • **Are the resistances less than 5 ohms?**	**Yes** GO to K29 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. GO to Pinpoint Test P .
K29 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between 4X4 control module C281B-4, circuit CCF08 (GY/OG), harness side and ground; and between 4X4 control module C281B-5, circuit CCF07 (BN/GN), harness side and ground.  N0072609 • **Is any voltage present?**	**Yes** GO to K30 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. GO to Pinpoint Test P .
K30 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO GROUND	

• Ignition OFF. • Measure the resistance between 4X4 control module C281B-5, circuit CCF07 (BN/GN), harness side and ground; and between 4X4 control module C281B-4, circuit CCF08 (GY/OG).  N0072610 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. GO to Pinpoint Test P .

Pinpoint Test L: The 4X4 Indicators Do Not Operate Correctly/Do Not Operate

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

The 4X4 HIGH indicator status is transmitted to the IC from the 4X4 control module through the High Speed Controller Area Network (HS-CAN). A steady indicator displays whether the vehicle is in 4X4 LOW or 4X4 HIGH, according to the driver selection. A Four-Wheel Drive (4WD) system fault will cause the powertrain Malfunction Indicator Lamp (MIL) to illuminate when a 4WD system fault condition has been detected. This light also indicates other general powertrain failures.

This pinpoint test is intended to diagnose the following:

- Instrument Cluster (IC)
- 4WD system fault
- HS-CAN circuits
- 4X4 control module

PINPOINT TEST L: THE 4X4 INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

Test Step	Result / Action to Take
L1 CHECK THE 4X4 INDICATOR PROVE-OUT	
• Ignition ON. • Observe the 4X4 LOW and 4X4 indicators in the IC . • **Do the 4X4 LOW and 4X4 indicators prove out correctly?**	**Yes** GO to L2 . **No** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation.
L2 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test.	**Yes** REFER to the 4X4 Control Module DTC Chart in this

• **Are DTCs present?**	section for diagnosis. **No** GO to L3 .
L3 CHECK FOR INCORRECT 4X4 INDICATOR ILLUMINATION	
• Select 4X4 AUTO with transmission in NEUTRAL, vehicle at rest and engine running. • Observe the IC . • **Do any 4X4 IC indicators illuminate?**	**Yes** GO to L4 . **No** GO to L6 .
L4 CHECK THE CONTACT PLATE ENCODER PIDs	
• Enter the following diagnostic mode on the scan tool: PID/DATA Monitor and Record. • Using the active command contact plate power (PLATE_PWR) to energize the transfer case motor contact plate position return circuit. • **NOTE:** Plate PIDs are momentarily monitored when switching positions. • Monitor the 4X4 control module Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs. Refer to the following chart: • **Does the contact plate position PID indicate that the transfer case shift motor is in 4X4 AUTO?**	**Yes** GO to L5 . **No** GO to Pinpoint Test K .
L5 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID. • **Does the 4WDCPWMST PID read 2% at closed throttle?**	**Yes** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation. **No** GO to Pinpoint Test J .
L6 CHECK THE 4X4 INDICATOR	
• Select 4X4 HIGH. • Observe the IC . • **Does the 4X4 indicator illuminate?**	**Yes** GO to L7 . **No** GO to Pinpoint Test J .

Contact Plate Position PID	MSS 4X4 AUTO/4X4 HIGH	MSS 4X4 LOW
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

L7 CHECK THE 4X4 INDICATORS	
• Observe the IC . • **Are other 4X4 indicators illuminated?**	**Yes** CHECK the IC . REFER Section 413-01 . TEST the system for normal operation. **No** GO to L8 .
L8 CHECK THE 4X4 LOW INDICATOR	
• Select 4X4 LOW: ♦ vehicle stationary. ♦ shift the transmission to NEUTRAL. ♦ select 4X4 LOW. ♦ wait for the 4X4 LOW indicator to illuminate in the IC indicating that the shift is complete. • **Does the 4X4 LOW indicator illuminate?**	**Yes** GO to L10 . **No** GO to L9 .
L9 CHECK THE 4X4 INDICATORS	
• Observe the IC . • **Are other 4X4 indicators illuminated?**	**Yes** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation. **No** The indicators are working correctly. GO to Pinpoint Test P .
L10 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) AND TRANSFER CASE CONTACT PLATE SWITCH PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Using the active command PLATE_PWR to energize the transfer case motor contact plate position return circuit. • **NOTE:** The MSS is a momentary switch, the button must be pressed and held. • Monitor the 4X4 control module Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs. Refer to the following chart:	**Yes** CHECK the IC . REFER to Section 413-01 . TEST the system for normal operation. **No** CHECK the 4WD system. GO to Pinpoint Test K .

Contact Plate PID	MSS 4X4 AUTO/4X4 HIGH	MSS 4X4 LOW
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

• Monitor the 4WDCPWMST PID. • **Do the contact plate position PIDs indicate the transfer case shift motor is in 4X4 LOW mode and does the 4WDCPWMST PID read 10% at closed throttle?**	

Pinpoint Test M: Straightline Driveline Wind-Up

Normal Operation

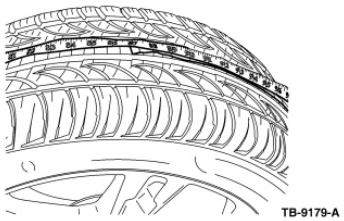
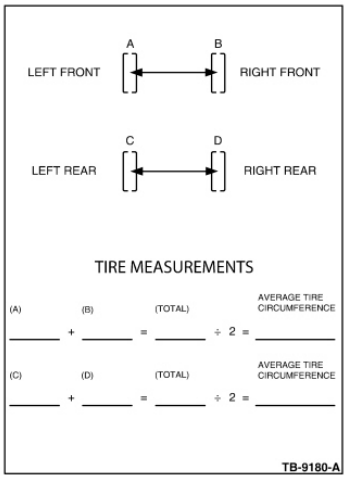
In order for the Four-Wheel Drive (4WD) system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

This pinpoint test is intended to diagnose the following:
- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST M: STRAIGHTLINE DRIVELINE WIND-UP

NOTE: 4X4 HIGH/LOW is not intended for driving on hard/dry surfaces.

Test Step	Result / Action to Take
M1 VERIFY THE CONCERN	
• Drive the vehicle and shift from 4X4 AUTO to 4X4 HIGH. There should be minimal wind-up in 4H mode during straightline maneuvers, (wind-up in turns is normal; 4X4 HIGH/LOW is not intended for driving on hard/dry surfaces). • **Is excessive wind-up present?**	**Yes** GO to M2 . **No** RETURN the vehicle to the customer. ADVISE about correct 4WD system operation and normal vehicle behavior.
M2 ISOLATE TRANSFER CASE	
• Disconnect all wiring going to the transfer case and road test. • **Is excessive wind-up present?**	**Yes** CARRY OUT the 4WD Functional Test. GO to Pinpoint Test P . **No** CONNECT the transfer case wiring and GO to M3 .
M3 CHECK FOR MATCHING WHEEL AND TIRE SIZES	
• Check the wheel and tire sizes. • **Do the 4 wheel and tire sizes match?**	**Yes** GO to M4 . **No** ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
M4 CHECK TIRE INFLATION PRESSURE	

• Check the inflation pressure in each tire. Refer to Vehicle Certification (VC) label. • **Are the tire inflation pressures correct?**	**Yes** GO to M5 . **No** ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
M5 CHECK THE TIRE CIRCUMFERENCE	
• Using a tailor's tape or flexible measuring tape, measure the circumference of all 4 tires and record the measurements.  TB-9179-A • Calculate the average of the circumference of the 2 front tires and 2 rear tires.  TB-9180-A • **Is the difference between the 2 averages or the side to side measurements greater than 13 mm (0.5 in)?**	**Yes** REPLACE the smallest circumference tire(s) and REMEASURE tire averages. REFER to Section 204-04 for additional information. **No** GO to M6 .
M6 CHECK THE FRONT AND REAR AXLE RATIOS	
• Check that front and rear axle ratios match. Refer to Section 205-00 . • **Do the front and rear axle ratios match?**	**Yes** RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior.

	No CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to Section 205-02 and Section 205-03 .

Pinpoint Test N: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straight Line

Normal Operation

When the vehicle is operating in 4X4 AUTO, all 4 wheels receive the same amount of torque and rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the Four-Wheel Drive (4WD) system to function correctly, each tire must be in good condition and the front and rear axle ratios must match.

This pinpoint test is intended to diagnose the following:

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST N: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHT LINE

NOTE: 4X4 HIGH/4X4 LOW is not intended for driving on hard/dry surfaces.

Test Step	Result / Action to Take
N1 VERIFY THE CONCERN	
• Test drive the vehicle on a straight stretch of road in 4X4 AUTO mode. • Drive the vehicle through turns and parking lot maneuvers. • **Does the vehicle bind, pulsate or shudder?**	**Yes** If the problem occurs in 4X4 AUTO mode, GO to N2 ; in 4X4 HIGH mode or 4X4 LOW mode, binding is a normal condition. **No** GO to Pinpoint Test P .
N2 CHECK THE INDICATORS	
• Review the test drive notes. • **Did any of the Instrument Cluster (IC) 4X4 indicators or the powertrain Malfunction Indicator Lamp (MIL) illuminate?**	**Yes** If the 4X4 or 4X4 LOW indicators stayed illuminated, GO to N3 . If the powertrain MIL stayed illuminated, GO to N4 . **No** GO to N5 .
N3 VERIFY THE FAULT	
• Review the test drive notes. • **Was 4X4 HIGH or 4X4 LOW selected when the indicators were illuminated?**	**Yes** The system is functioning correctly. **No** The fault may have been caused by an intermittent, uncommanded or autolock shift. TEST the system for

	normal operation. GO to Pinpoint Test P .
N4 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to N5 .
N5 VERIFY THE CONCERN	
• Ignition OFF. • Disconnect: Transfer Case C350. • Test drive the vehicle on a straight stretch of road and in turns, and shift the transfer case through each mode. Record any fault conditions. • **Is the concern present?**	**Yes** **Vehicles with limited slip rear differential:** The condition may be normal and no repair action is necessary. CHECK the rear axle to verify. REFER to Section 205-02 . TEST the system for normal operation. **Vehicles without limited slip rear differential:** INSPECT the driveline components for damage or wear. REFER to Inspection and Verification. TEST the system for normal operation. **No** GO to N6 .
N6 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Ignition OFF. • Connect: Transfer Case C350. • Ignition ON. • Clear the 4X4 control module DTCs. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID at closed throttle, Key ON Engine OFF (KOEO). • **Is the 4WDCPWMST PID greater than 10%?**	**Yes** GO to N7 . **No** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation.
N7 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - ABS Module. • While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs: ♦ Left Front Wheel Speed Sensor (LF_WSPD) ♦ Left Rear Wheel Speed Sensor (LR_WSPD)	**Yes** GO to N8 . **No** VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS for faults. REFER to Section 206-09 . TEST the system for normal operation.

♦ Right Front Wheel Speed Sensor (RF_WSPD) ♦ Right Rear Wheel Speed Sensor (RR_WSPD) • Compare the speedometer reading to the wheel speed sensor PIDs. • **Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**	
N8 CHECK THE TP STATUS (TPI) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is Accelerator Pedal Position (APP) as communicated by the PCM via High Speed Controller Area Network (HS-CAN). • Slowly move accelerator pedal from closed throttle to Wide Open Throttle (WOT) and observe the TPI PID, KOEO . • **Does the TPI PID value vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to N9 . **No** CHECK the APP sensor and/or PCM for faults. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. TEST the system for normal operation.
N9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 . • Rotate the front driveshaft by hand. • **Does the front driveshaft rotate freely (does it require less than 45 Nm [33 lb-ft] to rotate)?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. TEST the system for normal operation. **No** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation.

Pinpoint Test O: Neutral Tow Functional Test

Normal Operation

Neutral tow is a dealer-installed option that allows the vehicle to be towed with the 4 road wheels without damaging the transmission. Neutral tow operates by disengaging the transmission from the rear differential.

4X4 Control Module

DTC Description	Fault Trigger Conditions

• B1319 - Driver Door Ajar Circuit Failure	Open circuit or short to battery sensed by 4X4 control module C281A pin 12. DTC sets only if neutral tow feature is enabled.
• B1322 - Driver Door Ajar Circuit Short To Ground	Short to ground sensed by 4X4 control module C281A pin 12. DTC sets only if neutral tow feature is enabled.
• P1707 - Transfer Case Neutral or Park/Neutral Indication Circuit	30 ignition cycles of inactivity - open circuit, short to battery or short to ground sensed by 4X4 control module C281A pin 19. DTC sets only if neutral tow feature is enabled.
• P1816 - Transmission Neutral Safety Switch Circuit Failure	30 ignition cycles of inactivity - open circuit or short to battery sensed by 4X4 control module C281A pin 13. DTC sets only if neutral tow feature is enabled.
• P1819 - Transmission Neutral Safety Switch Short Circuit to Ground	30 ignition cycles of inactivity - short to ground sensed by 4X4 control module C281A pin 13 or vehicle in neutral during self-test. DTC sets only if neutral tow feature is enabled.

Smart Junction Box (SJB)

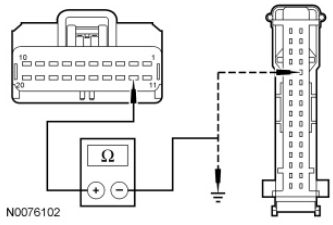
DTC Description	Fault Trigger Conditions
• B1895 - Driver's/Passenger's Door Ajar Output Circuit Failure	Open circuit or short to ground sensed by Smart Junction Box (SJB) C2280D pin 21. DTC sets only if neutral tow feature is enabled.
• B1896 - Driver's/Passenger's Door Ajar Output Circuit Short to Battery	Short to battery sensed by SJB C2280D pin 21. DTC sets only if neutral tow feature is enabled.

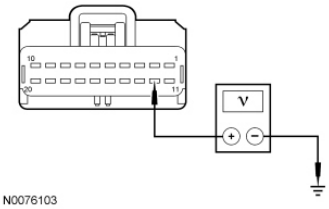
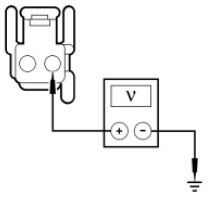
This pinpoint test is intended to diagnose the following:

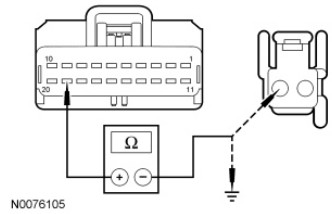
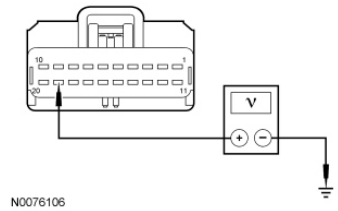
- Neutral tow indicator
- High Speed Controller Area Network (HS-CAN)
- Vehicle Security Module (VSM)
- Digital Transmission Range (TR) sensor (4.0L)
- Neutral shifter position sensor (4.6L)
- Brake ON/OFF switch
- Door ajar switch
- Ignition switch/circuitry

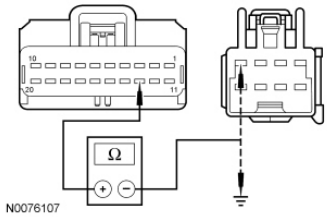
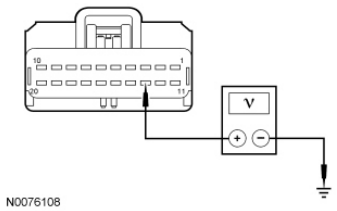
PINPOINT TEST O: NEUTRAL TOW FUNCTIONAL TEST

Test Step	Result / Action to Take
O1 CARRY OUT 4X4 CONTROL MODULE SELF-TEST	
• Connect the scan tool. • Ignition ON.	**Yes** For DTC B1319 or B1322, GO to O3 .

• Carry out the 4X4 control module self-test. • **Are DTCs present?**	For DTC P1707, GO to O7 . For DTC P1816 or P1819, GO to O11 . For all other DTCs, REFER to 4X4 Control Module DTC Chart in this section. **No** GO to O2 .
O2 CARRY OUT SJB SELF-TEST	
• Carry out the SJB self-test. • **Are DTCs present?**	**Yes** For DTC B1895 or B1896, GO to O3 . For all other SJB DTCs, REFER to Section 419-10 . **No** GO to O14 .
O3 CHECK THE SJB DRIVER DOOR AJAR SWITCH STATUS (D_DR_SW) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - SJB . • Monitor the D_DR_SW PID with the driver door closed and ajar. • **Does the D_DR_SW PID status match the driver door position?**	**Yes** GO to O4 . **No** REFER to Section 417-02 to diagnose the driver door ajar switch (courtesy lamps do not operate or stay on continuously). CLEAR the DTCs. REPEAT the self-test.
O4 CHECK CIRCUIT CPL01 (VT/GN) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Disconnect: 4X4 Control Module C281A. • Disconnect: SJB C2280D. • Measure the resistance between 4X4 control module C281A-12, circuit CPL01 (VT/GN), harness side and SJB C2280D-21, circuit CPL01 (VT/GN), harness side; and between 4X4 control module C281A-12, circuit CPL01 (VT/GN), harness side and ground.  • **Is the resistance less than 5 ohms between the 4X4 control module and the SJB and greater than 10,000 ohms between the 4X4 control**	**Yes** GO to O5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

module and ground?	
O5 CHECK CIRCUIT CPL01 (VT/GN) FOR A SHORT TO BATTERY	
• Ignition ON. • Measure the voltage between 4X4 control module C281A-12, circuit CPL01 (VT/GN), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to O6 .
O6 CHECK THE 4X4 CONTROL MODULE DRIVER DOOR AJAR SWITCH STATUS (D_DR_SW) PID	
• Ignition OFF. • Connect: 4X4 Control Module C281A. • Connect: SJB C2280D. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the D_DR_SW PID with the driver door closed and ajar. • **Does the D_DR_SW PID status match the driver door position?**	**Yes** System is functioning correctly. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.
O7 CHECK CIRCUIT SBB26 (YE/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Neutral Tow Indicator C2260. • Measure the voltage between neutral tow indicator C2260-1, circuit SBB26 (YE/RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to O8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
O8 CHECK CIRCUIT CCF21 (VT/WH) FOR AN OPEN OR SHORT TO GROUND	

• Disconnect: 4X4 Control Module C281A. • Measure the resistance between 4X4 control module C281A-19, circuit CCF21 (VT/WH), harness side and neutral tow indicator C2260-2, circuit CCF21 (VT/WH), harness side; and between 4X4 control module C281A-19, circuit CCF21 (VT/WH), harness side and ground.  N0076105 • **Is the resistance less than 5 ohms between the 4X4 control module and the neutral tow indicator and greater than 10,000 ohms between the 4X4 control module and ground?**	**Yes** GO to O9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
O9 CHECK CIRCUIT CFF21 (VT/WH) FOR A SHORT TO BATTERY	
• Ignition ON. • Measure the voltage between 4X4 control module C281A-19, circuit CCF21 (VT/WH), harness side and ground.  N0076106 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to O10 .
O10 CHECK THE NEUTRAL TOW INDICATOR USING THE NEUTRAL TOW LIGHT (TOW_LAMP) COMMAND	
• Ignition OFF. • Connect: Neutral Tow Indicator C2260. • Connect: 4X4 Control Module C281A. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Using the TOW_LAMP active command, command the neutral tow indicator on. • **Does the neutral tow indicator illuminate?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. **No** INSTALL a new neutral tow indicator. CLEAR the DTCs. REPEAT the self-test.
O11 CHECK CIRCUIT CCF20 (GY/VT) FOR AN OPEN OR SHORT TO GROUND	

• Ignition OFF. • Disconnect: 4X4 Control Module C281A. • Disconnect: Brake Shift Interlock C2008. • Measure the resistance between 4X4 control module C281A-13, circuit CCF20 (GY/VT), harness side and brake shift interlock C2008-4, circuit CCF20 (GY/VT), harness side; and between 4X4 control module C281A-13, circuit CCF20 (GY/VT), harness side and ground.  • **Is the resistance less than 5 ohms between the 4X4 control module and the brake shift interlock and greater than 10,000 ohms between the 4X4 control module and ground?**	**Yes** GO to O12 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
O12 CHECK CIRCUIT CCF20 (GY/VT) FOR A SHORT TO BATTERY	
• Ignition ON. • Measure the voltage between 4X4 control module C281A-13, circuit CCF20 (GY/VT), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to O13 .
O13 CHECK THE NEUTRAL SAFETY SWITCH (NTRL_SW) PID	
• Ignition OFF. • Connect: 4X4 Control Module C281A. • Connect: Brake Shift Interlock C2008. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4X4 control module NTRL_SW PID while shifting the transmission through gear ranges.	**Yes** System is functioning correctly. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.

• **Does the NTRL_SW PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?**	
O14 CHECK NEUTRAL TOW INDICATOR PROVE-OUT	
• Ignition ON. • Ignition OFF. • **Does the neutral tow indicator prove out?**	**Yes** GO to O15 . **No** GO to O20 .
O15 CHECK NEUTRAL TOW ACTIVATION	
• Activate neutral tow: ♦ transmission in NEUTRAL. ♦ key in OFF position. ♦ press the 4X4 AUTO switch and hold it for 5 seconds. • **Does neutral tow activate?**	**Yes** GO to O16 . **No** GO to O22 .
O16 CHECK FOR NEUTRAL TOW INDICATOR TIME-OUT	
• Close the driver door. • Monitor the neutral tow indicator. • **Does the indicator turn off after 20 seconds?**	**Yes** GO to O17 . **No** CHECK the module configuration. REFER to Section 418-01 . TEST the system for normal operation.
O17 CHECK NEUTRAL TOW INDICATION	
• Open the driver door. • Monitor the neutral tow indicator. • **Does the neutral tow indicator illuminate?**	**Yes** GO to O18 . **No** CHECK the module configuration. REFER to Section 418-01 . TEST the system for normal operation.
O18 CHECK NEUTRAL TOW DEACTIVATION BY IGNITION SWITCH	
• Ignition ON. • **Does neutral tow deactivate?**	**Yes** GO to O19 . **No** GO to O22 .
O19 CHECK NEUTRAL TOW REACTIVATION	
• Reactivate neutral tow: ♦ transmission in NEUTRAL. ♦ key in OFF position. ♦ press the 4X4 AUTO switch and hold it for 5 seconds. • Deactivate neutral tow by shifting the transmission out of NEUTRAL.	**Yes** The neutral tow system is operating correctly. **No** GO to O23 .

• **Does neutral tow reactivate then deactivate?**	
O20 CHECK NEUTRAL TOW SYSTEM INSTALLATION	
• Verify that the neutral tow system components are installed correctly. • **Are the neutral tow system components installed correctly?**	**Yes** GO to O21 . **No** INSTALL the neutral tow system components as necessary, then REPEAT the Neutral Tow Functional Test. TEST the system for normal operation.
O21 CHECK THE NEUTRAL TOW INDICATOR OPERATION	
• Connect the scan tool. • Follow the scan tool directions to activate neutral tow system. • Monitor the neutral tow indicator. • Key ON Engine OFF (KOEO). • **Does the neutral tow indicator prove out correctly?**	**Yes** GO to O15 . **No** CHECK and REPAIR neutral tow system wiring as necessary, then REPEAT the Neutral Tow Functional Test. TEST the system for normal operation.
O22 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION BY ACTIVATING 4X4 LOW	
• Ignition ON. • Select 4X4 LOW: ♦ vehicle stationary. ♦ shift the transmission to NEUTRAL. ♦ select 4X4 LOW. ♦ wait for the 4X4 LOW indicator to illuminate in the Instrument Cluster (IC) indicating that the shift is complete. • **Does the 4X4 LOW indicator illuminate?**	**Yes** GO to O23 . **No** GO to Pinpoint Test K .
O23 CHECK THE NEUTRAL SAFETY SWITCH (NTRL_SW) AND IGNITION STATE PIDs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • A. Monitor the 4X4 control module NTRL_SW PID while shifting the transmission through gear ranges. • B. Monitor the following ignition switch PIDs: ♦ Ignition Switch - Off/Unlock Position (IGN_O/U) ♦ ACC Position (IGN_A) ♦ Start Position 3 (IGN_S) ♦ Ignition Switch - Run/Start Position (IGN_R/S) ♦ Ignition Switch - Run Position (IGN_R)	**Yes** If all 6 PIDs are accurate, INSTALL a new 4X4 control module, then REPEAT the Neutral Tow Functional Test. TEST the system for normal operation. **No** **A.** REFER to Section 307-01A or Section 307-01B for further diagnosis of the neutral safety switch. TEST the system for normal operation. **B.** If the IGN_R/S PID did not match, CHECK SJB fuse 18 (10A). If the fuse is OK, REPAIR circuit CBP18 (GY/OG). CLEAR the DTCs. REPEAT the self-test. If the IGN_O/U,

• **A. Does the NTRL_SW PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?** **B. Do the ignition switch PIDs match the ignition switch positions?**	IGN_A, IGN_S or IGN_R PIDs did not match, REFER to Section 211-05 to diagnose the ignition switch concern.

Pinpoint P: Four-Wheel Drive (4WD) System Functional Test

Refer to Wiring Diagrams Cell 34 , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

When the vehicle is operating in 4X4 HIGH or 4X4 LOW (4H/4L), all 4 wheels rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the Four-Wheel Drive (4WD) system to operate correctly, each wheel/tire assembly must have matching sizes and the front and rear axle ratios must match.

This pinpoint test is intended to diagnose the following:
- 4X4 indicators
- 4X4 control module
- Transfer case and related components
- Wheel/tire assemblies

PINPOINT TEST P: 4WD SYSTEM FUNCTIONAL TEST

NOTE: 4X4 HIGH/4X4 LOW are not intended for driving on hard/dry surfaces.

Test Step	Result / Action to Take
P1 CHECK 4X4 INDICATOR PROVE-OUT	
• Ignition ON. • **Do the 4X4 indicators illuminate at prove out?**	**Yes** GO to P2 . **No** CHECK the Instrument Cluster (IC). REFER to Section 413-01 . TEST the system for normal operation.
P2 CHECK 4X4 AUTO OPERATION	
• If in 4X4 LOW, switch the Mode Select Switch (MSS) to 4X4 AUTO. • **Are the 4X4 indicators off?**	**Yes** GO to P5 . **No** GO to P3 .
P3 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No**

	GO to P4 .
P4 CHECK FOR WIND-UP IN 4X4 AUTO	
• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test J . **No** GO to Pinpoint Test K .
P5 CHECK THE 4WD CLUTCH PWM STATUS (4WDCPWMST) PID	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Monitor the 4WDCPWMST PID. • **Does the 4WDCPWMST PID indicate 2-4% clutch application at closed throttle?**	**Yes** GO to P7 . **No** GO to P6 .
P6 CHECK THE TRANSFER CASE CONTACT PLATE SWITCH PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • Using the active command PLATE_PWR to energize the transfer case motor contact plate position return circuit. • **NOTE:** Plate PIDs are momentarily monitored when switching positions. • Monitor the 4X4 control module Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs. Refer to the following chart: • **Does the contact plate position PIDs indicate that the transfer case shift motor is in 4X4 AUTO?**	**Yes** GO to Pinpoint Test J . **No** GO to Pinpoint Test K .
P7 CHECK FRONT SHAFT SPEED (FR_OUTSHA) AND REAR SHAFT SPEED (R_OUTSHA) PIDs	
• Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module.	**Yes** GO to P8 . **No**

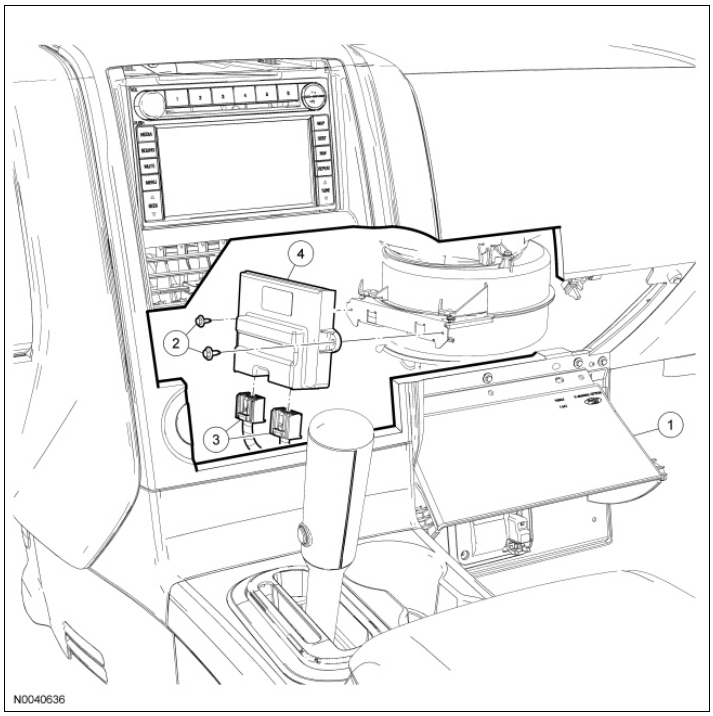
Contact Plate Position PID	MSS 4X4 AUTO/4X4 HIGH	MSS 4X4 LOW
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

• Monitor the FR_OUTSHA AND R_OUTSHA PIDs. • Drive the vehicle at 30 km/h (18 mph). • Record and compare the FR_OUTSHA AND R_OUTSHA PIDs. • **Do the FR_OUTSHA and R_OUTSHA PID values match within 1.5 km/h (1 mph)?**	CHECK the ABS. REFER to Section 206-09 and VERIFY that the 4 road tire sizes match. TEST the system for normal operation.
P8 CHECK THE TP STATUS (TPI) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger - 4X4 Control Module. • **NOTE:** The TPI PID is APP as communicated by the PCM via High Speed Controller Area Network (HS-CAN). • Slowly move throttle from closed throttle to Wide Open Throttle (WOT) and observe the 4X4 control module TPI PID, Key ON Engine OFF (KOEO). • **Does the TPI PID value vary between 0 at closed throttle and 255 at WOT ?**	**Yes** GO to P9 . **No** CHECK the APP accelerator pedal position sensor and/or PCM. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. TEST the system for normal operation.
P9 CHECK FOR WIND-UP IN TURNS ON THROTTLE	
• Drive the vehicle on a dry, hard surface, executing turns while applying the throttle. • **Is wind-up present?**	**Yes** CHECK the transfer case. REFER to Section 308-07B . TEST the system for normal operation. **No** GO to P10 .
P10 CHECK 4X4 HIGH OPERATION	
• Select 4X4 HIGH. • **Does the 4X4 indicator illuminate correctly?**	**Yes** GO to P11 . **No** GO to P12 .
P11 CHECK FOR 4X4 HIGH WIND-UP	
• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to P14 . **No** GO to Pinpoint Test J .
P12 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to P13 .
P13 CHECK FOR WIND-UP IN 4X4 HIGH ON THROTTLE	

• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test K . **No** GO to Pinpoint Test J .
P14 CHECK THE 4X4 LOW OPERATION	
• Select 4X4 LOW: ♦ vehicle stationary. ♦ shift the transmission to NEUTRAL. ♦ select 4X4 LOW. ♦ wait for the 4X4 LOW indicator to illuminate in the IC indicating that the shift is complete. • **Does the 4X4 LOW indicator illuminate?**	**Yes** GO to P15 . **No** GO to P16 .
P15 CHECK FOR WIND-UP IN 4X4 LOW	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to P19 . **No** GO to P17 .
P16 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to P18 .
P17 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module DTC Chart in this section for diagnosis. **No** GO to Pinpoint Test J .
P18 CHECK FOR WIND-UP IN 4X4 LOW	
• Drive the vehicle on a dry, hard surface in turns while applying the throttle. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test K . **No** GO to Pinpoint Test J .
P19 CHECK 4X4 AUTO OPERATION	
• Switch the MSS to 4X4 AUTO. • **Do the 4X4 indicators turn off?**	**Yes** The 4WD system is operating correctly. **No** GO to P20 .
P20 CHECK FOR DTCs	
• Connect the scan tool. • Carry out the 4X4 control module self-test.	**Yes** REFER the 4X4 Control Module DTC Chart in this section.

• **Are DTCs retrieved?**	**No** GO to P21 .
P21 CHECK FOR WIND-UP IN 4X4 AUTO	
• Drive the vehicle on a dry, hard surface in turns. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test L . **No** GO to Pinpoint Test K .

4X4 Control Module



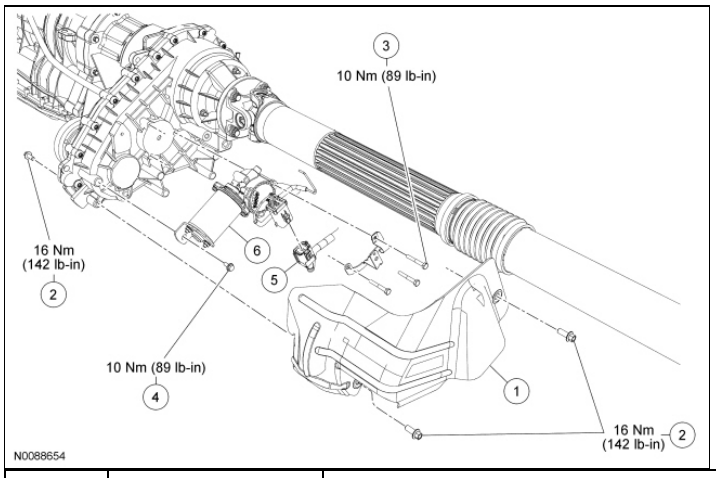
Item	Part Number	Description
1	-	Glove compartment
2	W705314	Screws
3	-	Connectors
4	7E453	4X4 control module

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Open the glove compartment, press in on sides and lower it to gain access.
3. Remove the 2 screws.
4. Disconnect the electrical connectors.
5. Remove the 4X4 control module.
6. To install, reverse the removal procedure.

Transfer Case Shift Motor

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



Item	Part Number	Description
1	7C277	Heat shield
2	7A443	Heat shield bolts (3 required)
3	N800670-S	Transfer case shift motor bolt (3 required)
4	N802503-S	Transfer case shift motor bolt
5	-	Transfer case shift motor electrical connector
6	7G360	Transfer case shift motor

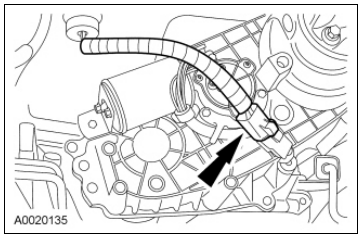
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. With the ignition ON, press the 4X4 HIGH button on the Mode Select Switch (MSS).

3. Remove the 3 heat shield bolts and the heat shield.
   - To install, tighten to 16 Nm (142 lb-in).

4. Disconnect the transfer case shift motor electrical connector.

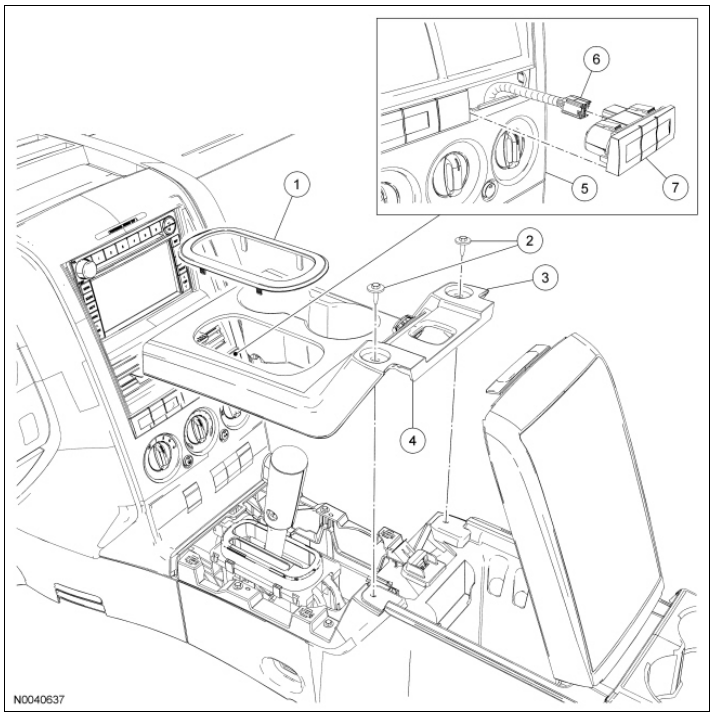


5. Using an electrical connector pin extractor tool, remove the coil wire pin from the electrical connector.

6. Remove the 4 transfer case shift motor mounting bolts and the transfer case shift motor.
    - To install, tighten to 10 Nm (89 lb-in).

7. To install, reverse the removal procedure.
    - Apply a coat of multi-purpose grease to the transfer case shift motor bolts.
    - Apply a thin coat of silicone sealant to the shift motor mating surface.

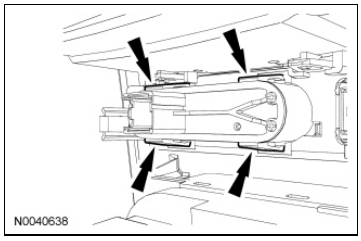
Mode Select Switch (MSS)



Item	Part Number	Description
1	-	Bezel
2	W705314	Screws
3	-	Floor console center finish panel
4	14401	Auxiliary power point electrical connector
5	980327	Instrument panel center finish panel
6	14401	Mode Select Switch (MSS) electrical connector
7	7Z155	MSS

Removal and Installation

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Remove the bezel.
3. With the center console cover open, remove the floor console center finish panel screws.
4. Raise the floor console center finish panel and disconnect the auxiliary power point electrical connector.
5. Remove the floor console center finish panel.
6. Disconnect the electrical connector(s).
7. Disengage the locking tangs and remove the Mode Select Switch (MSS) from the instrument panel center finish panel.



8. To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Transfer Case Fluid XL-12	ESP-M2C166-H	1.42L (3.0 pt)
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

Torque Specifications

Description	Nm	lb-ft	lb-in
Clutch coil assembly nuts	10	-	89
Damper snubber Torx screws	7	-	62
Driveshaft yoke bolts	112	83	-
Heat shield bolts	16	-	142
Hex head bolts	10	-	89
Rear output flange nut	355	262	-
Skid plate bolts	24	18	-
Transfer case bolts [a]	-	-	-
Transfer case drain plug	20	-	177
Transfer case fill plug	20	-	177
Transfer case shift motor bolts	10	-	89
Transfer case-to-transmission bolts	20	-	177
Transmission insulator nuts	98	72	-
Transmission insulator-to-transfer case bolts	90	66	-

[a] Refer to the procedure for specifications.

Transfer Case

The Four-Wheel Drive (4WD) system consists of the following:

- Transfer case
- Front driveshaft
- Rear driveshaft
- 4X4 control module

All-Wheel Drive (AWD) Transfer Case

Torque from the transmission is transferred to the input shaft through the planetary gear assembly and out the rear output shaft. Torque also flows through the planetary gear assembly to the drive gear outward to the driven gear. The torque flow continues from the upper drive sprocket through the drive chain to the lower drive sprocket to the front output shaft. The open differential provides 60% of available torque to the rear and 40% to the front, between the rear output shaft drive gear and the front output shaft driven gear.

1-Speed Torque-On-Demand Transfer Case

The transfer case transfers power from the transmission to the rear axle and front axle when the electromechanical clutch is activated.

The electromechanical clutch assembly drives the drive sprocket after the 4X4 control module activates the clutch coil. The drive sprocket turns the drive chain that rotates the front output shaft and the front driveshaft.

2-Speed Torque-On-Demand Transfer Case

4X4 AUTO Mode

Torque from the transmission is transferred to the input shaft which drives the rear output shaft that drives the rear axle assembly. The electromechanical clutch assembly drives the drive sprocket after the 4X4 control module activates the clutch coil. The drive sprocket turns the drive chain that rotates the front output shaft and the front driveshaft.

4X4 HIGH Mode

The operation is the same as in AUTO Mode, except that the 4X4 control module constantly activates the electromechanical clutch assembly.

4X4 LOW Mode

The HIGH-LOW shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gearset to the output shaft. Then, torque transmitted through the sun gear from the input shaft turns the front planetary gearset assembly. The front planetary gearset assembly is engaged and provides transfer case speed reduction.

Transfer Case

Refer to Section 308-07A .

Transfer Case Draining and Filling

Material

Item	Specification
Motorcraft® Transfer Case Fluid XL-12	ESP-M2C166-H

1. ***NOTICE:*** **Transfer case failure can result if the correct fill procedures are not followed.**

   NOTE: Position a suitable drain pan under the transfer case.

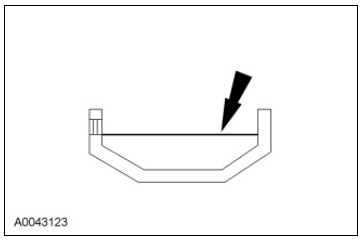
   Remove the drain plug and drain the fluid.

2. Clean and install the drain plug.
   - Tighten to 20 Nm (177 lb-in).

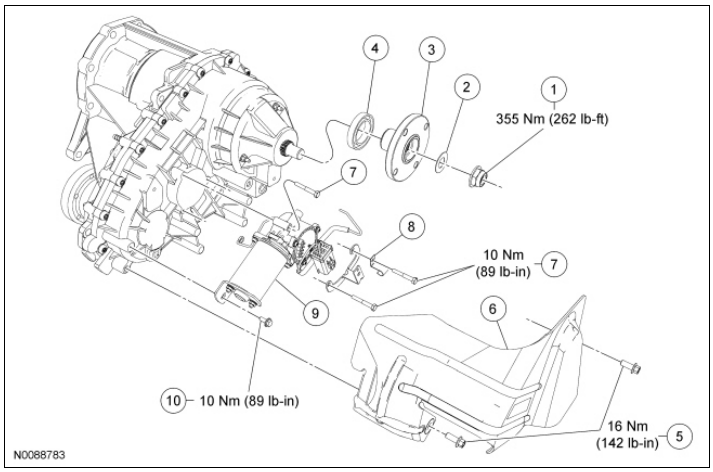
3. ***NOTICE:*** **Incorrect fluid fill can result in transfer case failure.**

   NOTE: Fill the transfer case with the vehicle on a level surface. Make sure the fluid is level with the filler opening for the correct fluid level.

   Clean the area around the fill plug. Remove the fill plug. Using a suitable oil suction gun, fill the transfer case to the correct level with the specified fluid.



Transfer Case - Exploded View

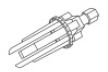
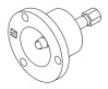


Item	Part Number	Description
1	7045	Rear output shaft flange nut
2	7B368	Rear output shaft flange washer
3	7B214	Rear output shaft flange
4	7B215	Rear output shaft oil seal
5	7A443	Heat shield bolts (3 required)
6	7C277	Heat shield
7	N800670	Shift motor bolts (3 required)
8	7K470	J-clip
9	7G360	Transfer case shift motor
10	N802503	Transfer case shift motor bolt

1. For additional information, refer to the procedures in this section.

Transfer Case Rear Output Shaft Seal

Special Tool(s)

 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST2305-A	Installer, Input Shaft Oil Seal 308-186 (T90T-7172-B)
 ST1213-A	Remover, Bushing 307-001 (TOOL-1175-AC) or equivalent
 ST2415-A	Remover, Output Shaft Flange 307-523 or equivalent
 ST1351-A	Slide Hammer 100-001 (T50T-100-A)

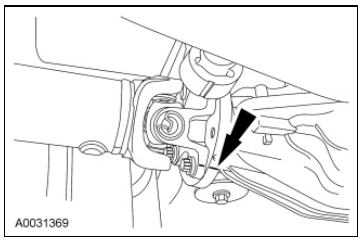
Material

Item	Specification
Motorcraft® Transfer Case Fluid XL-12	ESP-M2C166-H
Threadlock and Sealer TA-25	WSK-M2G351-A5

Removal and Installation

1. With the transmission in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

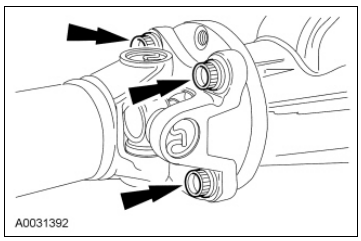
2. Index-mark the rear output flange and the driveshaft yoke.


A0031369

3. **NOTE:** If new driveshaft yoke bolts are not available, coat the threads of the original bolts with threadlock and sealer.

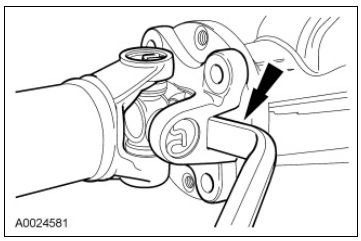
   Remove the 4 driveshaft yoke bolts.

- To install, tighten to 112 Nm (83 lb-ft) evenly in a cross pattern.

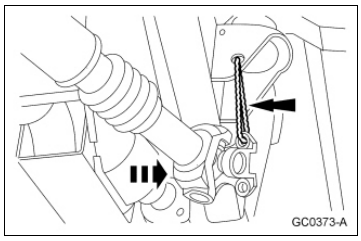


4. ***NOTICE:*** **The driveshaft flange fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its components to disconnect the driveshaft flange from the pinion flange. Pry only in the area shown, with a suitable tool, to disconnect the driveshaft flange from the pinion flange or damage to the components can occur.**

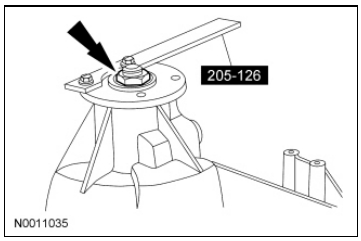
   Using a suitable tool as shown, disconnect the driveshaft flange from the rear axle pinion flange.



5. Position the driveshaft aside and support with mechanic's wire.

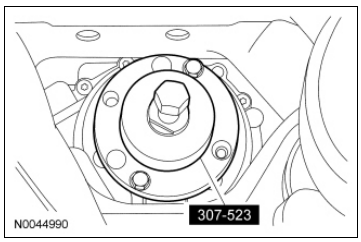


6. Using the Drive Pinion Flange Holding Fixture to hold the output flange, remove the nut.
   - To install, tighten to 355 Nm (262 lb-ft).



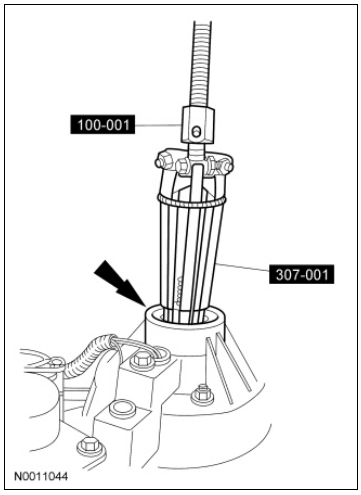
7. Remove the output shaft yoke washer.

8. Using the Output Shaft Flange Remover, remove the rear output shaft flange.

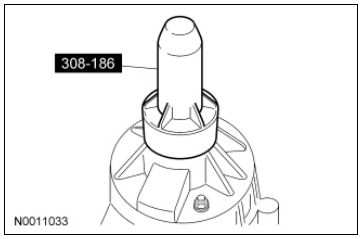


9. Remove and discard the rear output shaft flange oil seal.

10. Using the Bushing Remover with the Slide Hammer, remove the rear output shaft oil seal.



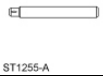
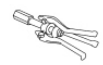
11. Using the Input Shaft Oil Seal Installer, install a new rear output shaft oil seal.



12. To install, reverse the removal procedure.
    - Always install a new rear output shaft flange oil seal.

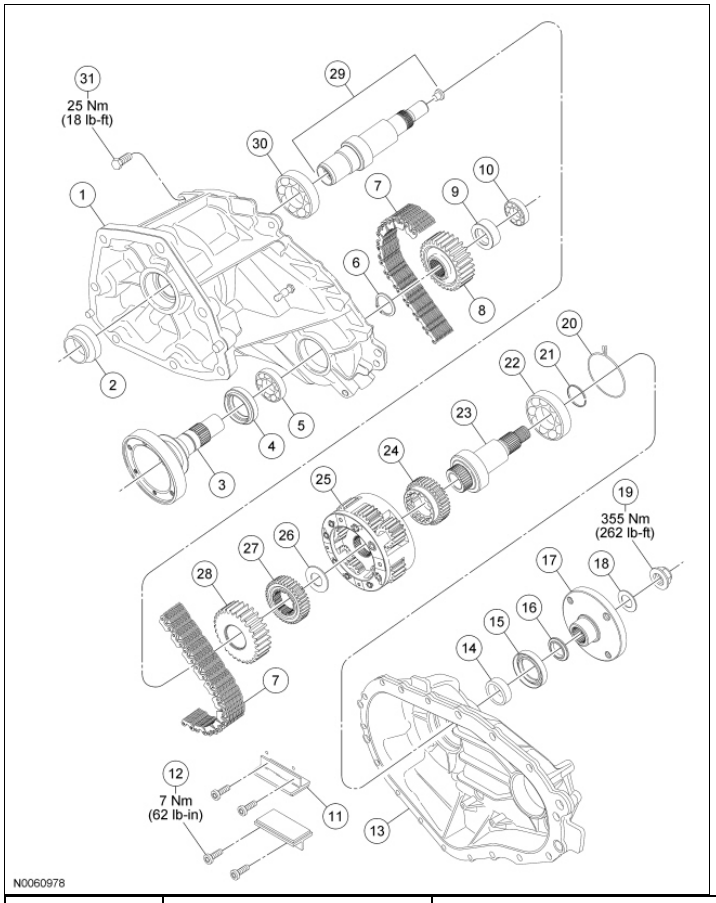
Transfer Case - All-Wheel Drive (AWD)

Special Tool(s)

 ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST2509-A	Installer, Differential Bearing Cup 308-163 (T88C-77000-FH)
 ST2876-A	Installer, Front Pump Fluid Seal 307-184 (T87L-77248-AH)
 ST1471-A	Installer, Wheel Hub Bearing Cup 204-020 (T73T-1202-A)
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
 ST1303-A	Remover/Installer, Bearing Tube 308-024 (T75L-7025-B)
 ST1362-A	Remover, Stator Bearing 307-318 (T94P-77001-KH)
 ST1351-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® Transfer Case Fluid XL-12	ESP-M2C166-H
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4



Item	Part Number	Description
1	7005	Transfer case
2	7B215	Input shaft seal
3	7061	Output shaft
4	7B215	Yoke-to-flange seal
5	7025	Bearing
6	7917	Snap ring
7	7A029	Drive chains
8	7177	Lower drive sprocket
9	-	Spacer
10	7025	Bearing
11	7F123	Damper snubber
12	7A771	Torx head screws (4 required)
13	7005	Transfer case
14	7025	Bearing
15	7B215	Yoke-to-flange seal
16	7052	Oil seal
17	7B214	Output flange
18	7B368	Output shaft yoke washer
19	7045	Output flange nut
20	7917	Snap ring
21	7R141	Snap ring
22	7025	Bearing

23	7061	Upper output shaft
24	-	Sun gear
25	-	Planetary gear
26	-	Thrust washer
27	-	Sun gear
28	-	Upper drive sprocket
29	7017	Input shaft assembly
30	7025	Input shaft bearing
31	7A443	Transfer case bolt (17 required)

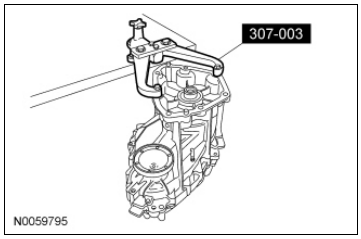
Disassembly

1. **NOTE:** Discard all seals after removing them.

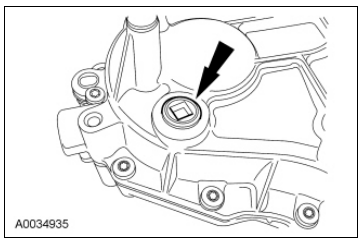
   Remove the transfer case from the vehicle. For additional information, refer to Transfer Case in this section.

2. ⚠ **WARNING: Always verify that the lockpin on the bench-mounted holding fixture is correctly secured to help prevent unexpected component rotation. Failure to follow this instruction may result in serious personal injury.**

   Using the Transmission Holding Fixture, secure the transfer case to a bench.

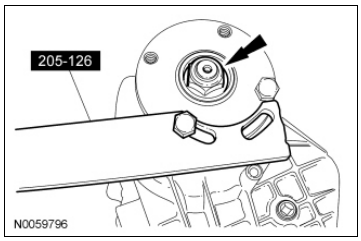


3. If not done previously, remove the drain plug and drain the fluid.
   - Install the drain plug when finished draining.
   - Tighten to 20 Nm (177 lb-in).

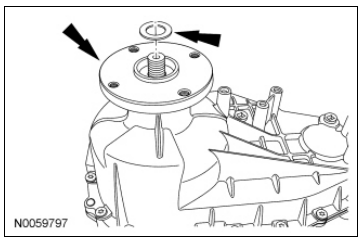


4. **NOTE:** Index-mark the rear output flange and the upper output shaft.

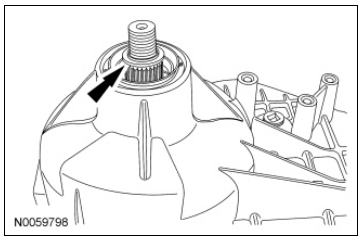
   Using the Drive Pinion Flange Holding Fixture to hold the output flange, remove the output flange nut.



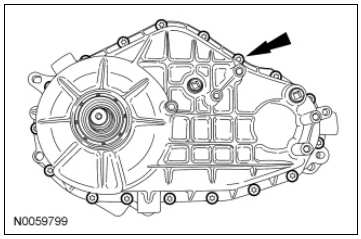
5. Remove the output flange and the output shaft yoke washer.



6. Remove the oil seal.

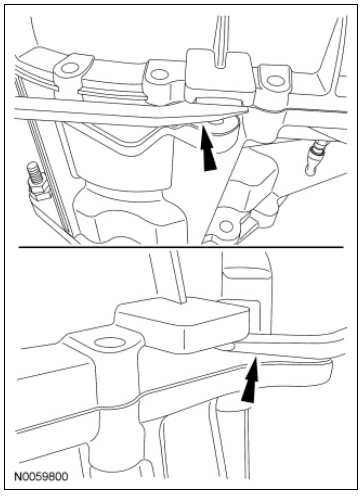


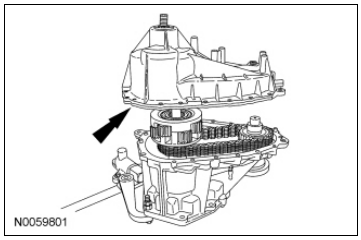
7. Remove the 17 transfer case bolts.



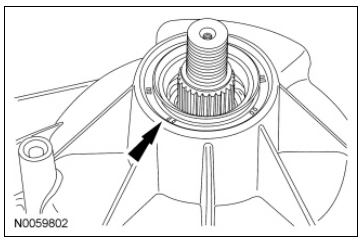
8. ***NOTICE:*** **Pry only at the transfer case pry bosses. Prying other than at the pry bosses may cause damage to the components.**

   Using a pry bar, separate the rear case from the front case.

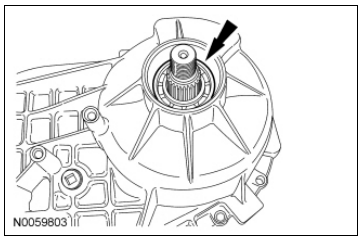




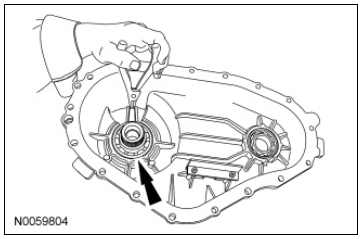
9. Remove the oil seal.



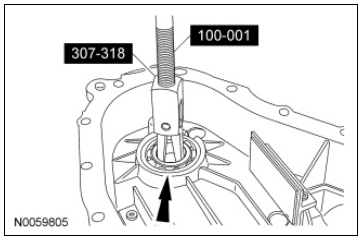
10. Remove the bearing.



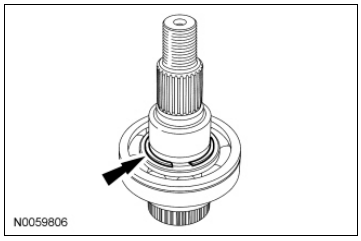
11. Expand the snap ring, then remove the output shaft and bearing.



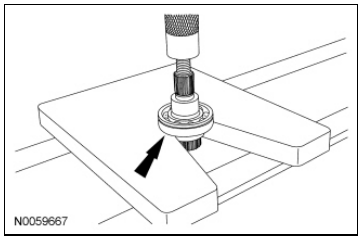
12. Using the Slide Hammer and Stator Bearing Remover, remove the bearing.



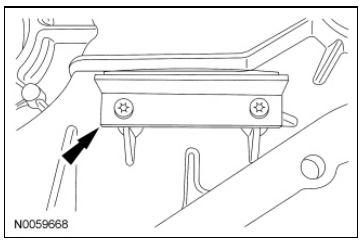
13. Remove the snap ring and discard.



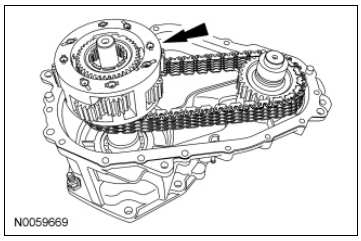
14. Using a suitable press, remove the bearing.



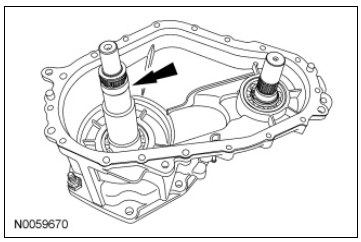
15. Remove the 4 Torx screws and the damper snubber.



16. Remove the sun gears, the thrust washer, the planetary, the upper drive sprocket, the drive chain, the lower drive sprocket and the sprocket spacer as an assembly.

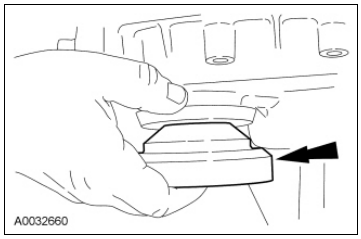


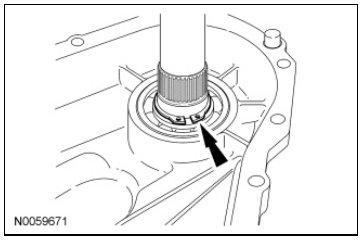
17. Remove the input shaft.



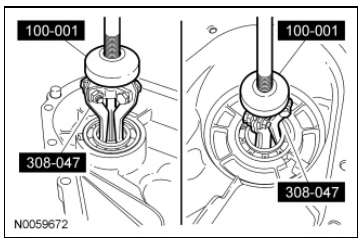
18. Remove the input shaft bearing.

19. Holding the front output shaft, remove the snap ring and discard, then remove the front output shaft.

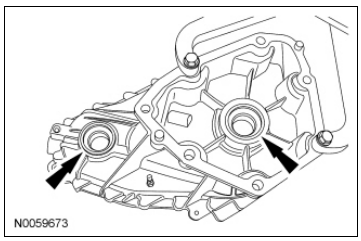




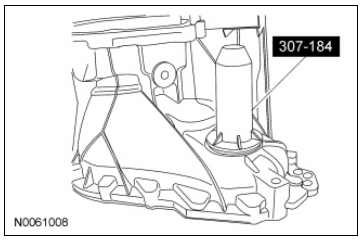
20. Using the Slide Hammer and Bearing Cup Remover, remove the bearings.



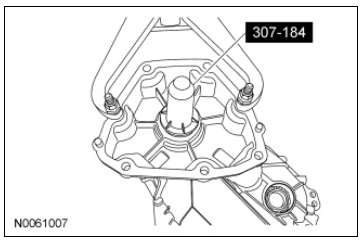
21. Remove the seals.



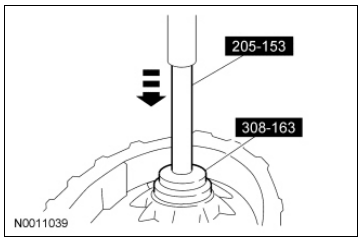
Assembly



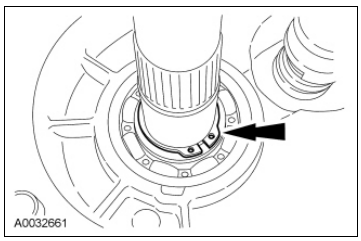
1. Using the Front Pump Fluid Seal Installer, install the seals in the front transfer case.



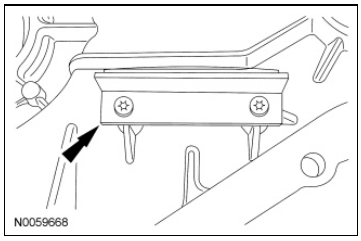
2. Using the Differential Bearing Cup Installer and Handle with Adapter, install the bearing.



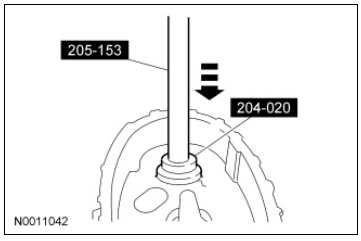
3. Install the front output shaft.
    - Install the front output shaft.
    - Install a new snap ring.



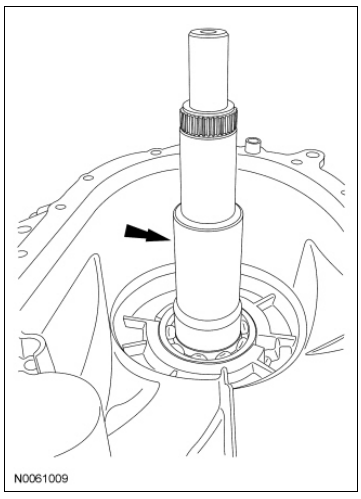
4. Position the damper snubber and install the 4 Torx screws.
    - Tighten to 7 Nm (62 lb-in).



5. Using the Wheel Hub Bearing Cup Installer and Handle with Adapter, install the bearing.

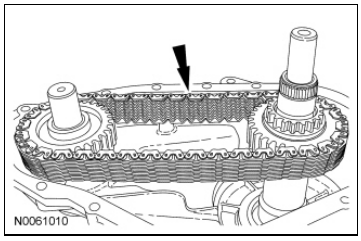


6. Install the input shaft.

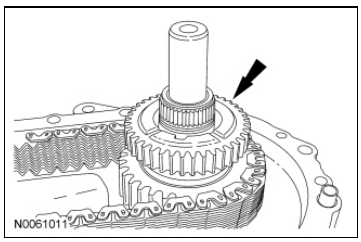


7. Assemble the upper drive sprocket, lower drive sprocket and the drive chain.

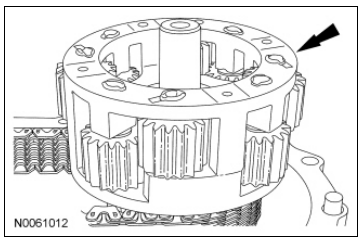
8. Install the upper and lower drive sprockets and the drive chain as an assembly.



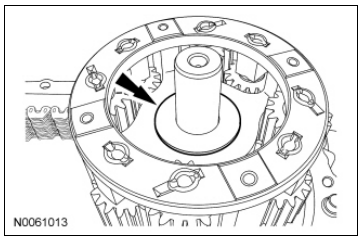
9. Install the lower sun gear.



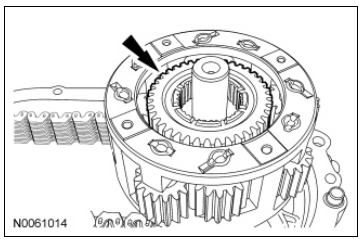
10. Install the front planetary gear assembly.



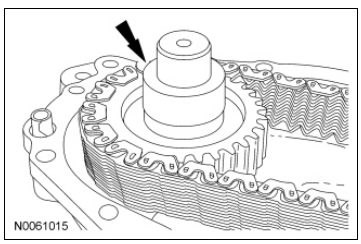
11. Install the thrust washer.



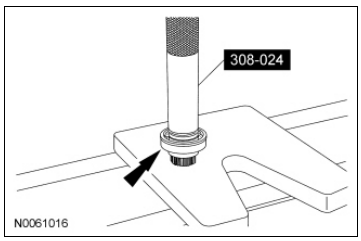
12. Install the upper sun gear.



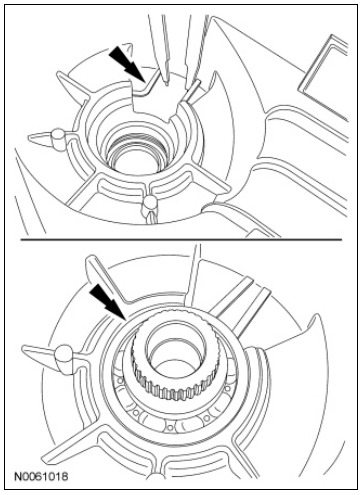
13. Install the spacer.



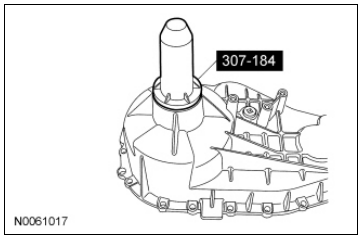
14. Using the Bearing Tube Remover/Installer, install the bearing.



15. Install the output shaft and bearing in the rear case half.
    - Expand the snap ring. Install the output shaft.



16. Using the Front Pump Fluid Seal Installer, install the yoke-to-flange seal.



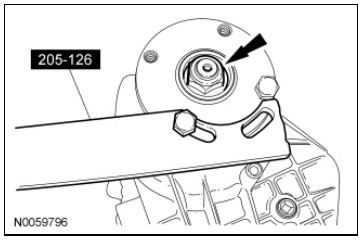
17. ***NOTICE:*** **Applying excess silicone rubber can damage the internal components.**

    Apply a 3 mm (0.125 in) bead of silicone rubber on the rear case mating surface.

18. Assemble the front and rear case halves.

19. Install the 17 transfer case bolts.
    - Tighten to 25 Nm (18 lb-ft) evenly in a star pattern.

20. Using the Drive Pinion Flange Holding Fixture to hold the output flange, install the nut.
    - Tighten to 355 Nm (262 lb-ft).

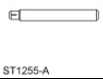
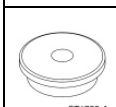
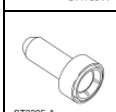
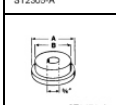
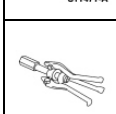
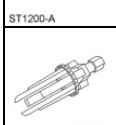
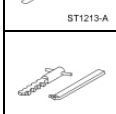
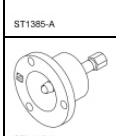
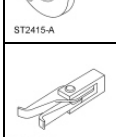
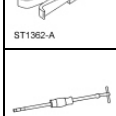


21. Install the transfer case in the vehicle. For additional information, refer to Transfer Case in this section.

22. Fill the transfer case. For additional information, refer to Transfer Case Draining and Filling in this section.

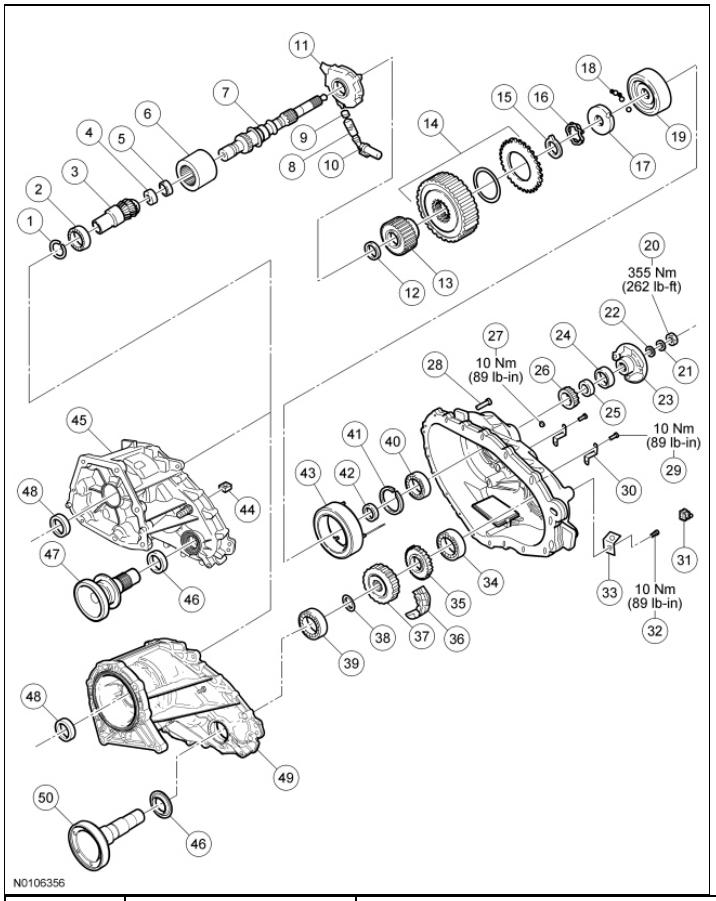
Transfer Case - 1-Speed Torque-On-Demand

Special Tool(s)

 ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1783-A	Installer, Differential Bearing Cup 308-163 (T88C-77000-FH)
 ST2305-A	Installer, Input Shaft Oil Seal 308-186 (T90T-7127-B)
 ST1471-A	Installer, Wheel Hub Bearing Cup 204-020 (T73T-1202-A)
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
 ST1213-A	Remover, Bushing 307-001 (TOOL-1175-AC) or equivalent
 ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
 ST2415-A	Remover, Output Shaft Flange 307-523 or equivalent
 ST1362-A	Remover, Stator Bearing 307-318 (T94P-77001-KH)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® Transfer Case Fluid XL-12	ESP-M2C166-H
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Threadlock and Sealer TA-25	WSK-M2G351-A5



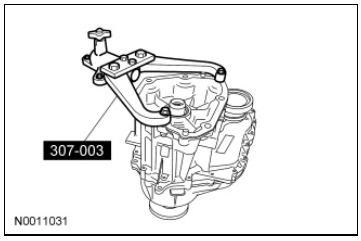
Item	Part Number	Description
1	7917	Snap ring
2	7025	Bearing
3	7017	Input shaft
4	7025	Bearing
5	-	Output shaft bushing (part of 7017)
6	7017	Collar
7	7061	Rear output shaft and oil pump assembly
8	7A210	Pump hose
9	382846	Hose clamp
10	7A098	Oil strainer
11	7A149	Pump assembly
12	7Z111	Thrust washer
13	7177	Drive sprocket (30T)
14	7C108	Clutch pack assembly
15	7917	Snap ring

16	7E085	Wave spring
17	7R428	Apply cam
18	7A534	Balls (3 required)
19	7G362	Cam and coil housing assembly
20	7045	Rear output shaft flange nut
21	7B368	Output shaft flange washer
22	7052	Output flange oil seal
23	7B214	Rear output shaft flange
24	7B215	Yoke-to-flange oil seal
25	7072	Spacer
26	7G450	Tone wheel (upper)
27	N620480	Clutch coil assembly nut (3 required)
28	7A443	Transfer case bolt (17 required)
29	N802503	Bolt (hex-head) 2 required
30	7K470	Bracket
31	-	Electrical connector
32	N802503	Bolt (hex-head) 2 required
33	7K470	J-clip
34	7025	Front output shaft rear bearing
35	7G450	Tone wheel (lower)
36	7A029	Drive chain
37	7177	Driven sprocket (30T)
38	7064	Snap ring
39	7025	Bearing
40	7025	Rear output shaft support bearing
41	7917	Snap ring
42	7D221	Thrust bearing
43	7G361	Clutch coil assembly
44	7L027	Oil pan magnet
45	7005	Transfer case cover (4.0L)
46	7B215	Oil seals (4.0L)
47	7061	Output shaft and flange (front) (4.0L)
48	7B215	Input seals
49	7005	Transfer case cover (4.6L)
50	7061	Output shaft and flange (4.6L)

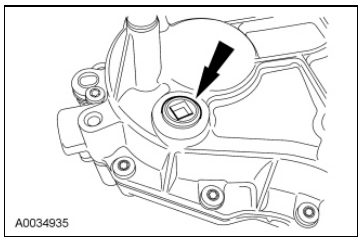
Disassembly

1. Remove the transfer case. For additional information, refer to Transfer Case in this section.
2. ⚠ **WARNING: Always verify that the lockpin on the bench-mounted holding fixture is correctly secured to help prevent unexpected component rotation. Failure to follow this instruction may result in serious personal injury.**

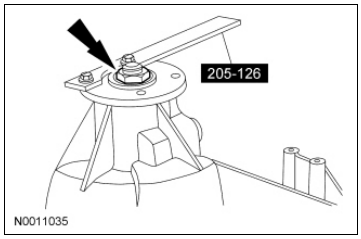
   Using the Transmission Holding Fixture, secure the transfer case to the bench.



3. If not previously done, remove the drain plug and drain the fluid.
    - When finished draining, install the drain plug and tighten to 20 Nm (177 lb-in).

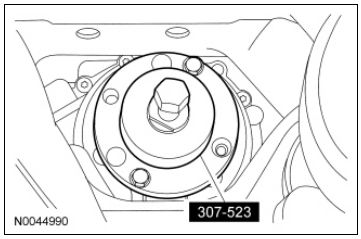


4. Using the Drive Pinion Flange Holding Fixture to hold the rear output flange, remove the rear output shaft flange nut.



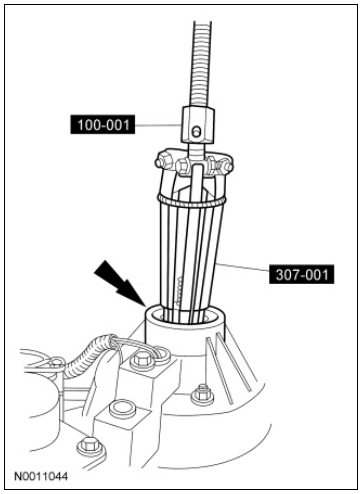
5. Remove the output shaft yoke washer.

6. Using the Output Shaft Flange Remover, remove the rear output shaft flange.

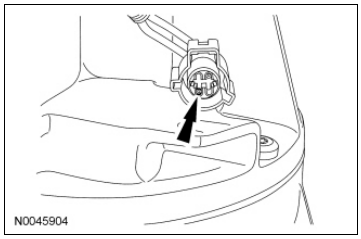


7. Remove and discard the output flange oil seal.

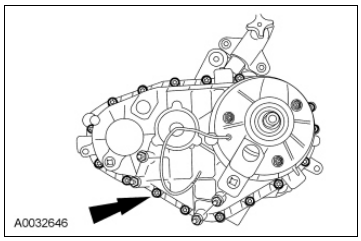
8. Using the Bushing Remover with the Slide Hammer, remove and discard the yoke-to-flange seal.



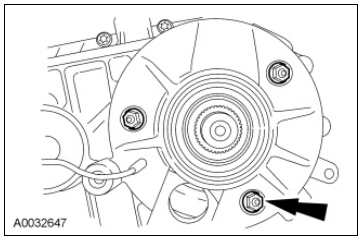
9. Remove the connector interlock from the electrical connector. Using an electrical connector pin extractor tool, remove the coil wire pin.



10. Remove the 17 transfer case bolts.

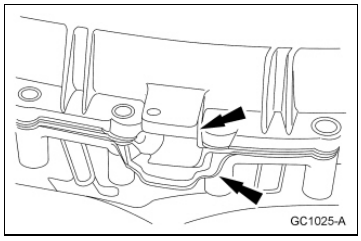


11. Remove the 3 clutch coil assembly nuts.

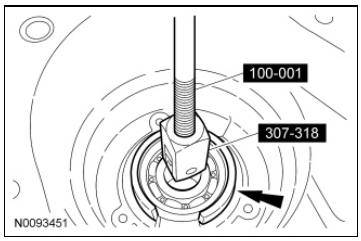


12. ***NOTICE:*** **Pry only at the transfer case pry bosses. Prying other than at the pry bosses may cause damage to the components.**

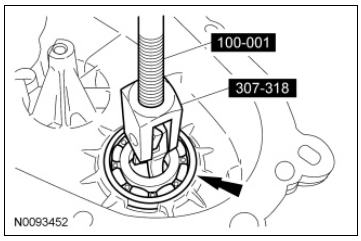
    Separate the transfer case halves at the transfer case pry bosses.



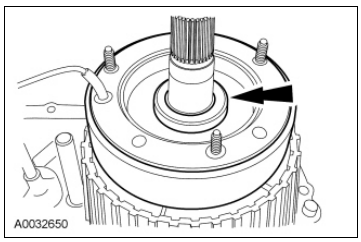
13. Remove the snap ring, then using the Slide Hammer and the Stator Bearing Remover, remove the rear output shaft support bearing.



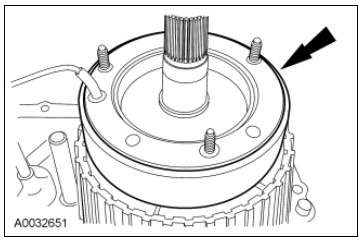
14. Using the Slide Hammer and the Stator Bearing Remover, remove the front output shaft rear bearing.



15. Remove the thrust bearing.

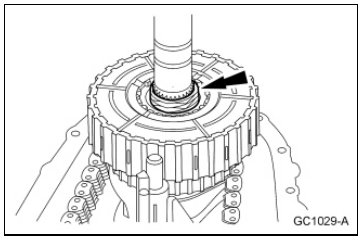


16. Remove the cam and coil housing assembly.

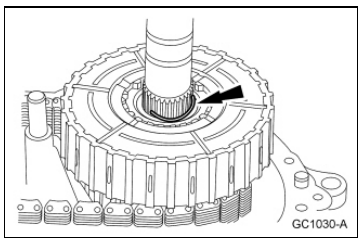


17. Remove the apply cam and 3 steel balls.

18. Remove the wave spring.



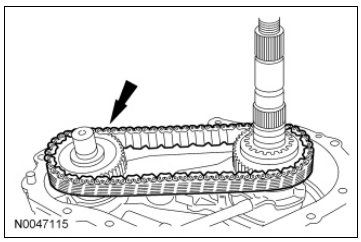
19. Remove the snap ring.



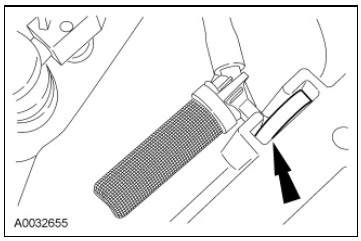
20. ***NOTICE:*** **When removing or installing the clutch pack assembly, do not separate the clutch pack assembly. Keep tension on the clutch pack upon removal. Set the clutch pack assembly on the bench in the same position as it was located in the transfer case. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem can occur.**

    Remove the clutch pack assembly.

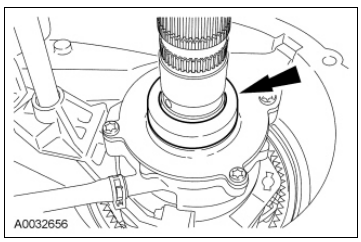
21. Remove the drive chain and the 2 sprockets as an assembly.



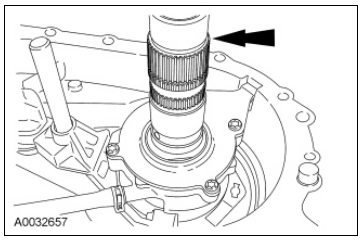
22. Remove and clean the oil pan magnet.



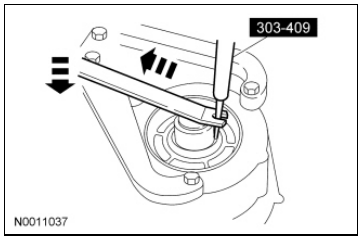
23. Remove the thrust washer.



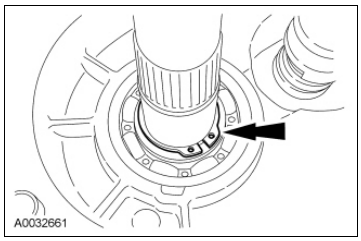
24. Remove the pump assembly and the rear output shaft as an assembly. Do not disassemble the pump assembly.



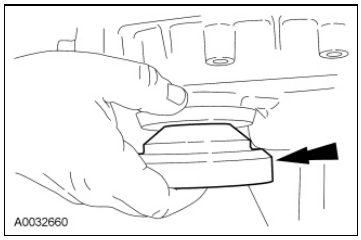
25. Using the Oil Seal Remover, remove the oil seal.



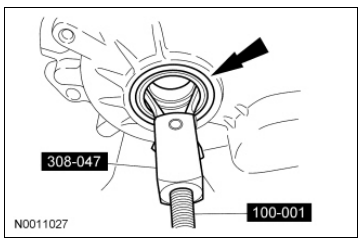
26. While holding the front output shaft and flange, remove the snap ring.



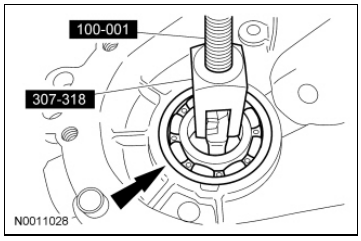
27. Remove the front output shaft and flange.



28. Using the Bearing Cup Remover with the Slide Hammer, remove the oil seal.

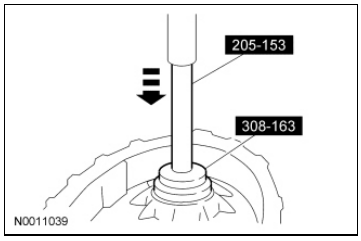


29. Using the Stator Bearing Remover with the Slide Hammer, remove the front output shaft support bearing.

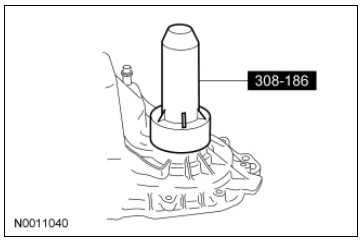


Assembly

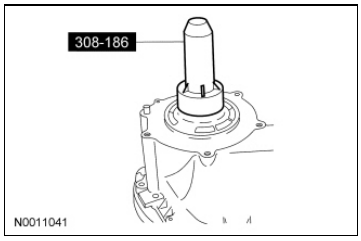
1. Using the Differential Bearing Cup Installer with the Adapter, press the front output shaft support bearing into the case.



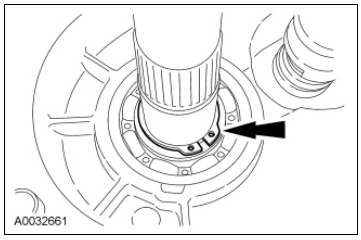
2. Using the Input Shaft Oil Seal Installer, install the oil seal.



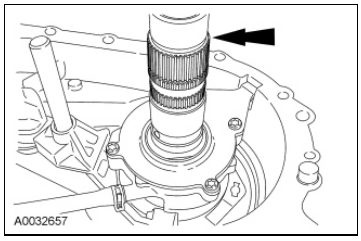
3. Using the Input Shaft Oil Seal Installer, install the oil seal.



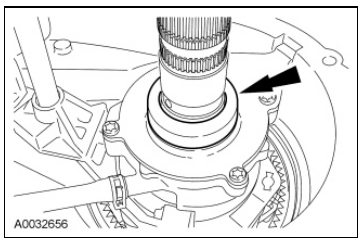
4. Install the front output shaft and flange and snap ring.



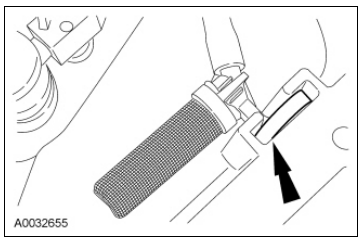
5. Install the pump assembly and the rear output shaft as an assembly.



6. Install the thrust washer.



7. Install the oil pan magnet.

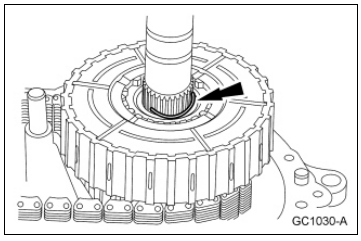


8. Install the drive chain and the 2 sprockets as an assembly.

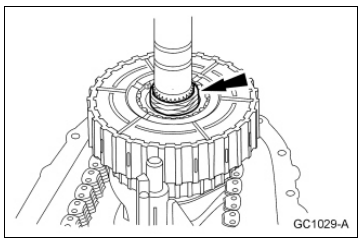
9. ***NOTICE:*** **When removing or installing the clutch pack assembly, do not separate the clutch pack assembly. Keep tension on the clutch pack upon removal. Set the clutch pack assembly on the bench in the same position as it was located in the transfer case. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem can occur.**

   Install the clutch pack assembly.

10. Install a new snap ring.

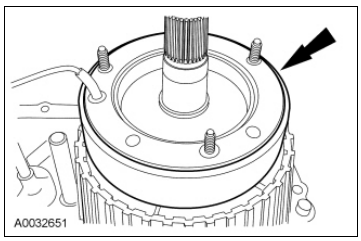


11. Install the wave spring.

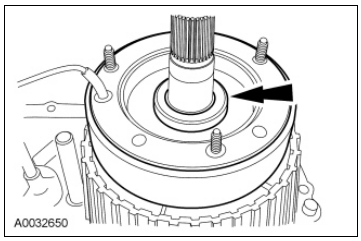


12. Install the apply cam and 3 steel balls.

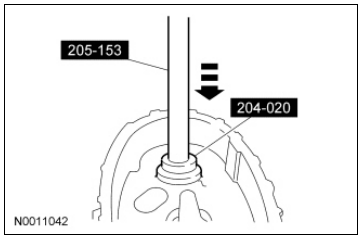
13. Install the cam and coil housing assembly.



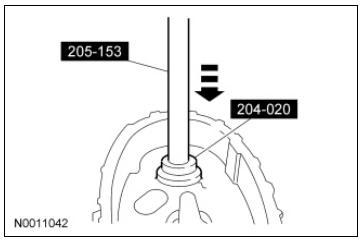
14. Install the thrust bearing.



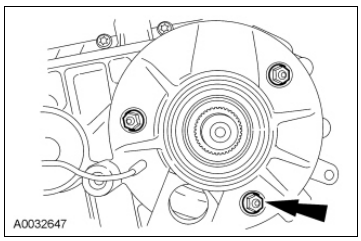
15. Using the Wheel Hub Bearing Cup Installer with the Adapter, install the front output shaft rear bearing into the case.



16. Using the Wheel Hub Bearing Cup Installer with the Adapter, install the rear output shaft rear bearing into the case.

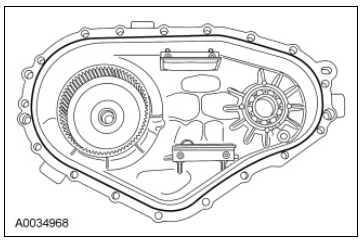


17. Position and support the clutch coil assembly, then install the 3 nuts.
    - Tighten to 10 Nm (89 lb-in).



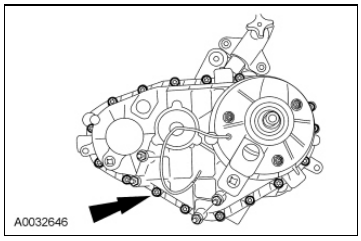
18. ***NOTICE:*** **Applying excess gasket sealant can damage the internal components.**

Apply a 3 mm (0.11 in) bead of gasket sealant on the rear case mating surface.

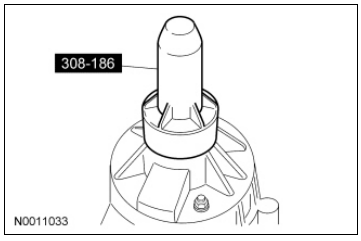


19. Assemble the front and rear case halves.

20. Install the 17 transfer case bolts.
    - Tighten the bolts evenly in a cross pattern to 25 Nm (18 lb-ft).



21. Using the Input Shaft Oil Seal Installer, install the yoke-to-flange oil seal.



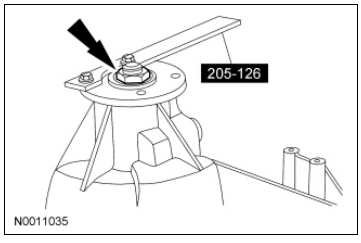
22. Install a new output flange oil seal.

23. **NOTE:** Align the index marks made during disassembly.

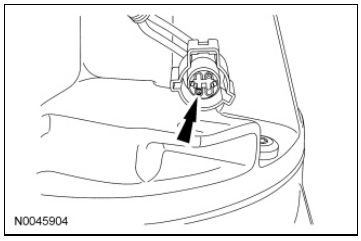
    Install the output flange.

24. Install the output shaft yoke washer.

25. Using the Drive Pinion Flange Holding Fixture to hold the output flange, install the nut.
    - Tighten to 355 Nm (262 lb-ft).



26. Seat the coil wire pin into the electrical connector and install the connector interlock.

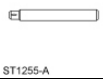
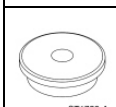
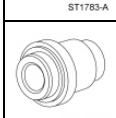
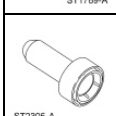
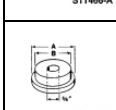
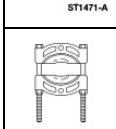
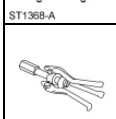
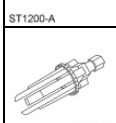
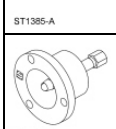


27. Install the transfer case in the vehicle. For additional information, refer to Transfer Case in this section.

28. Fill the transfer case. For additional information, refer to Transfer Case Draining and Filling in this section.

Transfer Case - 2-Speed Torque-On-Demand

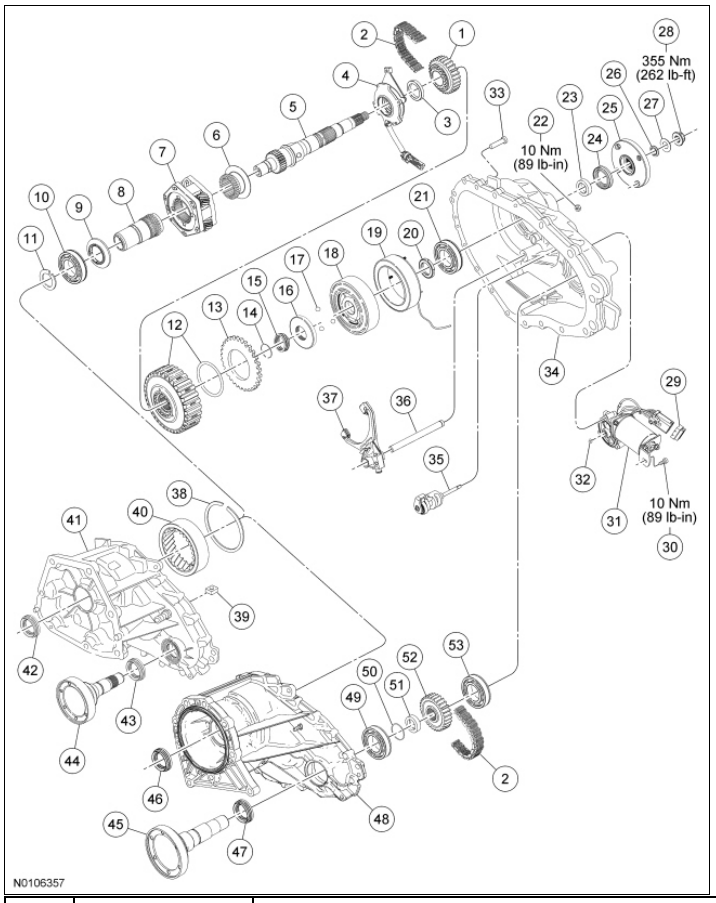
Special Tool(s)

 ST1255-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
 ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1783-A	Installer, Differential Bearing Cup 308-163 (T88C-77000-FH)
 ST1789-A	Installer, Input Shaft Bearing 308-085 (T83T-7025-C)
 ST2305-A	Installer, Input Shaft Oil Seal 308-186 (T90T-7127-B)
 ST1466-A	Installer, Valve Stem Oil Seal 303-367 (T90P-6510-AH)
 ST1471-A	Installer, Wheel Hub Bearing Cup 204-020 (T73T-1202-A)
 ST1368-A	Puller, Bearing 205-D064 (D84L-1123-A) or equivalent
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)
 ST1213-A	Remover, Bushing 307-001 (TOOL-1175-AC) or equivalent
 ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)
 ST2415-A	Remover, Output Shaft Flange 307-523 or equivalent

 ST1362-A	Remover, Stator Bearing 307-318 (T94P-77001-KH)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® Transfer Case Fluid XL-12	ESP-M2C166-H
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Threadlock and Sealer TA-25	WSK-M2G351-A5



Item	Part Number	Description
1	7177	Drive sprocket
2	7A029	Drive chain
3	7Z112	Thrust washer
4	-	Oil pump assembly
5	7061	Rear output shaft
6	7100	High-low collar
7	7A398	Front planetary gear set assembly

8	7017	Input shaft
9	7N062	Hub
10	7127	Bearing
11	7917	Snap ring
12	7C108	Clutch pack assembly
13	7H150	Valve assembly
14	7917	Snap ring
15	7G159	Wave spring
16	7R428	Apply cam
17	7A534	Balls (3 required)
18	7G362	Cam and coil housing assembly
19	7G361	Clutch coil assembly
20	7A443	Thrust bearing
21	7025	Front output shaft rear bearing
22	7045	Clutch coil nut (3 required)
23	7G450	Wheel
24	7B215	Yoke-to-flange oil seal
25	7B214	Rear output shaft flange
26	7052	Output flange oil seal
27	7B368	Output shaft flange washer
28	7045	Rear output shaft flange nut
29	-	Electrical connector
30	N800670-S	Shift motor bolt (3 required)
31	7G360	Transfer case shift motor
32	7288	Shifter shaft seal
33	7A443	Transfer case bolt (17 required)
34	7005	Rear transfer case
35	7F063	Electric shift cam, torsion spring and shift shaft assembly
36	7240	Shift rail
37	7289	Reduction shift fork
38	7917	Snap ring
39	7L027	Oil pan magnet
40	7A153	Ring gear
41	7005	Transfer case cover (4.0L)
42	7B215	Oil seal
43	7B215	Oil seal
44	7061	Output shaft and flange (front) (4.0L)
45	7061	Output shaft and flange (front) (4.6L)
46	7B215	Oil seal
47	7B215	Oil seal
48	7005	Transfer case cover (4.6L)
49	7025	Bearing
50	7917	Snap ring

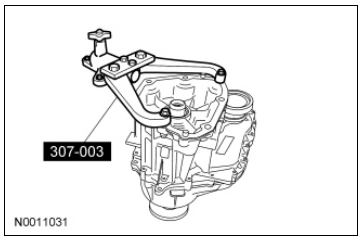
51	-	Spacer
52	7177	Driven sprocket
53	7025	Bearing

Disassembly

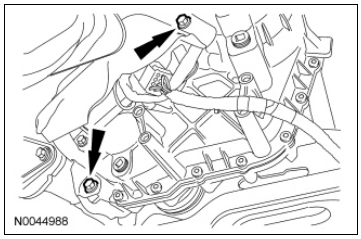
1. Remove the transfer case. For additional information, refer to Transfer Case in this section.

2. ⚠ **WARNING: Always verify that the lockpin on the bench-mounted holding fixture is correctly secured to help prevent unexpected component rotation. Failure to follow this instruction may result in serious personal injury.**

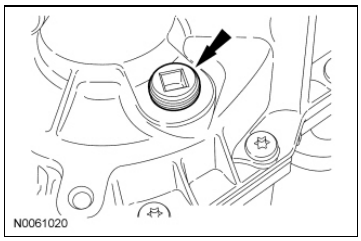
   Using the Transmission Holding Fixture, secure the transfer case to the bench.



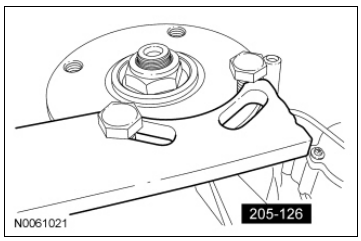
3. Remove the 3 heat shield bolts, then remove the heat shield.



4. If not previously done, remove the drain plug and drain the fluid.
   - When finished draining, install the drain plug and tighten to 20 Nm (177 lb-in).

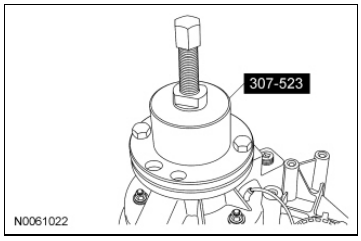


5. Using the Drive Pinion Flange Holding Fixture to hold the output flange, remove the rear output shaft flange nut.

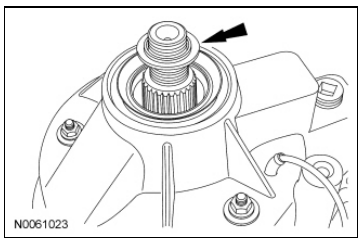


6. Remove the output shaft yoke washer.

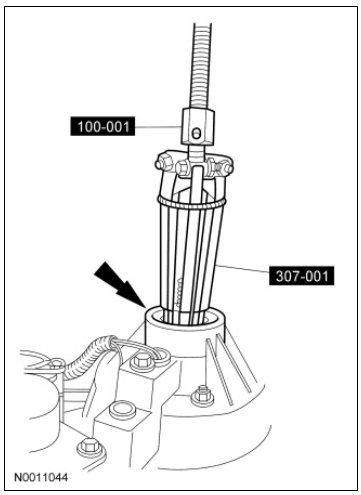
7. Using the Output Shaft Flange Remover, remove the output flange.



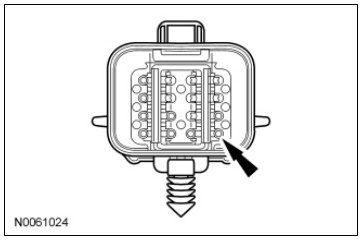
8. Remove and discard the output flange oil seal.



9. Using the Bushing Remover with the Slide Hammer, remove and discard the yoke-to-flange seal.

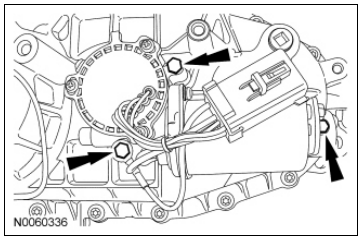


10. Remove the connector interlock. Using an electrical connector pin extractor tool, remove the coil wire pin from the electrical connector.

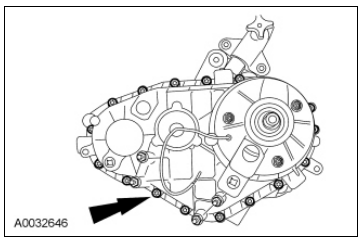


11. Remove the 4 transfer case shift motor bolts.

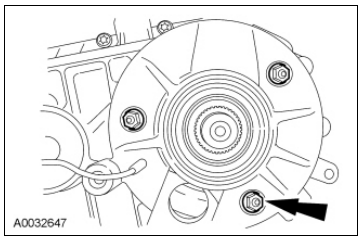
12. Remove the transfer case shift motor.



13. Remove the 17 transfer case bolts.

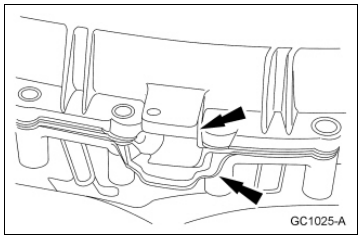


14. Remove the 3 clutch coil assembly nuts.

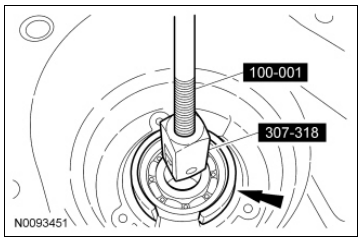


15. ***NOTICE:*** **Pry only at the transfer case pry bosses. Prying other than at the pry bosses may cause damage to the components.**

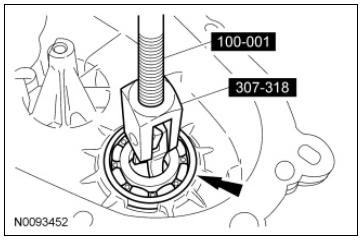
    Separate the transfer case halves at the transfer case pry bosses.



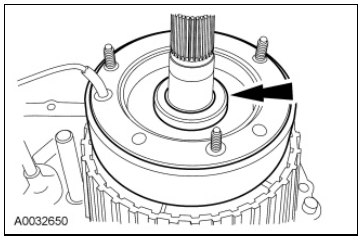
16. Remove the snap ring, then using the Slide Hammer and the Stator Bearing Remover, remove the rear output shaft support bearing.



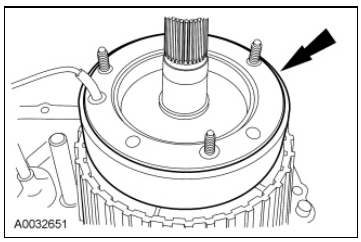
17. Using the Slide Hammer and the Stator Bearing Remover, remove the front output shaft rear bearing.



18. Remove the thrust bearing.

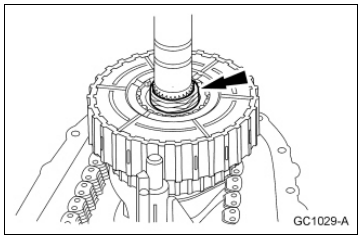


19. Remove the cam and coil housing assembly.

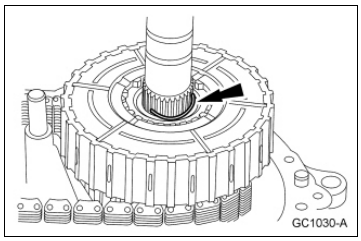


20. Remove the apply cam and 3 steel balls.

21. Remove the wave spring.



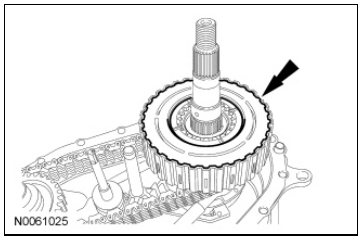
22. Remove the snap ring.



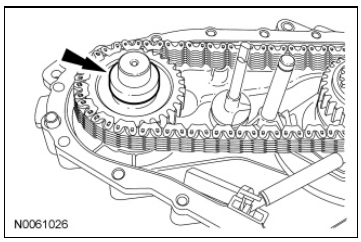
23. ***NOTICE:*** **When removing the clutch pack assembly, do not separate the clutch pack assembly. Keep tension on the clutch pack during removal. Set the clutch pack assembly on the bench in the same position as located in the transfer case. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem will occur.**

    NOTICE: **If the clutch pack is disassembled, a new clutch pack must be installed. Failure to install a new clutch pack can result in component failure.**

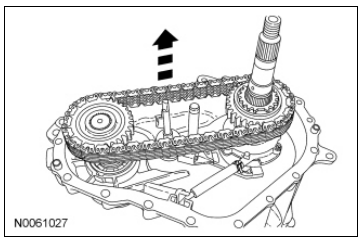
    Remove the clutch pack assembly.



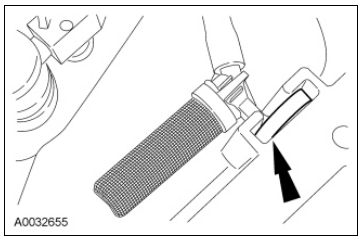
24. Remove the driven sprocket thrust washer.



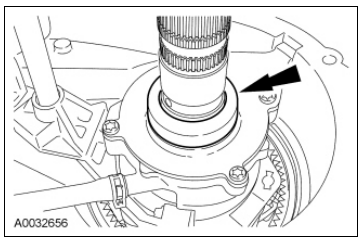
25. Remove the drive chain and the 2 sprockets as an assembly.



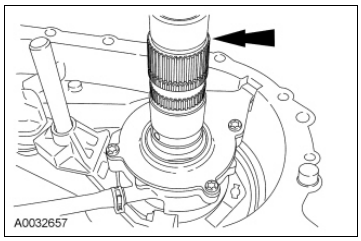
26. Remove and clean the oil pan magnet.



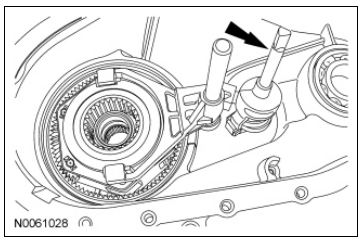
27. Remove the thrust washer.



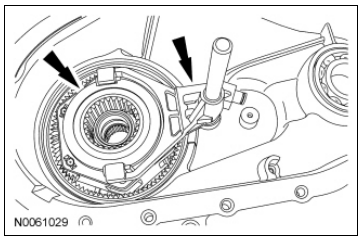
28. Remove the pump assembly and the rear output shaft as an assembly.



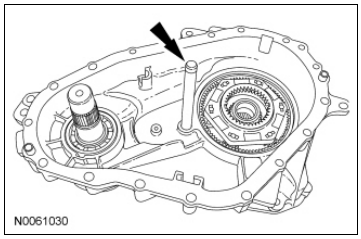
29. Remove the electric shift cam assembly. Do not disassemble the electric shift cam assembly.



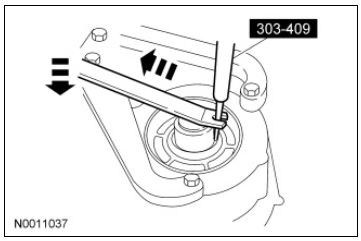
30. Remove the reduction shift fork and the high-low collar as an assembly.



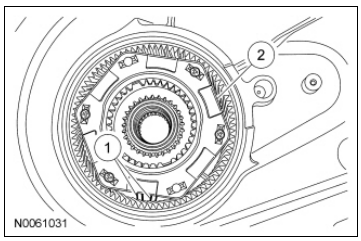
31. Remove the shift rail.



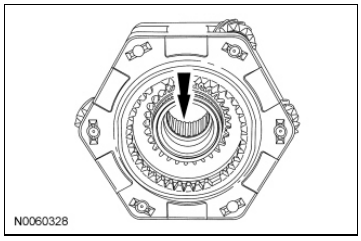
32. Using the Oil Seal Remover, remove and discard the oil seal.



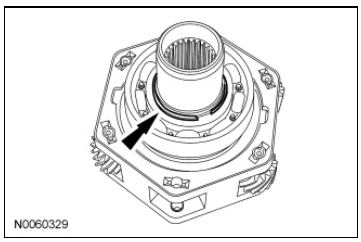
33. Remove the front planetary gear set assembly.
    1. Expand the snap ring.
    2. Remove the front planetary gear set assembly.



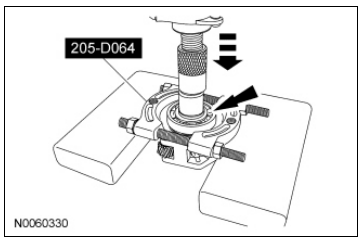
34. Using a drift and hammer, remove the output shaft bushing and bearing, if necessary.



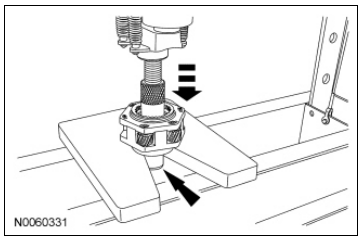
35. If the planetary gear carrier support bearing removal is necessary, remove the snap ring.



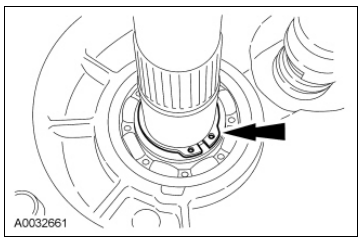
36. Using a suitable press and the Bearing Puller, remove the planetary gear carrier support bearing.



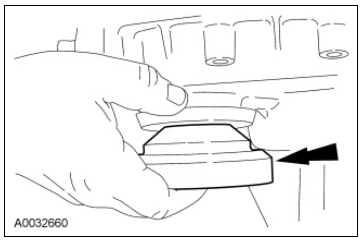
37. Remove the planetary input shaft.



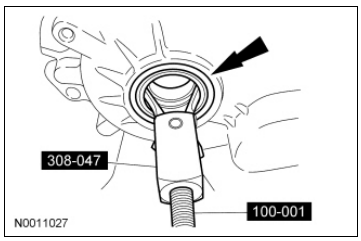
38. While holding the front output shaft and flange, remove the snap ring.



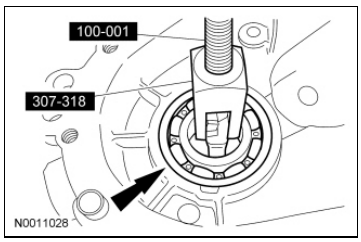
39. Remove the front output shaft and flange.



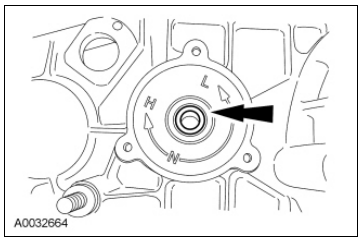
40. Using the Bearing Cup Remover with the Slide Hammer, remove and discard the oil seal.



41. Using the Stator Bearing Remover with the Slide Hammer, remove the front output shaft support bearing.

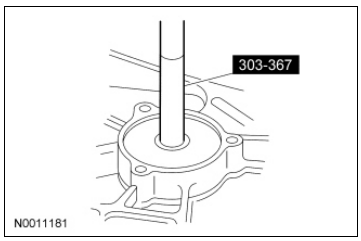


42. Remove and discard the shifter shaft seal.

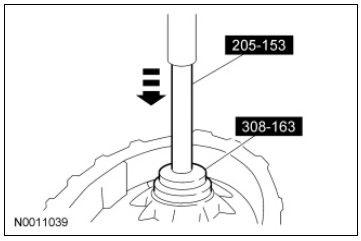


Assembly

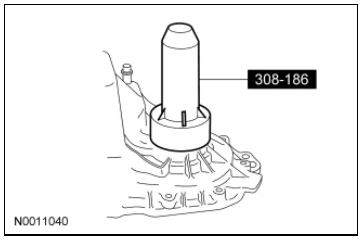
1. Using the Valve Stem Oil Seal Installer, carefully install the shifter shaft seal.



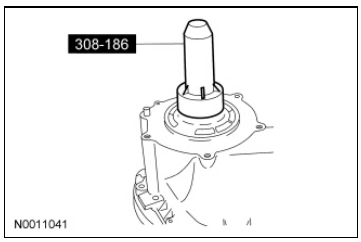
2. Using the Differential Bearing Cup Installer with the Adapter, press the front output shaft support bearing into the case.



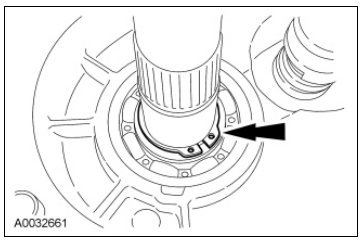
3. Using the Input Shaft Oil Seal Installer, install a new oil seal.



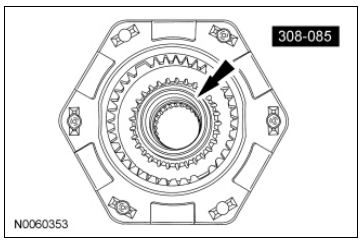
4. Using the Input Shaft Oil Seal Installer, install a new oil seal.



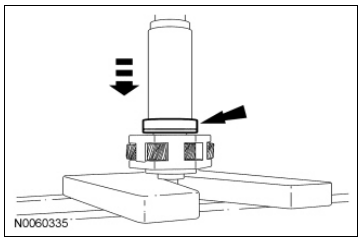
5. Install the front output shaft and flange and snap ring.



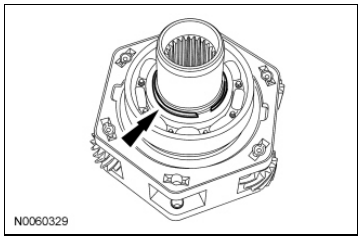
6. Using a suitable press and the Input Shaft Bearing Installer, install the bushing and the bearing, if removed.



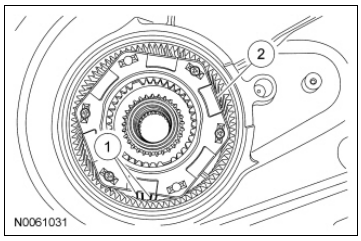
7. Using a suitable press, install the planetary gear carrier support bearing, if removed.



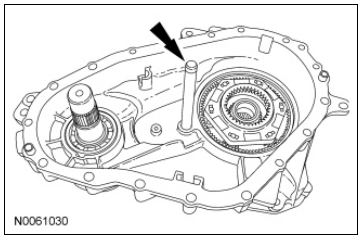
8. Install a new snap ring.



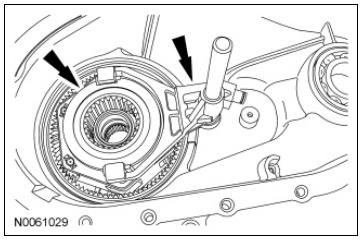
9. Install the front planetary gear set assembly.
    1. Expand the snap ring.
    2. Position the front planetary gear set assembly and release the snap ring.



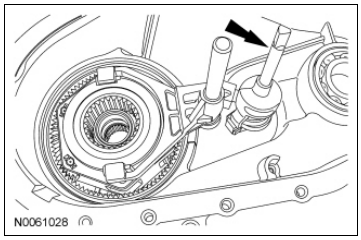
10. Install the shift rail.



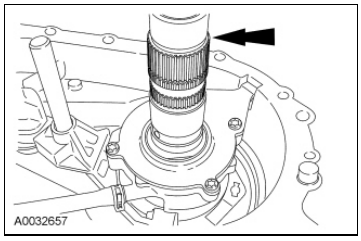
11. Install the reduction shift fork and the high-low collar as an assembly.



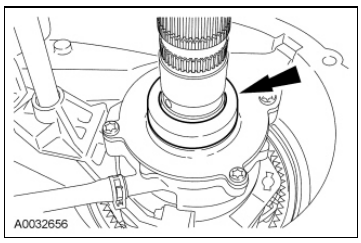
12. Install the electric shift cam assembly.



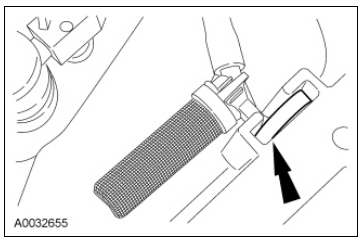
13. Install the pump assembly and the rear output shaft as an assembly.



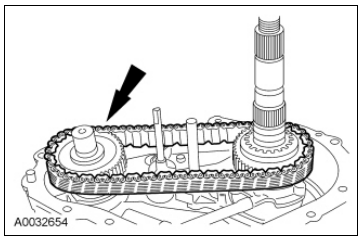
14. Install the thrust washer.



15. Install the oil pan magnet.



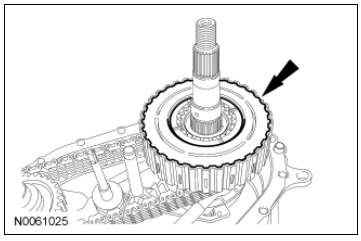
16. Install the drive chain and the 2 sprockets as an assembly.



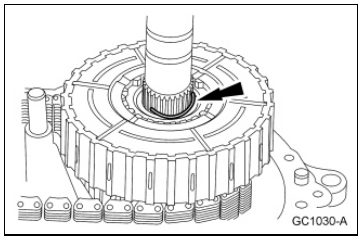
17. ***NOTICE:*** **When installing the clutch assembly, do not separate the clutch pack assembly. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem will occur.**

    NOTICE: **If the clutch pack is disassembled, a new clutch pack must be installed. Failure to install a new clutch pack can result in component failure.**

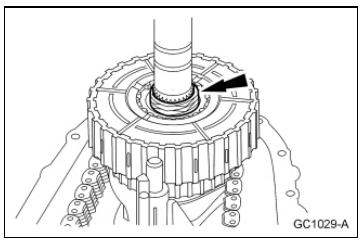
    Install the clutch pack assembly.



18. Install a new snap ring.

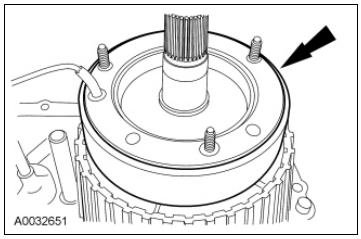


19. Install the wave spring.

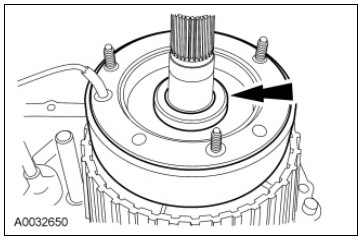


20. Install the apply cam and 3 steel balls.

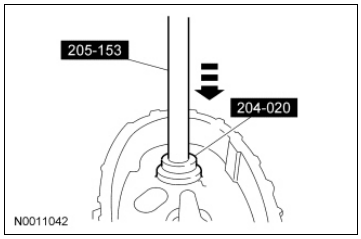
21. Install the cam and coil housing assembly.



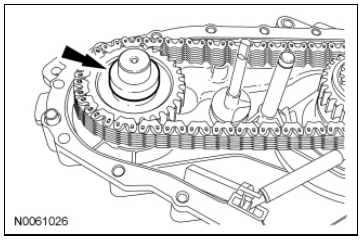
22. Install the thrust bearing.



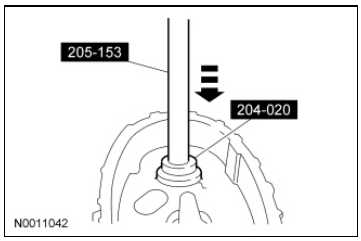
23. Using the Wheel Hub Bearing Cup Installer with the Adapter, install the front output shaft rear bearing into the case.



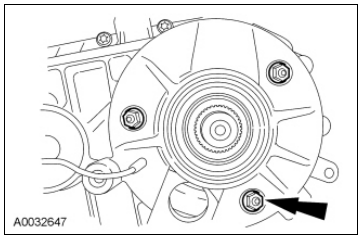
24. Install the driven sprocket thrust washer.



25. Using the Wheel Hub Bearing Cup Installer with the Adapter, install the rear output shaft rear bearing into the case.

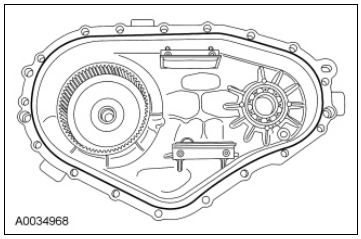


26. Position and support the clutch coil assembly, then install the 3 nuts.
    - Tighten to 10 Nm (89 lb-in).

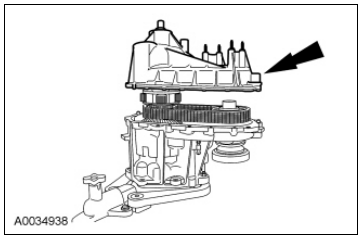


27. ***NOTICE:*** **Applying excess silicone rubber can damage the internal components.**

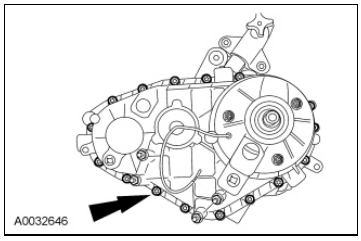
    Apply a 3 mm (0.11 in) bead of silicone rubber on the rear case mating surface.



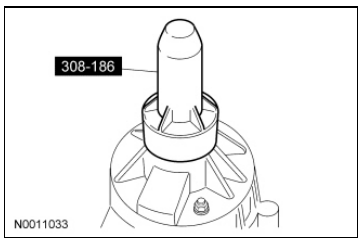
28. Assemble the front and rear case halves.



29. Install the 17 transfer case bolts.
    - Tighten the bolts evenly in a star pattern to 25 Nm (18 lb-ft).



30. Using the Input Shaft Oil Seal Installer, install a new yoke-to-flange oil seal.



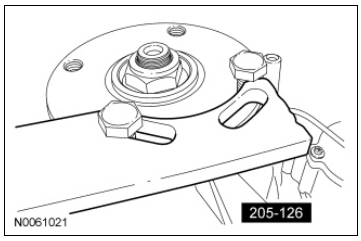
31. Install a new output flange oil seal.

32. **NOTE:** Align the index marks made during disassembly.

    Install the output flange.

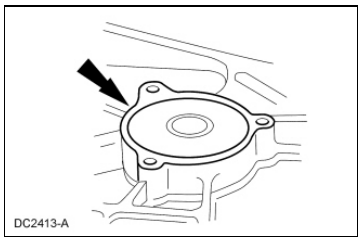
33. Install the output shaft yoke washer.

34. Using the Drive Pinion Flange Holding Fixture to hold the output flange. Install the rear output shaft flange nut.
    - Tighten to 355 Nm (262 lb-ft).

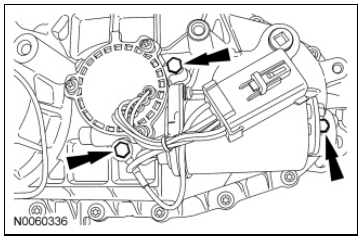


35. **NOTE:** Make sure the motor mounting surfaces are clean.

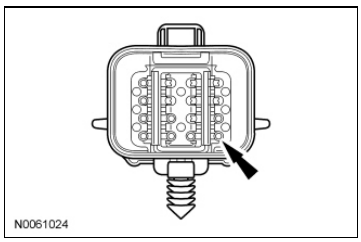
    Apply a 3 mm (0.11 in) bead of sealant to the motor mounting surface on the case.



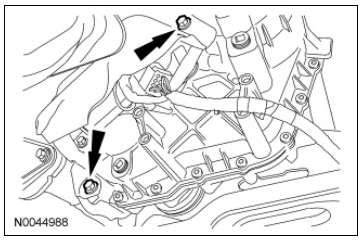
36. Position the transfer case shift motor and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).



37. Seat the coil wire pin into the electrical connector. Install the connector interlock.



38. Position the heat shield and install the 3 heat shield bolts.
    - Tighten to 16 Nm (142 lb-in).



39. Install the transfer case in the vehicle. For additional information, refer to Transfer Case in this section.

40. Fill the transfer case. For additional information, refer to Transfer Case Draining and Filling in this section.

Transfer Case

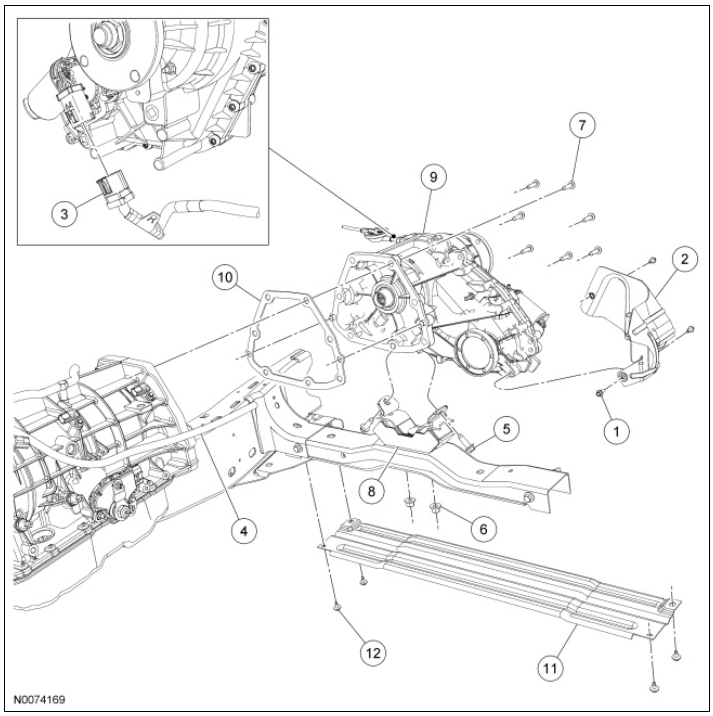
Special Tool(s)

 ST1130-A	Transmission Jack 077-00116

Material

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-

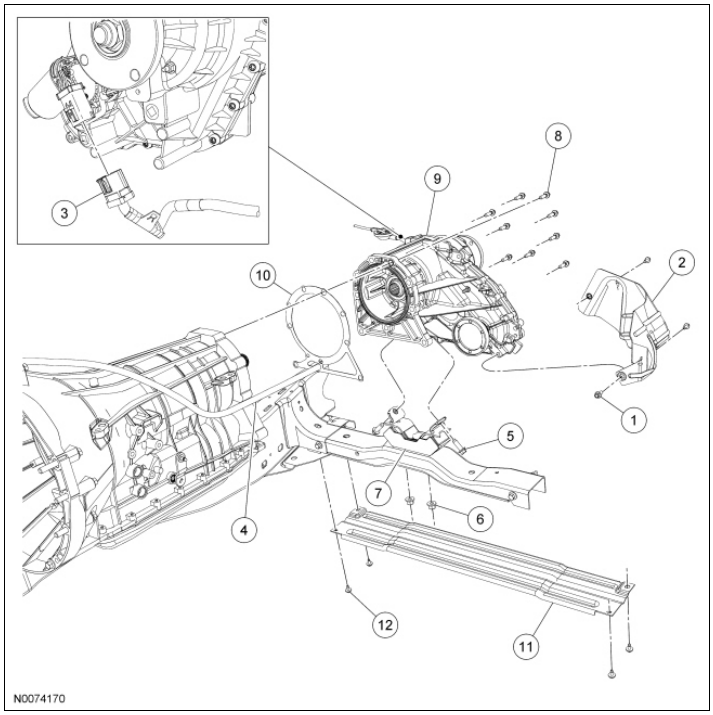
4.0L



Item	Part Number	Description
1	W706695-S900	Heat shield bolt (3 required)
2	7F168	Heat shield
3	14A099	Transfer case wire harness
4	-	Transfer case vent tube
5	W707429-S900	Transmission insulator-to-transfer case bolt (2 required)
6	N621945-S301	

		Crossmember-to-transmission insulator nut (2 required)
7	7A443	Transfer case-to-transmission bolt (7 required)
8	6068	Transmission insulator
9	7A195	Transfer case
10	7086	Transfer case-to-transmission gasket
11	-	Skid plate
12	-	Skid plate bolt (4 required)

4.6L



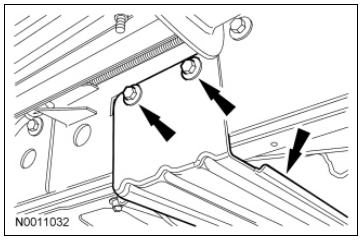
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7	6068	Transmission insulator
8	W500311-S309	Transfer case-to-transmission bolt (7 required)
9	7A195	Transfer case
10	7086	Transfer case-to-transmission gasket
11	-	Skid plate
12	-	Skid plate bolt (4 required)

Removal

1. Remove the rear driveshaft. For additional information, refer to Section 205-01 .

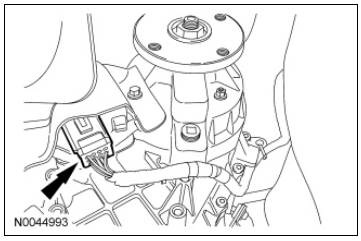
2. Remove the front driveshaft. For additional information, refer to Section 205-01 .

3. Remove the 4 bolts and the skid plate, if equipped.

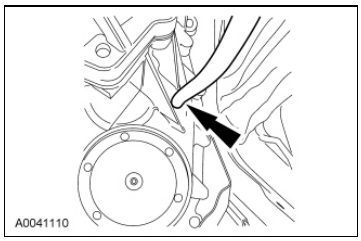


4. Drain the fluid if the transfer case is to be disassembled. For additional information, refer to Transfer Case Draining and Filling in this section.

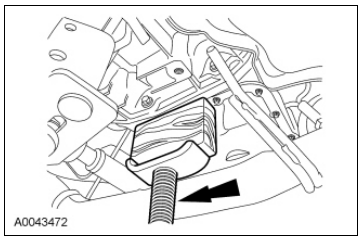
5. Disconnect the shift motor electrical connector.



6. Disconnect the vent hose from the transfer case.

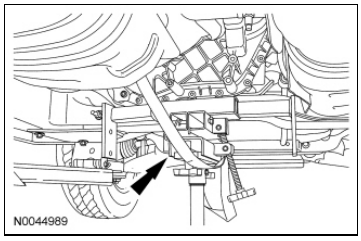


7. Position a suitable jack under the transmission.



8. Remove and discard the 7 transfer case-to-transmission bolts.

9. Using the Transmission Jack, position it to the transfer case. Securely strap the transfer case to the Transmission Jack.



10. Move the transfer case rearward. Remove the transmission insulator, then move the transfer case forward. Using the jack, tip the rear end of the transfer case downward, remove the transfer case from vehicle.

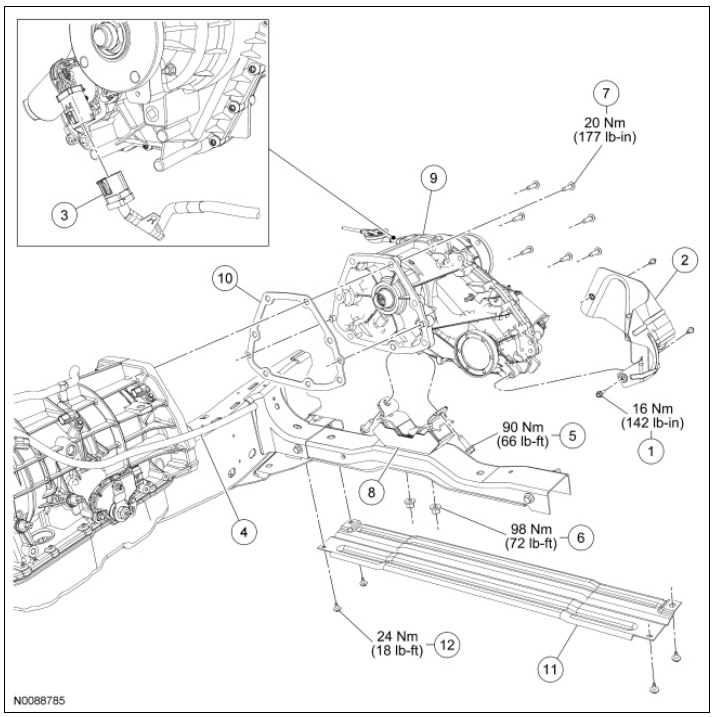
11. Remove the transfer case-to-transmission gasket and clean the mating surfaces of the transfer case and the transmission with metal surface prep.

Transfer Case

Special Tool(s)

 ST1130-A	Transmission Jack 077-00116

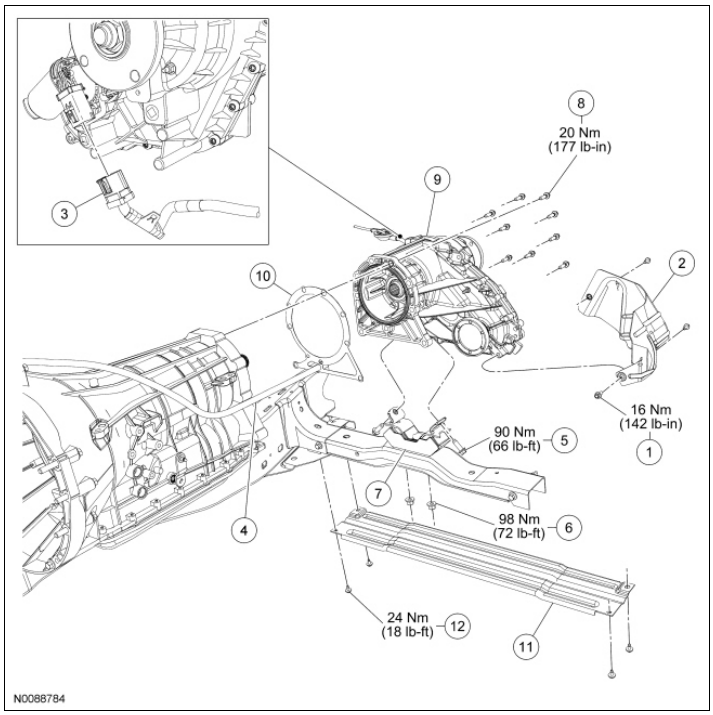
4.0L



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12	-	Skid plate bolt (4 required)

4.6L



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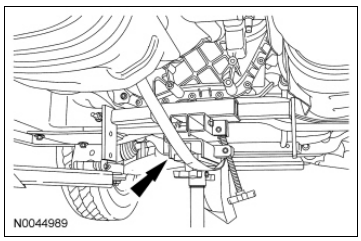
Installation

1. Install a new transfer case-to-transmission gasket onto the transfer case.
2. **NOTE: Always install new aluminum bolts. Do not reuse the old bolts.**

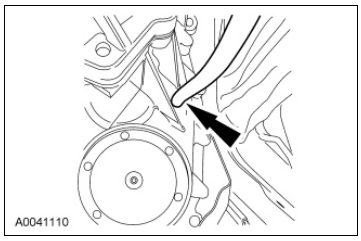
   Position the transfer case and install 7 new aluminum transfer case-to-transmission bolts.

   - Tighten to 20 Nm (177 lb-in).

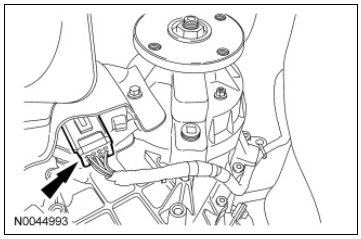
3. Remove the Transmission Jack from the transfer case.



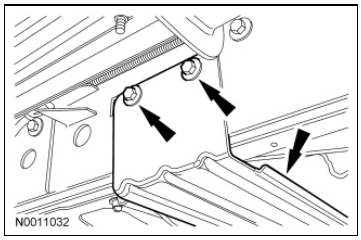
4. Connect the vent hose to the transfer case.



5. Connect the shift motor electrical connector.



6. Position the skid plate and install the 4 bolts, if equipped.
   - Tighten to 24 Nm (18 lb-ft).



7. Install the front driveshaft. For additional information, refer to Section 205-01 .

8. Install the rear driveshaft. For additional information, refer to Section 205-01 .

9. Fill the transfer case. For additional information, refer to Transfer Case Draining and Filling in this section.

Torque Specifications

Description	Nm	lb-ft	lb-in
Exhaust Y-pipe - dual catalytic converter heat shield clamp screws	7	-	62
Exhaust Y-pipe - dual catalytic converter-to-exhaust manifold nuts [a]	-	-	-
Muffler-to-catalytic converter bolts	40	30	-
Service exhaust coupler	47	35	-
Torca® clamp	48	35	-

[a] Refer to procedure in this section.

Exhaust System

The exhaust system consists of the following components:

- Exhaust Y-pipe dual catalytic converter
- Muffler
- Tail pipe

Exhaust System

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converter and a muffler assembly. Rubber exhaust hanger isolators attach the exhaust system to the mounting hooks.

Catalytic Converter

The catalytic converter plays a major role in the emission control system. The catalytic converter operates as a gas reactor. Its catalytic function is to speed the heat-producing chemical reaction of components in the exhaust gases in order to reduce air pollutants. The catalyst material inside the catalytic converter consists of a ceramic substrate.

The catalytic converter is designed to provide a long life. No maintenance is necessary for the catalytic converter.

Sound Insulators and Shields

Sound insulators and shields attached to the underbody protect the vehicle from exhaust system heat and should be inspected at regular intervals to make sure they are not dented or out of position. If a sound insulator and shield is damaged or shows evidence of deterioration, a new sound insulator and shield should be installed. The sound insulators and shields for the exhaust Y-pipe dual catalytic converter, muffler and tail pipe are installed separately.

Precautions

NOTICE: **Do not use leaded fuel in a vehicle equipped with a catalytic converter. In a vehicle that is continually misfueled, the lead in the fuel will be deposited in the catalytic converter and completely blanket the catalyst. Lead reacts with platinum to "poison" the catalyst. Continuous use of leaded fuel can destroy the catalyst and render the catalytic converter useless.**

NOTICE: **The addition of lead to the catalytic converter can also solidify the catalyst, causing excessive back pressure in the exhaust system and possibly causing engine damage.**

NOTICE: **Extremely high temperatures (1,100°C [2,012°F] or above) due to misfiring or over-rich fuel/air mixture will cause the ceramic substrate to sinter or burn, destroying the catalytic converter. Do not continue to operate the vehicle if the engine is misfiring, there is a power loss or other unusual**

operating conditions, such as engine overheating and backfiring.

NOTICE: **Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.**

NOTE: Exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

NOTE: Always install new gasket and nuts whenever an exhaust joint containing these is loosened.

Make sure to follow these precautions when carrying out the procedures in this section.

Exhaust System

Principles of Operation

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converters and a muffler assembly. The catalytic converters also play a major role in reducing air pollutants.

Inspection and Verification

1. Verify the concern by running the engine (with the vehicle on the ground) or road testing the vehicle to duplicate the condition.
2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or loss of power.
3. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Cracked exhaust manifold • Dirty engine air cleaner • Loose or damaged heat shields (4.6L only)

4. Verify that the exhaust system is installed correctly, with clamps correctly located and tightened to specification.
5. If the fault is not visually evident, determine the symptom. GO to Symptom Chart - Exhaust System or GO to Symptom Chart - NVH .

Symptom Chart - Exhaust System

Symptom Chart - Exhaust System

Symptom Chart - NVH

Symptom Chart - NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Rattle, squeaks or buzz type noise - from the bottom of vehicle

- Loose or damaged heat shield (4.6L only)

- INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system components. If any heat shields are loose, INSTALL either worm gear clamp FOTZ-5A231-A or W705949-S300 and tighten to 7 Nm (62 lb-in). If the heat shields are missing, INSTALL new heat shields or exhaust system components as necessary. If a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary. TEST the system for normal operation after the repair.

- Loose or damaged exhaust isolators

- CHECK that the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.

- Damaged exhaust isolator hanger bracket

- INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN bolts to specification or INSTALL new components as necessary. TEST the system for normal operation after the repair.

- Catalytic converter
- Muffler

- MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, lightly TAP on the exhaust components one at a time to duplicate the noise concern. DETERMINE if there are any loose or broken baffles or element. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.

- Exhaust grounded to chassis

- INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the Exhaust System Alignment in this section.

- Drone or clunk type noise - from bottom of vehicle

- Loose or damaged exhaust isolators

- INSPECT exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.

- Exhaust grounded to chassis

- INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the Exhaust System Alignment in this section.

- Whistles, boom, hum or ticking type noise - noise tends to change as engine warms. Noises are often accompanied by exhaust fumes

- Exhaust system leak

- INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which would indicate exhaust leakage at that point. To magnify a small leak, have an assistant hold a shop towel over the tail pipe outlet, while listening for a leak. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.

- Catalytic converter
- Muffler

- MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, lightly TAP on the exhaust components one at a time to duplicate the noise concern. DETERMINE if there are any loose or broken baffles or element. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.

- Exhaust muffler/resonator drain hole enlarged due to corrosion

- **NOTE:** Check with vehicle on the ground, not on a hoist.

  CONFIRM drain holes are noise source. INSTALL new components as necessary. TEST the system for normal operation after the repair.

- Thermal expansion of exhaust versus heat shields (4.6L only)

- This is a normal condition.

- Hissing or rushing noise - high frequency sound. Vehicle performance is unaffected

- Exhaust system. Exhaust flow through pipes

- MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, lightly TAP on the exhaust components one at a time to duplicate the noise concern. DETERMINE if there are any loose or broken baffles or element. CHECK for missing or leaking Torca® clamps. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.

- Pinging noise - occurs when exhaust system is hot, engine turned off

- Catalytic converter/exhaust system
- Thermal expansion of exhaust system

- Cool down pinging is the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
- Vibration - occurs at idle and at low speeds. Also accompanied by clunk or buzz type noise
- Loose or damaged exhaust isolators
- INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.
- Loose or damaged exhaust isolator hanger brackets
- INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary. TEST the system for normal operation after the repair.
- Exhaust system grounded to chassis
- CARRY OUT the Exhaust System Alignment in this section.
- Engine drumming noise - normally accompanied by vibration
- Damaged or misaligned exhaust system
- INSPECT the exhaust system for loose or damaged fasteners, Torca® clamps or isolators. CARRY OUT the Exhaust System Alignment in this section. TEST the system for normal operation after the repair.
- Sputter type noise - noise worse when cold, lessens or disappears when the vehicle is at operating temperature
- Damaged or worn exhaust system
- INSPECT the exhaust system for leaks or damage. REPAIR as necessary. TEST the system for normal operation after the repair.
- Thumping noise - from the bottom of the vehicle, worse at acceleration
- Misaglined exhaust system
- CHECK the exhaust system-to-chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary. TEST the system for normal operation after the repair.
- Engine vibration - is felt with increases and decreases in engine rpm
- Strain on exhaust system isolators
- CARRY OUT the Exhaust System Alignment in this section. REPAIR as necessary. TEST the system for normal operation after the repair.
- Drumming noise - occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent
- Exhaust system vibration excites the body resonances inducing interior noise.

- GO to Pinpoint Test A .

Pinpoint Test

Pinpoint Test A: Drumming Noise

This pinpoint test is intended to diagnose the following:

- Exhaust system

PINPOINT TEST A: DRUMMING NOISE

Test Step	Result / Action to Take
A1 CHECK THE EXHAUST SYSTEM	
• Start the engine. • Increase the engine rpm until the noise is the loudest. Note the engine rpm. • Ignition OFF. • Add approximately 9 kg (20 lb) of weight to the exhaust system. First place the weight at the tail pipe and test, then at the front pipe. • Start the engine. • Increase the engine rpm and listen for the drumming noise. Note the engine rpm if the noise occurs. • Ignition OFF. • Determine the amount of vibration that occurs with the drumming noise. • **Is the noise/vibration reduced or eliminated, or does the noise/vibration occur at a different rpm?**	**Yes** REFER to Exhaust System Alignment in this section. TEST the system for normal operation. **No** CONDUCT a diagnosis on other suspect systems. REFER to Section 100-04 .

Exhaust System Alignment

All vehicles

NOTICE: **Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation. Use only water-based lubricants on the isolators.**

NOTE: Exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

NOTE: Always install new gasket and nuts whenever an exhaust joint is loosened.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Loosen all fasteners joining the exhaust system components.

3. **NOTE:** Do not fully torque the exhaust Y-pipe dual catalytic converter-to-exhaust manifold joint.

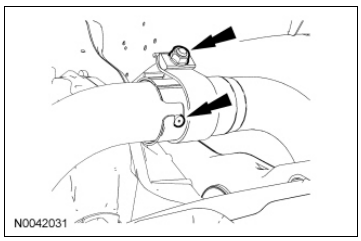
   Position the exhaust Y-pipe dual catalytic converter to the exhaust manifold and loosely tighten all nuts to stiffen the joint enough to maintain position.

   - Tighten to 8 Nm (71 lb-in) and then add additional torque if needed to stiffen the joint.

4. **NOTE:** Make sure that the tab on the muffler assembly is seated inside the notch on the tail pipe before tightening the Torca® clamp.

   Tighten the muffler assembly-to-tail pipe Torca® clamp.

   - Tighten to 48 Nm (35 lb-ft).



5. Confirm that the exhaust isolators are at zero load.

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6. **NOTE:** The production muffler assembly is a one-piece design. The service muffler assembly is serviced with 2 pieces.

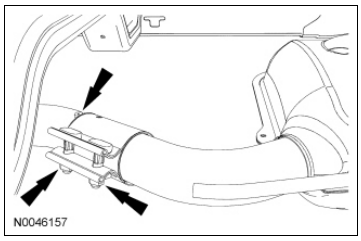
   NOTE: If the muffler has not been removed from the vehicle, this muffler inlet pipe joint will not be present.

NOTE: If installing a service muffler kit, the coupling will be welded into position on the muffler inlet pipe.

NOTE: The factory muffler inlet pipe will not have an alignment nub.

If equipped, and not welded to the muffler inlet pipe, make sure that the service exhaust coupler is against the alignment nub and is positioned approximately at the 2 o'clock position facing the muffler. If the muffler inlet pipe does not have an alignment nub, center the exhaust coupler over the muffler inlet pipe joint and position it at approximately the 2 o'clock position facing the muffler.

- Tighten to 47 Nm (35 lb-ft).



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7. **NOTE:** The production muffler assembly is a one-piece design. The service muffler assembly is serviced with 2 pieces.

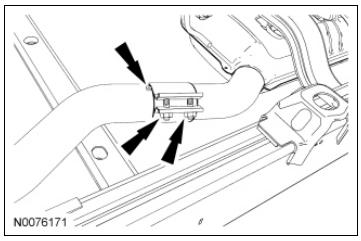
   NOTE: If the muffler has not been removed from the vehicle, this muffler inlet pipe joint will not be present.

   NOTE: If installing a service muffler kit, the coupling will be welded into position on the muffler inlet pipe.

   NOTE: The factory muffler inlet pipe will not have an alignment nub.

   If equipped, and not welded to the muffler inlet pipe, make sure that the service exhaust coupler is against the alignment nub and is positioned approximately at the 2 o'clock position facing the muffler. If the muffler inlet pipe does not have an alignment nub, center the exhaust coupler over the muffler inlet pipe joint and position it at approximately the 2 o'clock position facing the muffler.

   - Tighten to 47 Nm (35 lb-ft).



Explorer Sport Trac

8. Confirm that the exhaust isolators are at zero load.

All vehicles

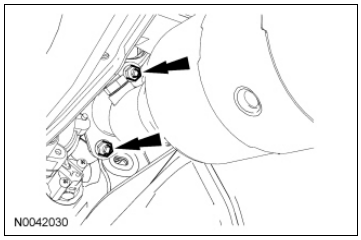
9. Tighten the exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts.

- Tighten to 40 Nm (30 lb-ft).

10. Confirm that the exhaust isolators are at zero load.
11. **NOTE:** RH shown, LH similar.

    Tighten the exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.

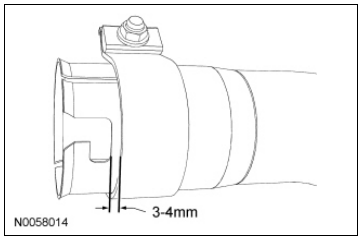
    - Tighten to 40 Nm (30 lb-ft).



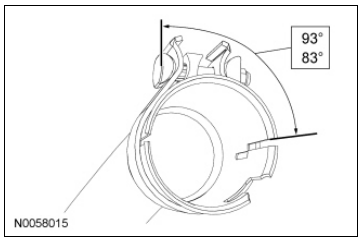
12. Confirm that the exhaust isolators are at zero load.
13. Start the engine and check the exhaust system for leaks.

Torca® Clamp

1. Remove the nut from the Torca® clamp.
2. Grind the spot weld from the Torca® clamp and remove the clamp.
3. Clean the uneven surface area and, using an abrasive pad, clean the Torca® clamp surface area of any rust on the pipe.
4. Position a new Torca® clamp 3-4 mm (0.12-0.16 in) from the button slot.



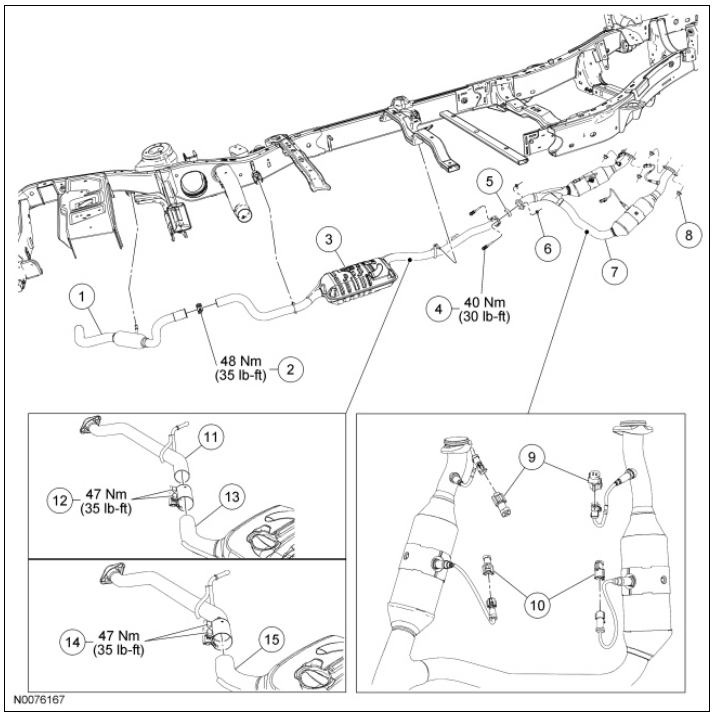
5. Rotate the Torca® clamp until it is 83 to 93 degrees from slot in the side of pipe.



Exhaust System - Exploded View

4.0L Explorer Sport Trac

NOTE: Vehicle body removed for clarity.

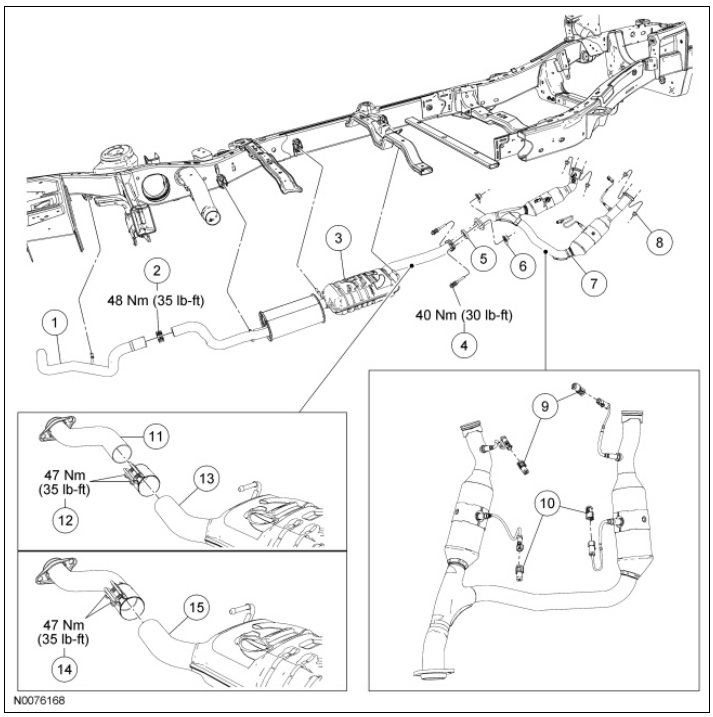


Item	Part Number	Description
1	5212	Tail pipe
2	5221	Tail pipe-to-muffler assembly Torca® clamp
3	5K214	Muffler assembly
4	5G215	Muffler-to-catalytic converter bolt (2 required)
5	5E241	Gasket
6	N807634	Muffler-to-catalytic converter nut (2 required)
7	5F250	Exhaust Y-pipe dual catalytic converter
8	W520414	Exhaust Y-pipe dual catalytic converter-to-exhaust manifold nut (4 required)
9	-	Heated Oxygen Sensor (HO2S) electrical connectors (part of 12B637)
10	-	Catalyst Monitor Sensor (CMS) electrical connectors (part of 12B637)
11	-	Muffler inlet pipe (part of 5K244)
12	5A281	Exhaust coupler (service part)
13	-	Muffler (part of 5K244)

14	-	Muffler inlet pipe with welded on exhaust coupler (service part) (part of 5D256)
15	-	Muffler (service part) (part of 5D256)

4.6L Explorer Sport Trac

NOTE: Vehicle body removed for clarity.



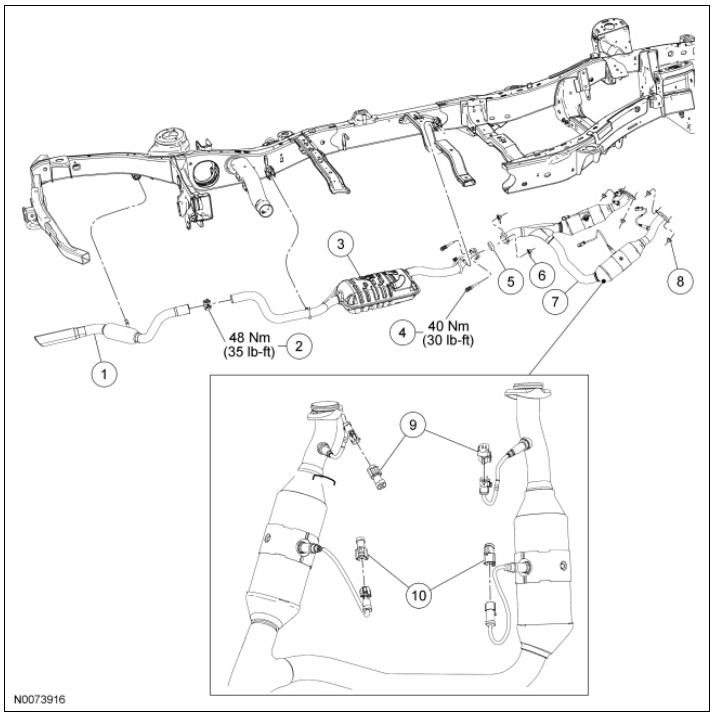
Item	Part Number	Description
1	5202	Tail pipe
2	5221	Tail pipe-to-muffler assembly Torca® clamp
3	5K214	Muffler assembly
4	5G215	Muffler-to-catalytic converter bolt (2 required)
5	5E241	Gasket
6	N807634	Muffler-to-catalytic converter nut (2 required)
7	5F250	Exhaust Y-pipe dual catalytic converter
8	W520414	Exhaust Y-pipe dual catalytic converter-to-exhaust manifold nut (4 required)
9	-	Heated Oxygen Sensor (HO2S) electrical connectors (part of 12B637)
10	-	Catalyst Monitor Sensor (CMS) electrical connectors (part of 12B637)
11	-	Muffler inlet pipe (part of 5K244)
12	5A281	Exhaust coupler (service part)
13	-	Muffler (part of 5K244)
14	-	Muffler inlet pipe with welded on exhaust coupler

		(service part) (part of 5D256)
15	-	Muffler (service part) (part of 5D256)

4.0L Explorer/Mountaineer

NOTE: Vehicle body removed for clarity.

NOTE: Premier exhaust shown, standard exhaust similar.

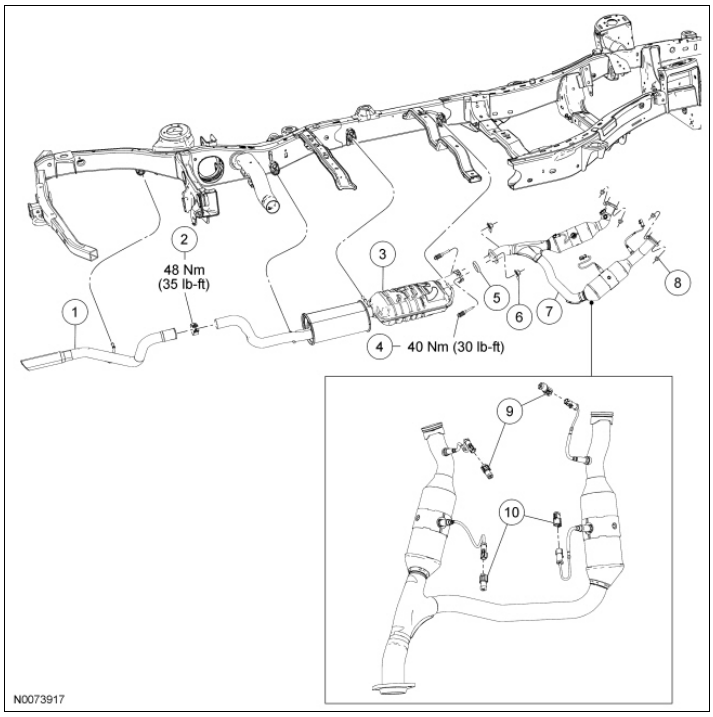


Item	Part Number	Description
1	5212	Tail pipe
2	5221	Tail pipe-to-muffler assembly Torca® clamp
3	5K214	Muffler assembly
4	5G215	Muffler-to-catalytic converter bolt (2 required)
5	5E241	Gasket
6	N807634	Muffler-to-catalytic converter nut (2 required)
7	5F250	Exhaust Y-pipe dual catalytic converter
8	W520414	Exhaust Y-pipe dual catalytic converter-to-exhaust manifold nut (4 required)
9	-	Heated Oxygen Sensor (HO2S) electrical connectors (part of 12B637)
10	-	Catalyst Monitor Sensor (CMS) electrical connectors (part of 12B637)

4.6L Explorer/Mountaineer

NOTE: Vehicle body removed for clarity.

NOTE: Premier exhaust shown, standard exhaust similar.



Item	Part Number	Description
1	5202	Tail pipe
2	5221	Tail pipe-to-muffler assembly Torca® clamp
3	5K214	Muffler assembly
4	5G215	Muffler-to-catalytic converter bolt (2 required)
5	5E241	Gasket
6	N807634	Muffler-to-catalytic converter nut (2 required)
7	5F250	Exhaust Y-pipe dual catalytic converter
8	W520414	Exhaust Y-pipe dual catalytic converter-to-exhaust manifold nut (4 required)
9	-	Heated Oxygen Sensor (HO2S) electrical connectors (part of 12B637)
10	-	Catalyst Monitor Sensor (CMS) electrical connectors (part of 12B637)

1. For additional information, refer to the procedures in this section.

Exhaust Y-Pipe - Dual Catalytic Converter

Removal

NOTICE: **Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation. Use only water-based lubricants on the isolators.**

NOTE: Exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Using a suitable jack, support the exhaust system.

3. Disconnect the Heated Oxygen Sensor (HO2S) and the Catalyst Monitor Sensor (CMS) electrical connectors.

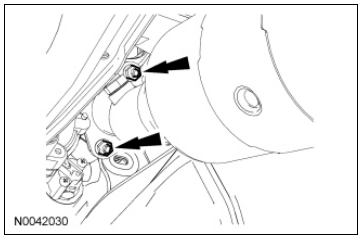
4. Remove the 2 exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts, 2 nuts and gasket.
   - Discard the exhaust Y-pipe dual catalytic converter-to-muffler assembly nuts and gasket.

5. Remove the transmission support crossmember. For additional information, refer to Section 502-02 .

6. **NOTE:** RH side shown, LH similar.

   Remove the exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.

   - Discard the exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.



7. Remove the exhaust Y-pipe dual catalytic converter.

Installation

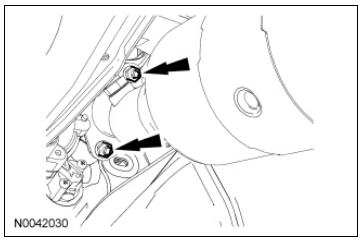
1. **NOTE:** RH side shown, LH similar.

   NOTE: Install new exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.

   NOTE: Do not fully tighten the exhaust Y-pipe dual catalytic converter-to-exhaust manifold joint.

Position the exhaust Y-pipe dual catalytic converter to the exhaust manifold and loosely tighten all 4 new nuts to stiffen the joint enough to maintain position.

- Tighten to 8 Nm (71 lb-in) and then add additional torque if needed to stiffen the joint.



2. **NOTE:** Install new exhaust Y-pipe dual catalytic converter-to-muffler assembly gasket and nuts.

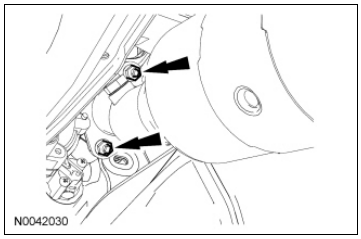
   Install the exhaust Y-pipe-dual catalytic converter-to-muffler assembly new gasket, 2 bolts and 2 new nuts.

   - Tighten to 40 Nm (30 lb-ft).

3. **NOTE:** RH shown, LH similar.

   Tighten the 4 new exhaust Y-pipe dual catalytic converter-to-exhaust manifold nuts.

   - Tighten to 40 Nm (30 lb-ft).



4. Install the transmission support crossmember. For additional information, refer to Section 502-02 .

5. Connect the HO2S and CMS electrical connectors.

6. Check to see if the exhaust system isolators are at zero load. If the exhaust system isolators are not at zero load, then carry out the exhaust system alignment procedure. For additional information, refer the Exhaust System Alignment in this section.

Muffler

Removal

All vehicles

NOTICE: **Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation. Use only water-based lubricants on the isolators.**

NOTE: Exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

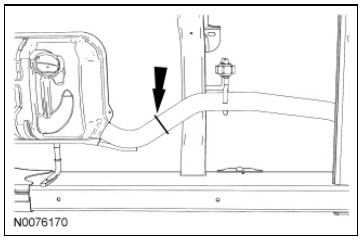
2. Using a suitable jack, support the exhaust system.

4.0L Explorer Sport Trac

3. **NOTE:** The production muffler assembly is a one-piece design. The service muffler assembly is serviced with 2 pieces.

   NOTE: In order to remove the muffler assembly, the muffler inlet pipe must be cut.

   Using a suitable exhaust cutter, cut the muffler inlet pipe between the first bend coming out of the muffler and the next bend in line. If a service exhaust coupler is present at this point, loosen the service exhaust coupler nuts and separate the muffler inlet pipe.

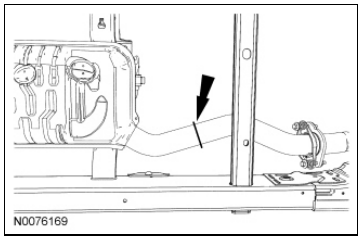


4.6L Explorer Sport Trac

4. **NOTE:** The production muffler assembly is a one-piece design. The service muffler assembly is serviced with 2 pieces.

   NOTE: In order to remove the muffler assembly, the muffler inlet pipe must be cut.

   Using a suitable exhaust cutter, cut the muffler inlet pipe between the first bend coming out of the muffler and the next bend in line. If a service exhaust coupler is present at this point, loosen the service exhaust coupler nuts and separate the muffler inlet pipe.



All vehicles

5. Loosen the muffler assembly-to-tail pipe Torca® clamp.

6. Remove the 2 exhaust Y-pipe dual catalytic converter-to-muffler assembly bolts, 2 nuts and gasket.
   - Discard the exhaust Y-pipe dual catalytic converter-to-muffler assembly nuts and gasket.

7. Disconnect the rubber isolators and remove the muffler assembly.

Installation

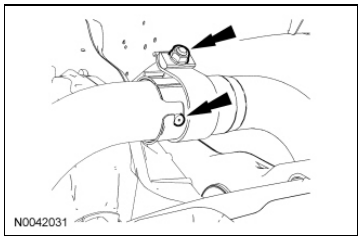
All vehicles

1. Position the muffler assembly and connect the rubber isolators.

2. **NOTE:** Using an abrasive pad, clean the muffler assembly-to-tail pipe surface area of any rust.

   Position the muffler assembly-to-tail pipe and make sure the tab on the muffler assembly is seated inside the notch on the tail pipe and then tighten the Torca® clamp.

   - Tighten to 48 Nm (35 lb-ft).



4.0L Explorer Sport Trac

3. **NOTE:** Using an abrasive pad, clean the muffler inlet pipe service coupler surface area of any rust.

   NOTE: If installing a service muffler kit, the coupling will be welded into position on the muffler inlet pipe.

   NOTE: The factory muffler inlet pipe will not have an alignment nub.

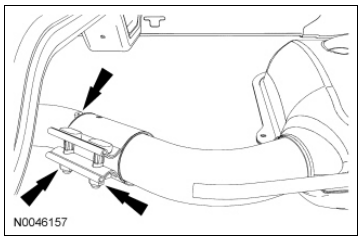
   If reusing the factory muffler assembly, position the 2 halves of the muffler inlet pipe into the service exhaust coupler and center the service exhaust coupler onto the cut joint on the muffler inlet pipe. If installing a new service muffler kit, install the muffler inlet pipe coming out of the muffler into the service exhaust coupler.

4. **NOTE:** If installing a service muffler kit, the coupling will be welded into position on the muffler inlet pipe.

NOTE: The factory muffler inlet pipe will not have an alignment nub.

If not welded to the muffler inlet pipe, make sure that the service exhaust coupler is against the alignment nub and is positioned approximately at the 2 o'clock position facing the muffler. If the muffler inlet pipe does not have an alignment nub, center the exhaust coupler over the muffler inlet pipe joint and position it at approximately the 2 o'clock position facing the muffler.

- Tighten to 47 Nm (35 lb-ft).



4.6L Explorer Sport Trac

5. **NOTE:** Using an abrasive pad, clean the muffler inlet pipe service coupler surface area of any rust.

   NOTE: If installing a service muffler kit, the coupling will be welded into position on the muffler inlet pipe.

   NOTE: The factory muffler inlet pipe will not have an alignment nub.

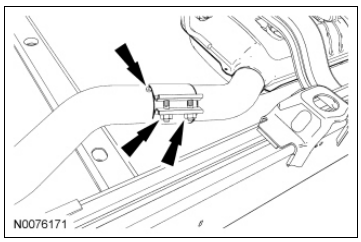
   If reusing the factory muffler assembly, position the 2 halves of the muffler inlet pipe into the service exhaust coupler and center the service exhaust coupler onto the cut joint on the muffler inlet pipe. If installing a new service muffler kit, install the muffler inlet pipe coming out of the muffler into the service exhaust coupler.

6. **NOTE:** If installing a service muffler kit, the coupling will be welded into position on the muffler inlet pipe.

   NOTE: The factory muffler inlet pipe will not have an alignment nub.

   If not welded to the muffler inlet pipe, make sure that the service exhaust coupler is against the alignment nub and is positioned approximately at the 2 o'clock position facing the muffler. If the muffler inlet pipe does not have an alignment nub, center the exhaust coupler over the muffler inlet pipe joint and position it at approximately the 2 o'clock position facing the muffler.

   - Tighten to 47 Nm (35 lb-ft).



All Vehicles

7. **NOTE:** Install new exhaust Y-pipe dual catalytic converter-to-muffler assembly gasket and nuts.

Install the exhaust Y-pipe-dual catalytic converter-to-muffler assembly new gasket, 2 bolts and 2 new nuts.

- Tighten to 40 Nm (30 lb-ft).

8. Check to see if the exhaust system isolators are at zero load. If the exhaust system isolators are not at zero load, then carry out the exhaust system alignment procedure. For additional information, refer the Exhaust System Alignment in this section.

Tailpipe

Removal

NOTICE: **Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation. Use only water-based lubricants on the isolators.**

NOTE: Exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

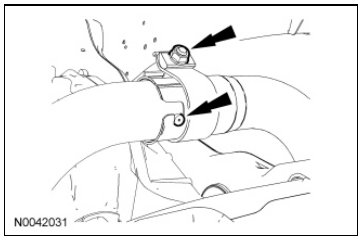
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Loosen the muffler assembly-to-tail pipe Torca® clamp.
3. Disconnect the rubber isolator and remove the tail pipe.

Installation

1. Position the tail pipe and connect the rubber isolator.
2. **NOTE:** Using an abrasive pad, clean the muffler assembly-to-tail pipe surface area of any rust.

   Position the muffler assembly-to-tail pipe and make sure the tab on the muffler assembly is seated inside the notch on the tail pipe and then tighten the Torca® clamp.

   - Tighten to 48 Nm (35 lb-ft).



3. Check to see if the exhaust system isolators are at zero load. If the exhaust system isolators are not at zero load, then carry out the exhaust system alignment procedure. For additional information, refer the Exhaust System Alignment in this section.

Material

Item	Specification	Fill Capacity
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A	-

General Specifications

Item	Specification
Fuel Pressure	
Key ON Engine OFF (KOEO)	207-276 kPa (30-40 psi)
Engine running	207-276 kPa (30-40 psi)
Fuel Tank Capacity	
Standard	85.2L (22.5 gal)

Torque Specifications

Description	Nm	lb-in
Fuel tank filler pipe clamp	3	27

Fuel System

The fuel system consists of the following componenets:

- Fuel and vapor tubes
- Fuel filter (located on the front of the fuel tank)
- Fuel Pump (FP) (located in the fuel tank)
- Fuel tank filler pipe assembly
- Fuel tank
- Fuel rail
- Fuel injectors
- Inertia Fuel Shutoff (IFS) switch (located behind the front passenger side interior kick panel)

The vehicle is equipped with electronic multi-port fuel injection that is supplied by an electronic returnless fuel system. The PCM receives pressure information from a fuel pressure sensor mounted on the fuel rail. The PCM is able to maintain constant fuel pressure by varying the FP output. This is accomplished by increasing or decreasing voltage supplied to the FP . The returnless fuel system offers improved economy, lower fuel temperatures and decreased fuel vapor in the fuel tank.

For exploded view information of the fuel system, refer to Fuel Tank and Filler Pipe - Exploded View or Fuel Lines and Fuel Filter - Exploded View in Section 310-01 .

Fuel System

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The following procedure diagnoses a slow-to-fill concern only. For all other concerns, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

The fuel tank filler pipe assembly is used to refuel the vehicle. The fuel tank inlet check valve prevents spitback of fuel during and after refueling. The fuel tank stores the fuel. The fuel tank contains a Fuel Pump (FP) module. The FP module consists of a fuel level sender and a FP . The fuel level sender sends a signal to the fuel gauge informing the driver of how much fuel is in the fuel tank. The FP provides fuel to the fuel tubes which supply the fuel rail.

During refueling, the fuel tank vents to the atmosphere through the vent and filler pipes, on vehicles without On-Board Refueling Vapor Recovery (ORVR) systems. In vehicles equipped with ORVR , the fuel tank and filler pipe are designed so that when the vehicle is being refueled, fuel vapors in the fuel tank travel to the Evaporative Emission (EVAP) canister, which absorbs the fuel vapors and vents the pressure from the fuel tank during refueling.

Inspection and Verification

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTE: Do not use incandescent lights when inspecting the fuel system. Use only flourescent or LED lighting.

1. Verify the customer concern by refueling the vehicle and observe the fuel fill rate.

2. Inspect to determine if any of the following mechanical concerns apply.

Visual Inspection Chart

Mechanical
• Bent, kinked or damaged fuel tank filler pipe • Bent, kinked or damaged fuel tank filler pipe vent tube (if equipped) • Incorrect routing of the fuel tank filler pipe • Incorrect routing of the fuel tank filler pipe vent tube (if equipped) • Incorrect position of fuel tank filler pipe clamps • Incorrect position of fuel tank filler pipe vent tube clamps (if equipped) • Fuel tank mounted vapor tubes bent or damaged • Evaporative Emission (EVAP) system tubes or hoses bent or damaged • Accident damage to the fuel tank • Accident damage to the vehicle affecting the fuel tank filler pipe-to-body connection • Unauthorized modifications and/or alterations to the vehicle • EVAP system fresh air hose plugged (dirt, spider webbing)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .

- If the network test passes, retrieve and record Continuous Memory Diagnostic Trouble Codes (CMDTCs).

8. Clear the continuous DTCs and carry out the self-test diagnostics for the EVAP system using the scan tool.

9. If the DTCs retrieved are related to the concern, go to Evaporative Emission (EVAP) System DTC Chart. For PCM-related DTCs, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. For all other DTCs, refer to Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Chart

Evaporative Emission (EVAP) System DTC Chart

DTC	Description	Action
P0446	Evaporative Emission System Vent Control Circuit	GO to Pinpoint Test A .
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	GO to Pinpoint Test A .
P0452	Evaporative Emission System Pressure Sensor/Switch Low	GO to Pinpoint Test A .
P0453	Evaporative Emission System Pressure Sensor/Switch High	GO to Pinpoint Test A .
P0454	Evaporative Emission System Pressure Sensor/Switch Intermittent	GO to Pinpoint Test A .
P1450	Unable to Bleed up Fuel Tank Vacuum	GO to Pinpoint Test A .
P1451	Evaporative Emission System Vent Control Circuit	GO to Pinpoint Test A .
P260F	Emission System Monitoring Processor Performance	GO to Pinpoint Test A .

Symptom Chart

Symptom Chart

Pinpoint Test

Pinpoint Test A: Slow to Fill

Normal Operation

Under normal operation, fuel should flow at a steady rate through the fuel tank filler pipe into the fuel tank. As fuel enters the fuel tank, air is vented through the filler pipe or the On-Board Refueling Vapor Recovery (ORVR) system.

This pinpoint test is intended to diagnose the following:

- Fuel tank filler pipe vent tube, if equipped
- Fuel tank filler pipe
- Evaporative Emission (EVAP) system
- Fuel tank inlet check valve (part of the fuel tank)
- Fuel level vent valve, if equipped

PINPOINT TEST A: SLOW TO FILL

Test Step	Result / Action to Take
A1 CARRY OUT INSPECTION AND VERIFICATION	
• Carry out Inspection and Verification. • **Was the cause of the concern found?**	**Yes** REPAIR or INSTALL new components to correct the concern. **No** GO to A2 .
A2 CHECK THE SYSTEM FOR ANY EVAP DTCs	
• Connect the scan tool. • Check the system for any of the following EVAP DTCs: P0446, P0451, P0452, P0453, P0454, P1450, P1451 and P260F. • **Are any of these DTCs present?**	**Yes** REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnosis the EVAP system. **No** GO to A3 .
A3 MONITOR THE FTP WHILE FILLING THE FUEL TANK	
• Monitor the Fuel Tank Pressure (FTP) reference value while filling the fuel tank. Refer to the Reference Values in the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is FTP within specification?**	**Yes** GO to A5 . **No** GO to A4 .
A4 MONITOR THE FTP WHILE FILLING THE FUEL TANK WITH THE EVAP SYSTEM DISCONNECTED	
• Disconnect the fuel tank-to- EVAP canister quick connect coupling at the EVAP canister. • Monitor the FTP reference value while filling the fuel tank. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. • **Is FTP within specification?**	**Yes** INSPECT the EVAP system for blockage or restrictions. REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL new EVAP system components. **No** GO to A5 .
A5 CHECK THE FUEL TANK FILLER PIPE ASSEMBLY FOR BLOCKAGE OR RESTRICTION	
• Remove the fuel tank filler pipe assembly. Refer to Section 310-01 . • Inspect the fuel tank filler pipe and fuel tank filler pipe vent tube (if equipped) for a blockage or restriction.	**Yes** If possible, REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL a new fuel tank filler pipe or fuel tank filler pipe vent tube. **No**

• **Is the fuel tank filler pipe or fuel tank filler pipe vent tube (if equipped) blocked or restricted?**	GO to A6 .
A6 CHECK THE FUEL TANK INLET CHECK VALVE	
• Inspect the fuel tank inlet check valve for restriction or sticking. • **Is the fuel tank inlet check valve restricted or sticking?**	**Yes** If possible, REPAIR the restrictions. If the restriction cannot be repaired, INSTALL a new fuel tank. REFER to Section 310-01 . **No** GO to A7 .
A7 CHECK TO MAKE SURE THAT THE FUEL LEVEL VENT VALVE IS FUNCTIONING CORRECTLY	
• **NOTE:** The fuel level vent valve, if equipped, is part of the FP module. • Remove the FP module. Refer to Section 310-01 . • Inspect the fuel level vent valve for foreign material at the bottom drain hole. • Invert the FP . Watch for a movement and a click noise. • **Was a movement/click noise witnessed?**	**Yes** Fuel level vent valve is OK. RETEST the system for normal operation. **No** INSTALL a new FP module. REFER to Section 310-01 .

Fuel System Pressure Release

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

1. **NOTE:** The front passenger door frame scuff plate is retained only by internal metal clips.

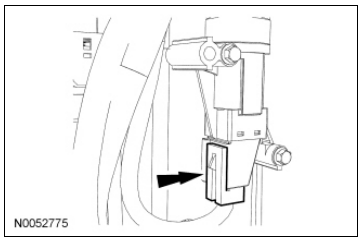
   Remove the front passenger door frame scuff plate.

2. **NOTE:** The front passenger door side interior kick panel is retained only by internal metal clips.

   NOTE: It may be necessary to reposition the lower end of the door jam weatherstripping to remove the front passenger door side interior kick panel.

   Remove the front passenger side interior kick panel.

3. Disconnect the Inertia Fuel Shutoff (IFS) switch electrical connector.

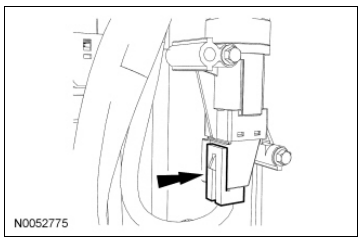


4. Start the engine and allow it to idle until it stalls.

5. After the engine stalls, crank the engine for approximately 5 seconds to make sure the fuel rail pressure has been released.

6. Turn the ignition switch to the OFF position.

7. When the fuel system service is complete, reconnect the IFS switch electrical connector.



8. **NOTE:** It may take more than one key cycle to pressurize the fuel system.

Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

9. Start the vehicle and check the fuel system for leaks.
10. Install the front passenger side interior kick panel.
11. Install the front passenger door frame scuff plate.

Fuel System Pressure Test

Special Tool(s)

 ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211-A) or equivalent

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

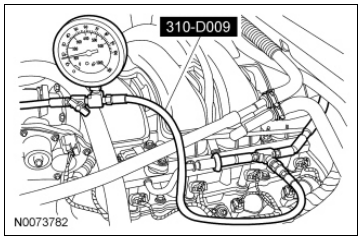
1. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. Disconnect the fuel supply tube-to-fuel rail spring lock coupling. For additional information, refer to Spring Lock Couplings in this section.

4. **NOTE:** 4.6L shown, 4.0L similar.

   Install the Fuel Pressure Test Kit in line between the fuel supply tube and fuel rail.



5. **NOTE:** The Inertia Fuel Shutoff (IFS) switch electrical connector was disconnected during fuel system pressure release.

Connect the IFS switch electrical connector.

6. Connect the battery ground cable. For additional information, refer to Section 414-01 .

7. **NOTE:** It may take more than one key cycle to pressurize the fuel system.

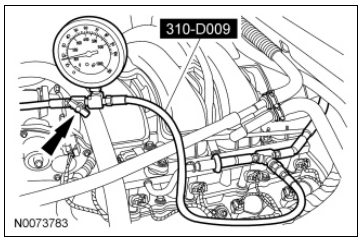
   Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

8. Test the fuel system pressure to make sure it is within the specified range. For additional information, refer to Specifications in this section.

9. **NOTE:** 4.6L shown, 4.0L similar.

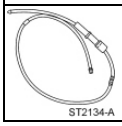
   NOTE: Open the drain valve slowly to relieve the fuel system pressure. This may drain fuel from the system. Place the fuel in a suitable container.

   Upon completion of the fuel system pressure test, open the drain valve on the Fuel Pressure Test Kit and relieve the fuel system pressure.



Fuel Tank Draining

Special Tool(s)

 ST1114-A	30 Gallon Hand-Operated Fuel Tanker 034-00002 or equivalent
 ST2134-A	Fuel Tank Drain Hose 310-F013

All vehicles

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

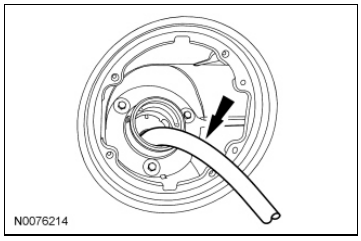
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

Explorer Sport Trac

3. Release the fuel tank filler cap and position aside.

4. **NOTE:** Fuel tank filler pipe cap and fuel door removed from art for clarity.

   Insert a suitable fuel drain tube into the fuel tank filler pipe until it stops.

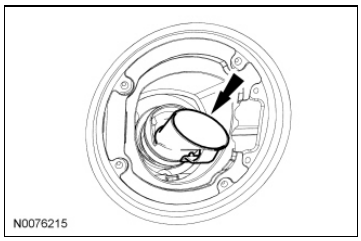


Explorer/Mountaineer

5. **NOTE:** Fuel door removed from art for clarity.

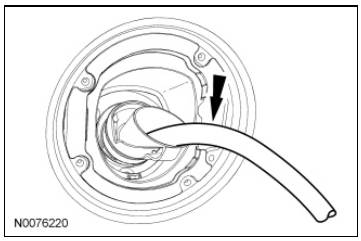
   NOTE: The use of the supplemental refueling adapter is necessary to open the fuel tank filler pipe.

   Insert the supplemental refueling adapter into the fuel tank filler pipe.



6. **NOTE:** Fuel door removed from art for clarity.

   Insert a suitable fuel drain tube through the supplemental refueling adapter and into the fuel tank filler pipe until it stops.



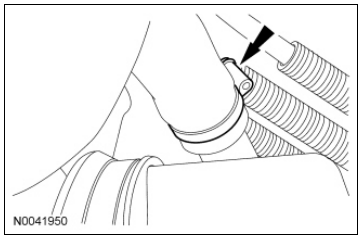
All vehicles

7. Attach the 30 Gallon Hand-Operated Fuel Tanker to the fuel drain tube and remove as much fuel as possible from the fuel tank filler pipe.

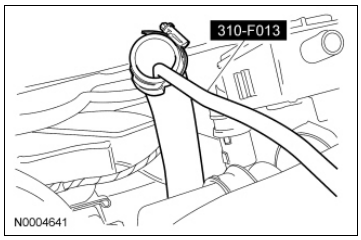
8. **NOTE:** There may be some residual fuel in the fuel tank filler pipe hose. Drain fuel into a suitable container.

   Loosen the clamp and disconnect the fuel tank filler pipe.

   - To install, tighten to 3 Nm (27 lb-in).



9. Using the Fuel Tank Drain Hose and the 30 Gallon Hand-Operated Fuel Tanker, siphon the fuel from the fuel tank.



Quick Connect Coupling

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Disconnect - Type I

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install plugs to any open orifices or tubes.**

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage**

to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

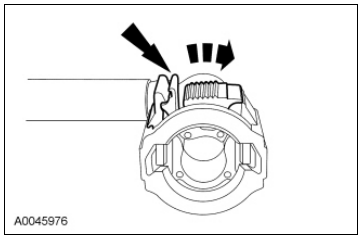
NOTE: During the repair or replacement of fuel-related components, all fuel liquid and fuel vapor openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. If servicing a liquid fuel tube, release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

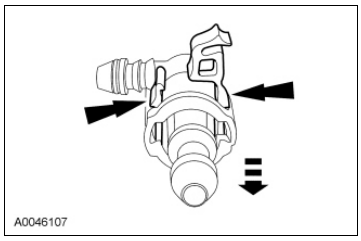
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. ***NOTICE:*** **Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.**

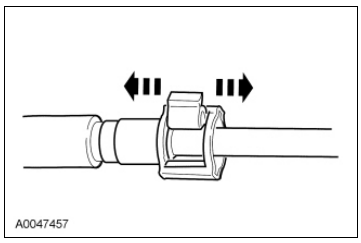
   Unclip the locking tab.



4. Depress the tabs and press the clip downward.



5. Separate the quick connect coupling.



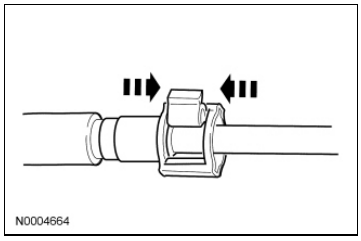
Connect - Type I

1. Inspect the quick connect coupling and the tube for damage. Remove any dirt or obstructions.

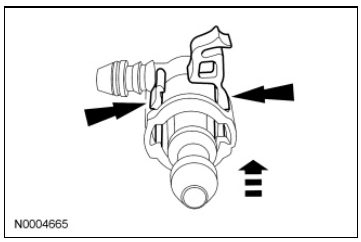
2. **NOTE:** Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

   NOTE: Lubricate the quick connect coupling with clean engine oil.

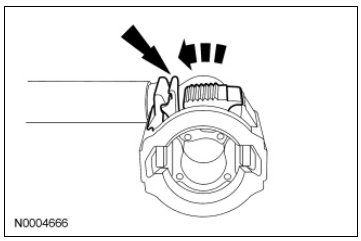
   Connect the quick connect coupling.



3. Push the clip up into the quick connect coupling. Pull on the tube to make sure it is seated correctly.



4. Clip the locking tab in place.



5. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Disconnect - Type II

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

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

damage may occur. Always install plugs to any open orifices or tubes.

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

NOTE: During the repair or replacement of fuel-related components, all fuel liquid and fuel vapor openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

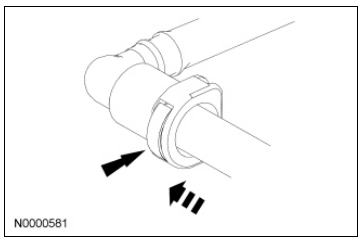
1. If servicing a liquid fuel tube, release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. ***NOTICE:*** **Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.**

   Disconnect the fuel tube quick connect coupling.

   - Press the fuel tube quick connect coupling button and pull the fuel tube to disconnect.



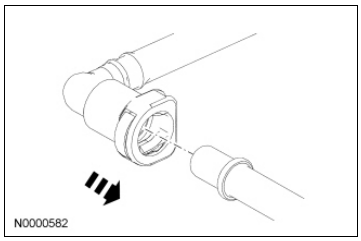
Connect - Type II

1. Inspect the quick connect coupling and the tube for damage. Remove any dirt or obstructions.

2. **NOTE:** Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

   NOTE: Apply clean engine oil to O-ring seals.

   Install the quick connect coupling onto the tube until it is fully seated.



3. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Disconnect - Type III

⚠ **WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working**

on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

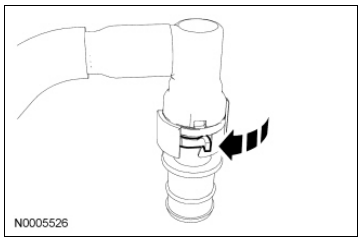
NOTICE: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install plugs to any open orifices or tubes.**

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

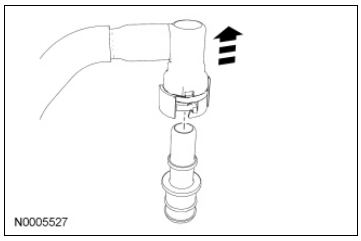
NOTE: During the repair or replacement of fuel-related components, all fuel liquid and fuel vapor openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. ***NOTICE:*** **Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.**

   Release the locking tab on the quick connect coupling.



2. Separate the quick connect coupling from the fitting.



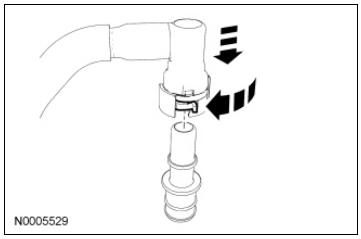
Connect - Type III

1. Inspect the quick connect coupling and the tube for damage. Remove any dirt or obstructions.

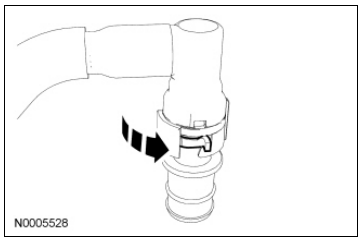
2. **NOTE:** Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

NOTE: Apply clean engine oil to O-ring seals.

Release the locking tab and install the quick connect coupling onto the fitting.



3. Position the locking tab into the latched position.



Disconnect - Type IV

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

NOTICE: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install plugs to any open orifices or tubes.**

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

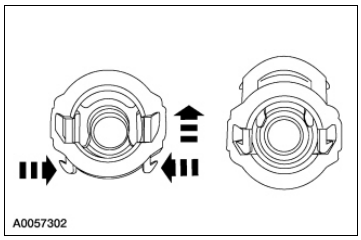
NOTE: During the repair or replacement of fuel-related components, all fuel liquid and fuel vapor openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. If servicing a liquid fuel tube, release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

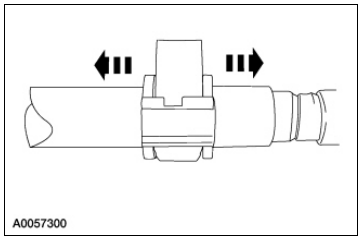
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

3. ***NOTICE:*** **Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.**

   Compress the clip legs and push the clip into the quick connect coupling.



4. Separate the quick connect coupling from the tube.



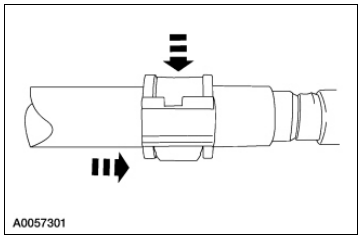
Connect - Type IV

1. Inspect the quick connect coupling and the tube for damage. Remove any dirt or obstructions.

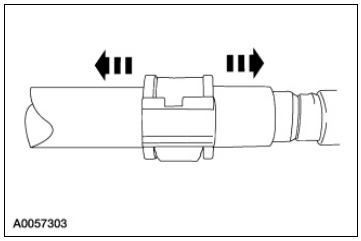
2. **NOTE:** Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

   NOTE: Apply clean engine oil to O-ring seals.

   Fully insert the male tube end in the quick connect coupling and push the clip downward to lock the fuel tubes together.



3. Pull on the connection to make sure it is fully engaged.



4. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Spring Lock Couplings

Special Tool(s)

 ST1147-A	Disconnect Tool, Spring Lock Coupling 310-D005 (D87L-9280-B) or equivalent
 ST1399-A	Disconnect Tool, Spring Lock Coupling 310-S039 (T90T-9550-S)

Material

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP (US); Motorcraft® SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12 (Canada); or equivalent	WSS-M2C929-A

Disconnect - Type I

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

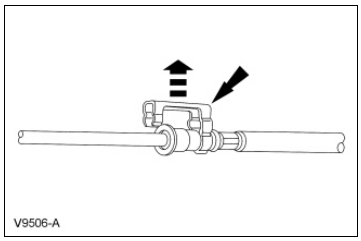
NOTICE: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install plugs to any open orifices or tubes.**

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

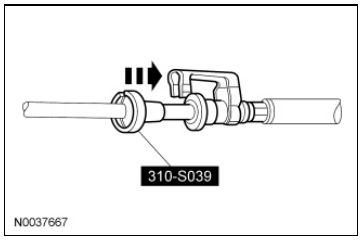
1. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

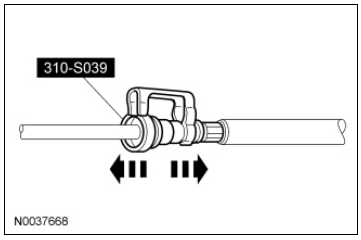
3. Disconnect the safety clip from the fuel tube.



4. Install the Spring Lock Coupling Disconnect Tool and press it into the spring lock coupling.



5. Separate the spring lock coupling.



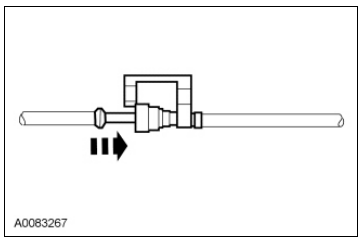
Connect - Type I

1. Inspect and clean both spring lock coupling ends.

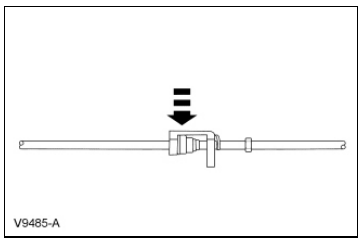
2. **NOTE:** Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

   NOTE: Lubricate the spring lock coupling with clean engine oil.

Align the fuel tube spring lock coupling and push together until a click is heard.



3. Pull on the spring lock coupling to make sure it is fully seated. Install the fuel tube safety clip on the male end.



4. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Disconnect - Type II

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

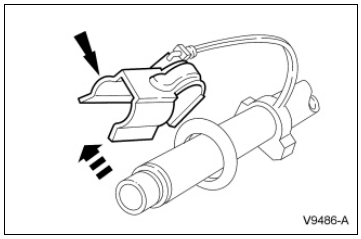
NOTICE: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install plugs to any open orifices or tubes.**

NOTICE: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

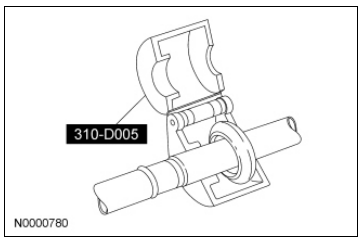
1. Release the fuel system pressure. For additional information, refer to Fuel System Pressure Release in this section.

2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

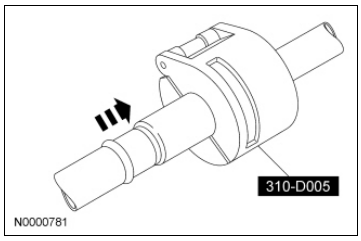
3. Remove the fuel tube safety clip.



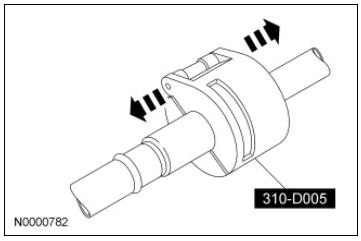
4. Install the Spring Lock Coupling Disconnect Tool.



5. Close and push the Spring Lock Coupling Disconnect Tool into the open side of the cage.

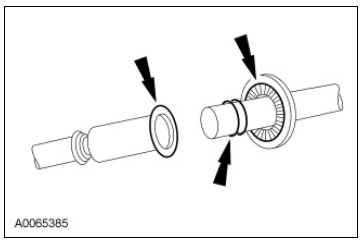


6. Separate the spring lock coupling.



Connect - Type II

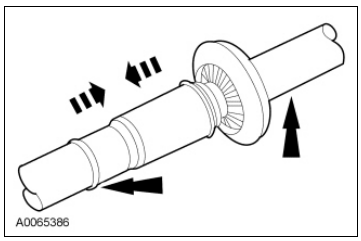
1. Inspect and clean both spring lock coupling ends. Install new O-ring seals and garter springs if necessary.



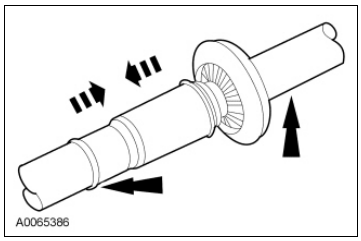
2. **NOTE:** Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

   NOTE: Apply clean engine oil to O-ring seals.

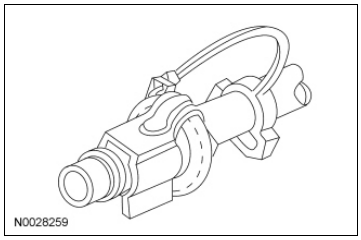
   Fit the male end into the female end and push until the garter spring snaps over the flared end of the female end.



3. Make sure the spring lock coupling is engaged by pulling on the tube.



4. Install the fuel tube safety clip.



5. Connect the battery ground cable. For additional information, refer to Section 414-01 .

Torque Specifications

Description	Nm	lb-ft	lb-in
Dust separator bracket bolt	9	-	80
Fuel filter heat shield bolts	20	-	177
Fuel filter shield nuts	6	-	53
Fuel tank filler pipe hose clamp	3	-	27
Fuel tank filler pipe-to-body bolts	1	-	9
Fuel tank filler pipe-to-frame bolts	15	-	133
Fuel tank skid plate bolts	40	30	-
Fuel tank skid plate nut	40	30	-
Fuel tank support strap bolt	48	35	-
Fuel tank support strap nut	48	35	-
Inertia Fuel Shutoff (IFS) switch bolts	2	-	18
Transfer case skid plate bolts	40	30	-

Fuel Tank and Lines

The fuel system consists of the following components:

- Fuel tank
- Fuel tank filler pipe which contains a restrictor plate to permit only unleaded fuel to be pumped into the fuel tank
- Electronic returnless fuel system
- One-fourth-turn-type fuel tank filler cap on Explorer Sport Trac
- Easy Fuel ™ capless fuel tank filler pipe on Explorer/Mountaineer
- Fuel filter providing filtration to protect the fuel injectors (located on the front of the fuel tank)
- Fuel tubes
- Vapor tubes
- Fuel Pump (FP) assembly containing:
    - ♦ the electric FP which provides pressurized fuel to the engine.
    - ♦ a serviceable fuel level sender.
    - ♦ an inlet filter.
    - ♦ a check valve which maintains system pressure after the FP is shut off.

The FP is controlled by the PCM which energizes the FP relay. Electrical power to the FP is provided through the Inertia Fuel Shutoff (IFS) switch.

Fuel Tank and Lines

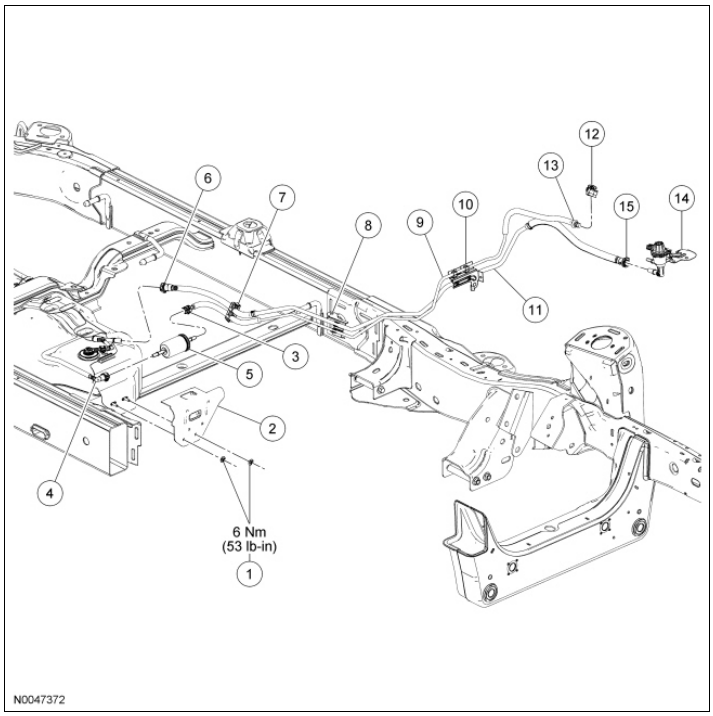
Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Fuel Lines and Fuel Filter - Exploded View

Explorer Sport Trac

NOTE: 4.6L shown, 4.0L similar.

NOTE: Vehicle body removed from art for clarity.



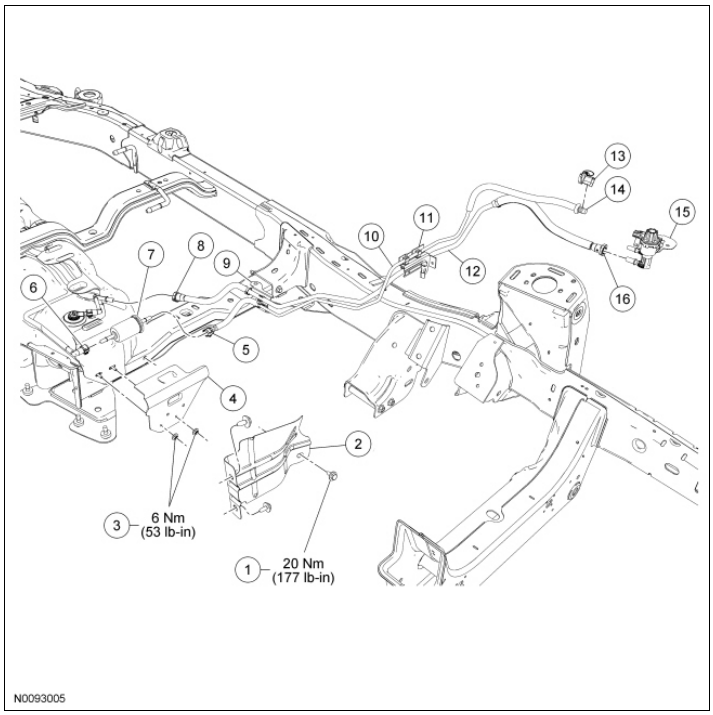
Item	Part Number	Description
1	W701014	Fuel filter shield nuts (2 required)
2	9A335	Fuel filter shield
3	-	Fuel filter-to-fuel supply tube quick connect coupling (part of 9J280)
4	-	Fuel supply tube-to-fuel filter quick connect coupling (part of 9J280)
5	9155	Fuel filter
6	-	Vapor tube-to-Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling (part of 9J338)
7	256535	Fuel line clip
8	9H304	Fuel supply tube and vapor tube bracket-to-transmission
9	9J280	Fuel supply tube
10	9D319	Fuel supply tube and vapor tube bracket-to-transmission
11	9J338	Vapor tube
12	9294	Fuel tube spring lock coupling retainer
13	-	

		Fuel supply tube-to-fuel rail spring lock coupling (part of 9J280)
14	9J451	Evaporative Emission (EVAP) canister purge valve
15	-	Vapor tube-to- EVAP canister quick connect coupling (part of 9J338)

Explorer/Mountaineer

NOTE: 4.6L shown, 4.0L similar.

NOTE: Vehicle body removed from art for clarity.



Item	Part Number	Description
1	W710617	Fuel filter heat shield bolt (3 required)
2	5D032	Fuel filter heat shield
3	W701014	Fuel filter shield nuts (2 required)
4	9A335	Fuel filter shield
5	-	Fuel filter-to-fuel supply tube quick connect coupling (part of 9J280)
6	-	Fuel supply tube-to-fuel filter quick connect coupling (part of 9J280)
7	9155	Fuel filter
8	-	Vapor tube-to-Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling (part of 9J338)
9	9H304	Fuel supply tube and vapor tube bracket-to-transmission
10	9J280	Fuel supply tube
11	9D319	Fuel supply tube and vapor tube bracket-to-transmission

12	9J338	Vapor tube
13	9294	Fuel tube spring lock coupling retainer
14	-	Fuel supply tube-to-fuel rail spring lock coupling (part of 9J280)
15	9J451	Evaporative Emission (EVAP) canister purge valve
16	-	Vapor tube-to- EVAP canister quick connect coupling (part of 9J338)

1. For additional information, refer to the procedures in this section.

Fuel Filter

Removal and Installation

All vehicles

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

NOTE: During the repair or replacement of fuel-related components, all liquid and vapor fuel openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

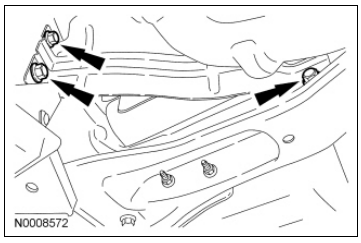
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Release the fuel system pressure. For additional information, refer to Section 310-00 .

3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

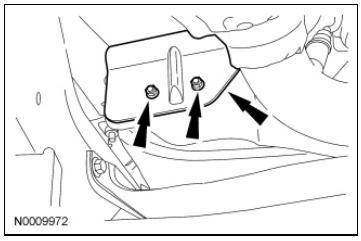
Explorer/Mountaineer

4. Remove the 3 bolts and the fuel filter heat shield.
   - To install, tighten to 20 Nm (177 lb-in).



All vehicles

5. Remove the 2 nuts and the fuel filter shield.
   - To install, tighten to 6 Nm (53 lb-in).



6. Disconnect the fuel supply tubes quick connect couplings. For additional information, refer to Section 310-00 .

7. Remove the fuel filter.

8. To install, reverse the removal procedure.

Fuel Lines

Removal and Installation

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

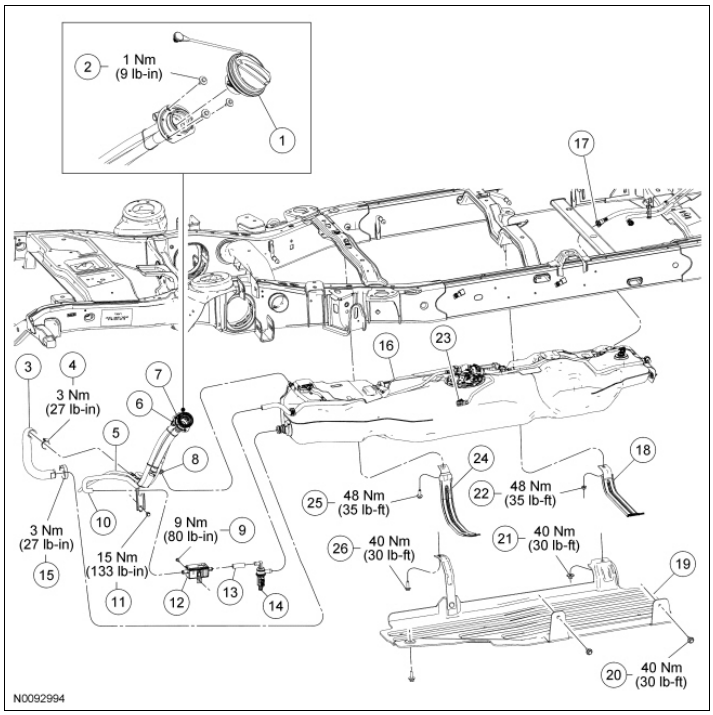
NOTE: During the repair or replacement of fuel-related components, all liquid and vapor fuel openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Release the fuel system pressure. For additional information, refer to Section 310-00 .
3. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
4. Disconnect the spring lock coupling at the engine and the vapor tube quick connect coupling at the purge valve. For additional information, refer to Section 310-00 .
5. Disconnect the quick connect coupling at the fuel filter and the vapor tube quick connect coupling at the fuel tank. For additional information, refer to Section 310-00 .
6. Remove the transmission. For additional information, refer to Section 307-01A or Section 307-01B .
7. Remove the fuel lines from the vehicle.
8. To install, reverse the removal procedure.

Fuel Tank and Filler Pipe - Exploded View

Explorer Sport Trac

NOTE: Vehicle body removed from art for clarity.

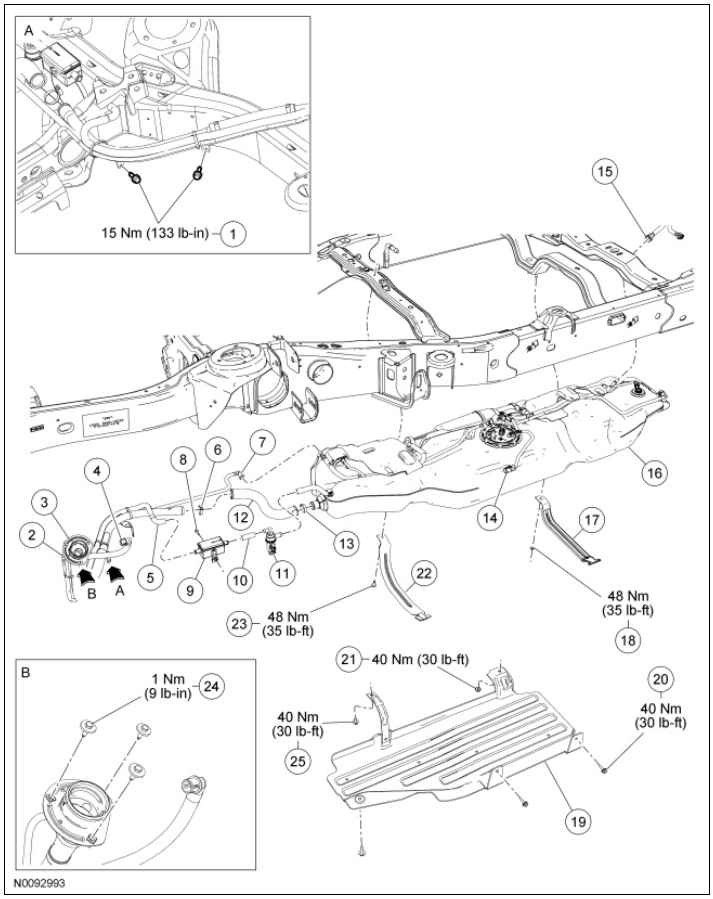


Item	Part Number	Description
1	9030	Fuel tank filler cap
2	N807605	Fuel tank filler pipe-to-body bolt (3 required)
3	9047	Fuel tank filler pipe hose
4	W525937	Fuel tank filler pipe hose clamp
5	-	Rear axle vent hose (part of 9034)
6	-	Fuel tank filler pipe fresh air vapor tube (part of 9034)
7	9034	Fuel tank filler pipe assembly
8	-	Fuel tank filler pipe vapor tube-to-fuel pressure sensor and vapor tube assembly quick connect coupling (part of 9034)
9	W506414	Dust separator bracket bolt
10	-	Dust separator hose (part of 9034)
11	W704901	Fuel tank filler pipe bolt
12	9B328	Dust separator
13	9S321	Evaporative Emission (EVAP) canister vent valve-to-dust separator hose
14	9F945	EVAP canister vent valve

15	W525937	Fuel tank filler pipe hose clamp
16	9002	Fuel tank
17	-	Vapor tube-to-Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling (part of 9J338)
18	9054	Fuel tank front support strap
19	9A147	Fuel tank skid plate (if equipped)
20	W711346	Fuel tank skid plate bolt (3 required) (if equipped)
21	W710675	Fuel tank skid plate nut (if equipped)
22	W520113	Fuel tank support strap nut
23	14A464	Fuel Pump (FP) electrical connector
24	9054	Fuel tank rear support strap
25	W711345	Fuel tank support strap bolt
26	W711345	Fuel tank skid plate bolt (if equipped)

Explorer/Mountaineer

NOTE: Vehicle body removed for clarity.



Item	Part Number	Description
1	W704901	Fuel filler pipe bolts (2 required)
2	-	Rear axle vent hose (part of 9034)

3	9034	Fuel tank filler pipe assembly
4	-	Fuel tank filler pipe fresh air vapor tube (part of 9034)
5	-	Dust separator hose (part of 9034)
6	W525937	Fuel tank filler pipe hose clamp
7	-	Fuel tank filler pipe vapor tube-to-fuel pressure sensor and vapor tube assembly quick connect coupling (part of 9034)
8	W506414	Dust separator bracket bolt
9	9B328	Dust separator
10	9S321	Evaporative Emission (EVAP) canister vent valve-to-dust separator hose
11	9F945	EVAP canister vent valve
12	9047	Fuel tank filler pipe hose
13	W525937	Fuel tank filler pipe hose clamp
14	14A464	Fuel Pump (FP) electrical connector
15	-	Vapor tube-to-Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling (part of 9J338)
16	9002	Fuel tank
17	9054	Fuel tank front support strap
18	W520113	Fuel tank support strap nut
19	9A147	Fuel tank skid plate (if equipped)
20	W711346	Fuel tank skid plate bolt (3 required) (if equipped)
21	W710675	Fuel tank skid plate nut (if equipped)
22	9054	Fuel tank rear support strap
23	W711345	Fuel tank support strap bolt
24	N807605	Fuel tank filler pipe-to-body bolt (3 required)
25	W711345	Fuel tank skid plate bolt (if equipped)

1. For additional information, refer to the procedures in this section.

Fuel Tank Filler Pipe

Removal and Installation

All vehicles

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

NOTE: During the repair or replacement of fuel-related components, all liquid and vapor fuel openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. Drain the fuel tank. For additional information, refer to Section 310-00 .

2. **NOTE:** The fuel tank filler pipe hose between the fuel tank filler pipe and the fuel tank is serviceable separately. The fuel tank filler pipe does not have to be removed from the vehicle to service the fuel tank filler pipe hose.

   If necessary, loosen the fuel tank filler pipe hose clamp at the fuel tank and disconnect the hose and remove from the vehicle.

   - To install, tighten to 3 Nm (27 lb-in).

Explorer Sport Trac

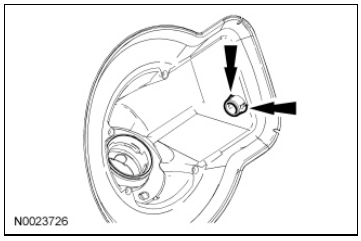
3. Open the fuel tank filler cap.

Explorer/Mountaineer

4. Remove the fuel tank filler pipe upper retainer. For additional information, refer to Section 501-08 .

5. **NOTE:** Body panel and fuel door removed from art for clarity.

   Depress the 2 tabs on the fresh air vent tube in the fuel filler door pocket and disconnect the fresh air vent tube from the inner fenderwell.



All vehicles

6. Remove the 3 bolts.
    - To install, tighten to 1 Nm (9 lb-in).

7. Disconnect the fuel filler pipe vapor tube-to-Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling. For additional information, refer to Section 310-00 .

8. Disconnect the rear axle vent hose.

9. Disconnect the dust separator hose.

10. Remove the 2 bolts and the fuel tank filler pipe assembly.
    - To install, tighten to 15 Nm (133 lb-in).

11. To install, reverse the removal procedure.

Fuel Tank Support Straps

Removal and Installation

All vehicles

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

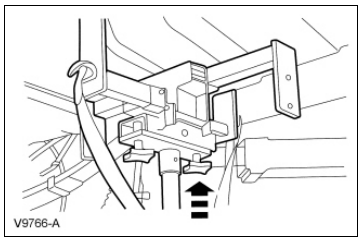
2. If equipped, remove the 4 bolts, the nut and the fuel tank skid plate.
   - To install, tighten to 40 Nm (30 lb-ft).

Explorer/Mountaineer

3. Remove the driveshaft. For additional information, refer to Section 205-01 .

All vehicles

4. Using a suitable jack, support the fuel tank.



5. Remove the bolt and the fuel tank rear support strap.
   - To install, tighten to 48 Nm (35 lb-ft).

6. Remove the nut and the fuel tank front support strap.
   - To install, tighten to 48 Nm (35 lb-ft).

7. To install, reverse the removal procedure.

Fuel Tank

Removal and Installation

All vehicles

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

NOTE: During the repair or replacement of fuel-related components, all liquid and vapor fuel openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Release the fuel system pressure. For additional information, refer to Section 310-00 .

3. Disconnect the battery negative cable. For additional information, refer to Section 414-01 .

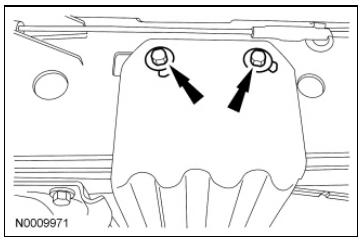
Explorer/Mountaineer

4. Remove the driveshaft. For additional information, refer to Section 205-01 .

All vehicles

5. Drain the fuel tank. For additional information, refer to Section 310-00 .

6. If equipped, remove the 4 bolts and the transfer case skid plate.
   - To install, tighten to 40 Nm (30 lb-ft).

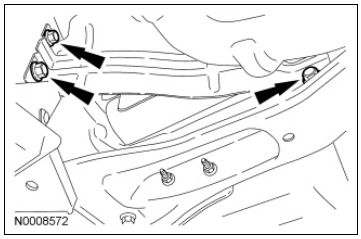


7. Disconnect the filler pipe vapor tube-to-Fuel Tank Pressure (FTP) sensor and vapor tube assembly quick connect coupling. For additional information, refer to Section 310-00 .

8. Disconnect the fuel vapor hose from the Evaporative Emission (EVAP) canister vent valve.

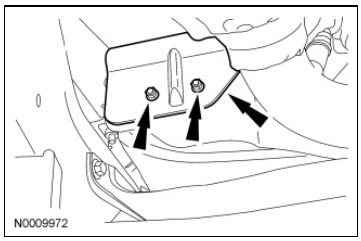
Explorer/Mountaineer

9. Remove the 3 bolts and the fuel filter heat shield.
    - To install, tighten to 20 Nm (177 lb-in).



All vehicles

10. Remove the 2 nuts and the fuel filter shield.
    - To install, tighten to 6 Nm (53 lb-in).

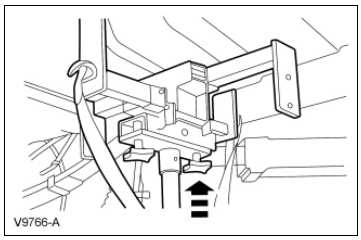


11. Disconnect the fuel filter outlet quick connect coupling. For additional information, refer to Section 310-00 .

12. Disconnect the FTP and tube assembly-to-vapor tube quick connect coupling. For additional information, refer to Section 310-00 .

13. If equipped, remove the 4 bolts, 1 nut and the fuel tank skid plate.
    - To install, tighten to 40 Nm (30 lb-ft).

14. Using a suitable jack, support the fuel tank.



15. Remove the bolt and the fuel tank rear support strap.
    - To install, tighten to 48 Nm (35 lb-ft).

16. Remove the nut and the fuel tank front support strap.
    - To install, tighten to 48 Nm (35 lb-ft).

17. Lower the fuel tank far enough to access the Fuel Pump (FP) electrical connector and disconnect the connector.

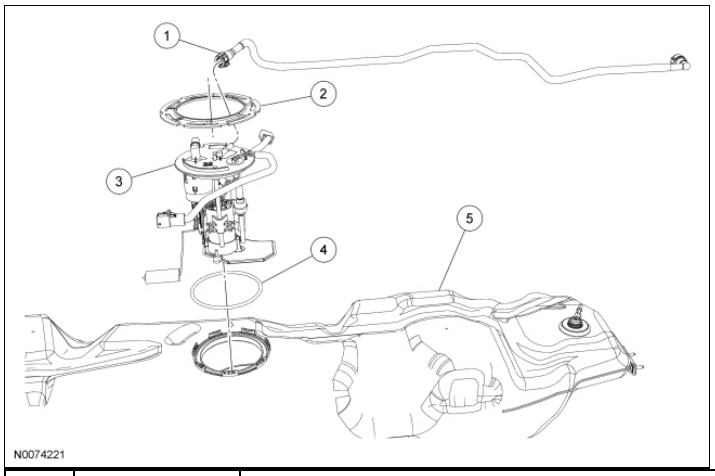
18. Remove the fuel tank from the vehicle.
19. **NOTE:** Make sure the fuel and vapor tubes are correctly routed prior to installing the fuel tank.

    To install, reverse the removal procedure.

Fuel Pump

Special Tool(s)

 ST2803-A	Wrench, Fuel Tank Sender Unit 310-123 (SR-015312)



Item	Part Number	Description
1	-	Fuel supply tube-to-fuel pump quick connect coupling (part of 9J280)
2	9C385	Fuel Pump (FP) locking ring
3	9H307	FP module
4	9417	FP O-ring seal
5	9002	Fuel tank

Removal

⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

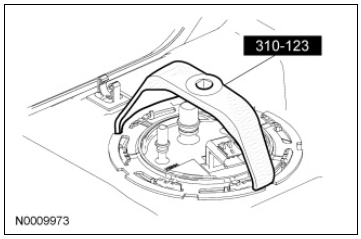
NOTE: During the repair or replacement of fuel-related components, all liquid and vapor fuel openings must be capped, taped or otherwise appropriately protected to prevent the ingress of dirt or other contamination. All caps, tape and other protective materials must be removed prior to installation.

1. Remove the Fuel Tank Pressure (FTP) sensor and vapor tube assembly. For additional information, refer to Section 303-13 .

2. Disconnect the fuel supply tube-to-Fuel Pump (FP) quick connect coupling. For additional information, refer to Section 310-00 .

3. Remove the fuel supply tube.

4. Using the Fuel Tank Sender Unit Wrench, remove the FP locking ring.



5. **NOTE:** The FP module must be handled carefully to avoid damage to the float arm and filter.

   Remove the FP module and the O-ring seal. Discard the O-ring seal.

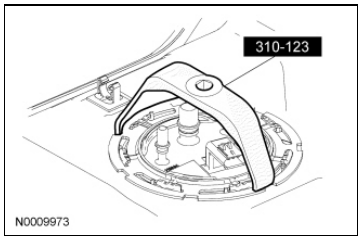
Installation

1. **NOTE:** The FP module must be handled carefully to avoid damage to the float arm and filter.

   Install a new O-ring seal and the FP module.

2. **NOTE:** The FP module locking ring is a cam-type lock. Turn the locking ring until it stops and is locked in place.

   Using the Fuel Tank Sender Unit Wrench, install the FP module locking ring.

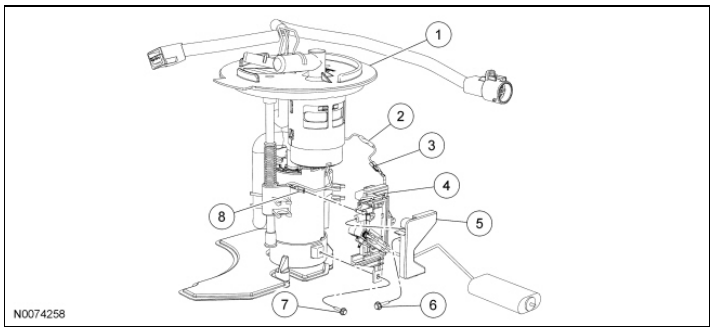


3. Install the fuel supply tube.

4. Connect the fuel supply tube-to- FP quick connect coupling. For additional information, refer to Section 310-00 .

5. Install the FTP sensor and vapor tube assembly. For additional information, refer to Section 303-13 .

Fuel Level Sender



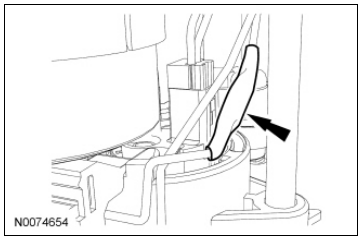
Item	Part Number	Description
1	9H307	Fuel Pump (FP)
2	-	Heat shrink tube
3	-	Fuel level sender wire electrical connector (part of 9A299)
4	-	Fuel level sender (part of 9A299)
5	-	Fuel level sender cover (part of 9A299)
6	-	Fuel level sender cover screw (part of 9A299)
7	-	Fuel level sender screw (part of 9A299)
8	-	Fuel level sender ground wire electrical connector (part of 9H307)

Removal

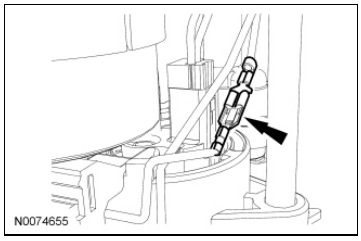
⚠ WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the Fuel Pump (FP). For additional information, refer to Fuel Pump in this section.
2. Remove the screw and the fuel level sender cover.
3. **NOTE:** Note the routing of the fuel level sender wire for installation.

   Remove the heat shrink tube covering the fuel level sender wire electrical connector.

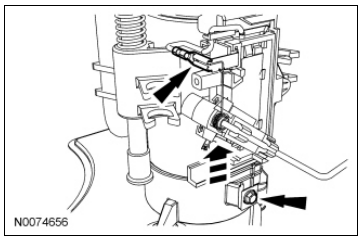


4. Disconnect the fuel level sender wire electrical connector.



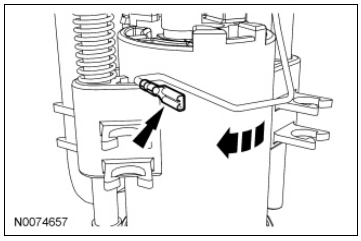
5. **NOTE:** Note the routing of the fuel level sender ground wire for installation.

   Disconnect the ground wire and remove the screw and lift up to remove the fuel level sender.

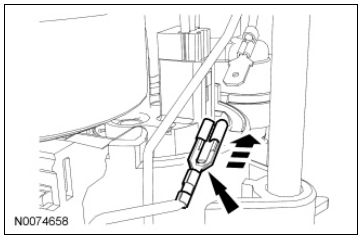


Installation

1. Route the fuel level sender ground wire along the FP body.

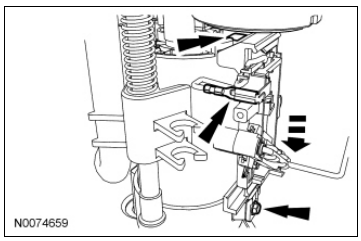


2. Route the fuel level sender wire through the center of the FP .

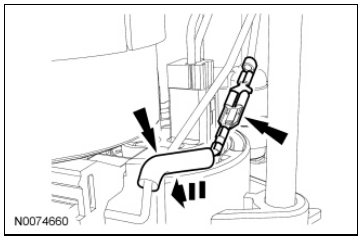


3. **NOTE:** Both fuel gauge sending wires must be routed behind the metal sending unit plate.

   Hook the fuel level sender on the FP and install and tighten the screw. Connect the fuel level sender unit ground wire.

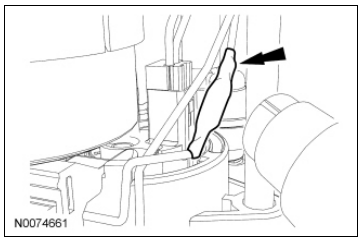


4. Slide the heat shrink tube onto the wire harness and connect the fuel level sender wire electrical connector.



5. ⚠ **WARNING: Do not use an open flame to shrink the heat shrink tube. Use a heat gun only. Fuel residue may be ignited if an open flame is used. Failure to follow this instruction may result in serious personal injury.**

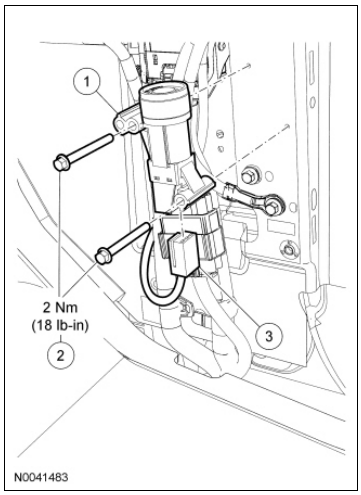
   Using a heat gun, shrink the heat shrink tube.



6. Install the fuel level sender cover and screw and tighten the screw.

7. Install the FP . For additional information, refer to Fuel Pump in this section.

Inertia Fuel Shutoff (IFS) Switch



Item	Part Number	Description
1	9341	Inertia Fuel Shutoff (IFS) switch
2	W504148	Bolts (2 required)
3	-	IFS switch electrical connector

Removal and Installation

1. **NOTE:** The front passenger door frame scuff plate is retained only by internal metal clips.

   Remove the front passenger door frame scuff plate.

2. **NOTE:** The front passenger door side interior kick panel is retained only by internal metal clips.

   NOTE: It may be necessary to reposition the lower end of the door jam weather stripping to remove the front passenger door side interior kick panel.

   Remove the front passenger side interior kick panel.

3. Disconnect the Inertia Fuel Shutoff (IFS) switch electrical connector.

4. Remove the 2 bolts and the IFS switch.
   - To install, tighten to 2 Nm (18 lb-in).

5. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Accelerator pedal mounting nuts	7	62

Acceleration Control

The acceleration control consists of one of the following:

- A fixed accelerator pedal and position sensor assembly
- An adjustable accelerator pedal and position sensor assembly

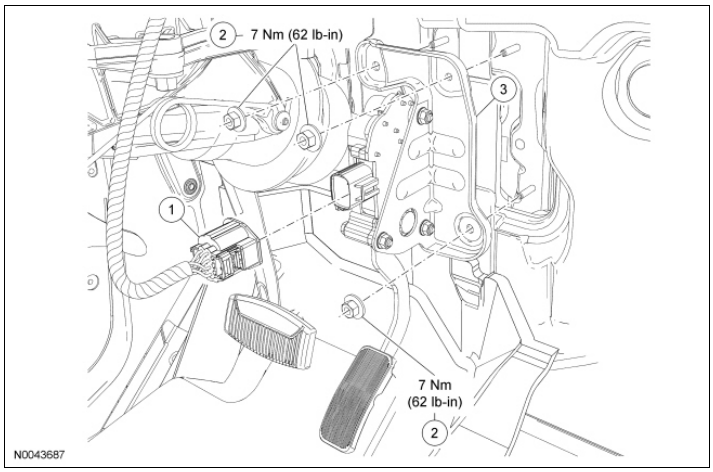
The throttle is controlled by an Accelerator Pedal Position (APP) sensor on the accelerator pedal assembly. The APP sensor sends a signal to the PCM in response to throttle pedal movements initiated by the driver. The PCM sends a signal to the electronic throttle control which increases and decreases throttle position.

Some vehicles are equipped with adjustable pedals. This allows both the accelerator and brake pedals to be adjusted simultaneously forward or rearward. A rocker switch on the instrument panel provides adjustment on the pedal assembly when it is activated. On vehicles with the memory seat option, the pedal position can be controlled by the memory selection, as well as the rocker switch. The components in the acceleration control system are not adjustable and new components must be installed if damaged or worn.

Acceleration Control

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Accelerator Pedal - Fixed



Item	Part Number	Description
1	-	Accelerator pedal electrical connector (part of 14401)
2	90907	Accelerator pedal assembly nuts (3 required)
3	9F836	Accelerator pedal assembly

Removal and Installation

1. Disconnect the accelerator pedal electrical connector.

2. Remove the 3 nuts and the accelerator pedal assembly.
   - To install, tighten to 7 Nm (62 lb-in).

3. To install, reverse the removal procedure.

Accelerator Pedal - Adjustable

Removal and Installation

1. The adjustable accelerator pedal and adjustable brake pedal must be serviced as a unit. For additional information, refer to Section 206-06 .

SECTION 310-03: Speed Control

DESCRIPTION AND OPERATION

2009 Explorer/Mountaineer/Explorer Sport Trac Workshop Manual

Procedure revision date: 02/27/2009

Speed Control

The vehicle speed control system consists of the following components:

- Speed control switch
- Speed control deactivator switch (integral to the stoplamp switch)
- Stoplamp switch
- Speed control indicator
- PCM
- Electronically controlled throttle
- Clockspring

The speed control system is controlled by the PCM. The speed control system is designed to maintain a selected vehicle speed between 40 km/h (25 mph) and the maximum limited vehicle speed. The speed control system is controlled by the steering wheel mounted switches (ON, OFF, SET+, SET-, and RES) and the brake pedal. The steering wheel mounted switches are hardwired to the PCM.

Speed Control

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The speed control system is controlled by the PCM. The speed control system is designed to maintain a selected vehicle speed between 40 km/h (25 mph) and the maximum limited vehicle speed. The speed control system is controlled by the steering wheel mounted switches (ON, OFF, SET+, SET-, and RES), the stoplamp switch and the speed control deactivator switch (integral to the stoplamp switch). The steering wheel mounted switches are hardwired to the PCM through the clockspring.

The speed control functions include:

- turning on the speed control system
- setting and maintaining the desired vehicle speed
- accelerating the vehicle speed
- decelerating the vehicle speed
- turning off the vehicle speed control system
- canceling the speed control

Pressing and releasing the ON switch turns the speed control system on. Pressing and releasing the SET +/- switch while the vehicle is traveling at the desired speed activates the speed control system.

Tapping the SET+ or the SET- switch while in the set mode increases or decreases the maintained vehicle speed by 1.6 km/h (1 mph) per tap, respectively. If either switch is pressed and held, the vehicle speed continues to accelerate (SET+) or decelerate (SET-) until the switch is released.

Pressing and releasing the OFF switch, or switching the ignition switch to the OFF position, turns the speed control system off. Applying the brake pedal puts the speed control system into the standby mode. Pressing the RES switch when the speed control system is in the standby mode causes the vehicle to accelerate to the last set speed. The RES switch does not function if the OFF switch is pressed or if the current vehicle speed is below the minimum operational speed.

Whenever the speed control system is engaged and active, a speed control icon on the Instrument Cluster (IC) is illuminated.

The clockspring provides the electrical interface between the steering column wiring and the speed control switch in the steering wheel.

When the brake pedal is applied, an electrical signal from the stoplamp switch is sent to the PCM to deactivate the speed control system. The speed control deactivator switch (integral to the stoplamp switch) is provided as an additional safety feature. Under increased brake pedal effort, the speed control deactivator switch opens and removes the voltage signal from the PCM input circuit, deactivating the speed control system.

The ABS module monitors brake pressure and also receives an electrical signal from the stoplamp switch. A fault in the ABS module can disable the speed control system.

The clockspring provides the electrical interface between the steering column wiring and the speed control switches in the steering wheel.

The inputs to the PCM for the speed control system are the:

- Output Shaft Speed (OSS) sensor
- Digital Transmission Range (TR) sensor
- Speed control switch
- Stoplamp switch
- Speed control deactivator switch (integral to the stoplamp switch)
- Accelerator pedal position sensor

The outputs from the PCM for the speed control system are the:

- Speed control indicator lamp
- Throttle command

The speed control system throttle position is completely controlled by the PCM through the electronically controlled throttle body. Speed control electronics are contained entirely within the PCM.

When the speed control system is active, the PCM corrects for deviations in the actual vehicle speed by proportionally moving the throttle plate. The PCM modulates the throttle to minimize error between actual and desired vehicle speed.

The PCM strategy uses the throttle control for smooth accelerations.

The PCM sends a serial message over the High Speed Controller Area Network (HS-CAN) to the IC to command the speed control telltale to be turned on or off.

In the event of an off command or a deactivation request from any source, the system carries out a hard deactivation and immediately returns the throttle to the idle position.

The speed control system provides self-diagnostics. The speed control system will disable operation and set a PCM DTC if it detects certain faults. The IC does not indicate speed control faults with a telltale or message center message. Fault codes are logged by the PCM.

Additionally, the following conditions will cause the speed control system to deactivate:

- The transmission gear selector is in a position other than D or OD.
- The speed control set speed is over-ridden with the accelerator pedal for longer than 5 minutes.
- Vehicle speed loss from set speed of greater than 16 km/h (10 mph) occurs.
- The vehicle speed falls below the minimum allowable limit (40 km/h [25 mph]).
- A speed control switch is pressed or stuck longer than 2 minutes.

- ABS system fault

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Throttle body	• Battery Junction Box (BJB) fuse 42 (15A) • Wiring, terminals or connectors • Speed control switch • Stoplamp switch • PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

PCM DTC Chart

DTC	Description	Action
P0579	Cruise Control Multi-Function Input A Circuit Range/Performance	GO to Pinpoint Test C .
P0581	Cruise Control Multi-Function Input A Circuit High	GO to Pinpoint Test C .
P1572	Brake Pedal Switch Circuit	GO to Pinpoint Test B .
P1703	Brake Switch Out of Self Test Range	GO to Pinpoint Test B .
All other DTCs	-	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Speed Control Is Inoperative

Refer to Wiring Diagrams Cell 31 , Speed Control for schematic and connector information.

Normal Operation

The PCM sends a signal through circuit VES10 (WH) to the speed control switch, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring. When the brake pedal is applied, the stoplamp switch sends a voltage signal to the PCM on circuit CCB08 (VT/WH) to deactivate the speed control if engaged.

The speed control deactivator switch, which is integral to the stoplamp switch, interrupts circuit CES09 (VT/OG) removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

The ABS module monitors brake pressure and also receives a voltage signal on circuit CCB08 (VT/WH) from the stoplamp switch . A fault in the ABS module can disable the speed control system.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM not configured for speed control
- Stoplamp switch
- Speed control deactivator switch (integral to the stoplamp switch)
- Speed control switch

- Digital Transmission Range (TR) sensor
- Vehicle speed signal
- PCM
- ABS module

PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 VERIFY PCM CONFIGURATION	
• Enter the following diagnostic mode on the scan tool: Programmable Parameters. • Verify that the speed control is enabled in the PCM. • **Is the speed control enabled?**	**Yes** GO to A2 . **No** ENABLE the speed control in the PCM using the scan tool programmable parameters menu. TEST the system for normal operation.
A2 CHECK FOR ABS DTCs	
• Review the recorded DTCs from the ABS self-test. • **Are any DTCs recorded?**	**Yes** REFER to the Section 206-09 . REPAIR all ABS module DTCs and RETEST the speed control. **No** GO to A3 .
A3 CHECK FOR PCM DTCs	
• Review the recorded DTCs from the PCM self-test. • **Are any non-speed control DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. REPAIR all PCM DTCs and RETEST the speed control. **No** GO to A4 .
A4 CHECK THE VEHICLE SPEED	
• Check for correct operation of the speedometer. • **Does the speedometer operate correctly?**	**Yes** GO to A5 . **No** REFER to Section 413-01 to continue diagnosis of the speedometer.
A5 CHECK THE STOPLAMP SWITCH (BOO AND BPA) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: PCM DataLogger. • Monitor the PCM PIDs BOO (brake pedal top travel) and BPA (brake pedal bottom travel) while applying and	**Yes** GO to A6 . **No** GO to Pinpoint Test B .

releasing the brake pedal as follows: **Brake Pedal Position** / **BOO PID** / **BPA PID** Released / Off / Off Applied lightly / On / Off Applied firmly / On / On • **Do the PID values agree with the brake pedal positions?**	
A6 MONITOR THE PCM (TR) PID	
• Apply the parking brake. • Enter the following diagnostic mode on the scan tool: PCM DataLogger. • Monitor the PCM PID (TR) . • Select DRIVE. • **Does the PID value agree with the transmission range selector lever position?**	**Yes** GO to A7 . **No** REFER to Section 307-01A or Section 307-01B to diagnose the digital TR sensor.
A7 CHECK THE SPEED CONTROL SWITCH	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger. • Press each speed control switch while monitoring the speed control switch PID (SCCS). **Speed Control Switch** / **SCCS PID Value** - / NONE Pressed RES / RESUME OFF / Off ON / On SET + / SET/+ SET - / SET/- • **Does the PID value agree with the switch position?**	**Yes** GO to A8 . **No** If only one switch does not display the correct PID value, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation. Otherwise, GO to Pinpoint Test C .
A8 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors.	**Yes** INSTALL a new PCM. REFER to Section 303-14 .

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P1572 or DTC P1703

Refer to Wiring Diagrams Cell 31 , Speed Control for schematic and connector information.

Normal Operation

When the brake pedal is applied, the stoplamp switch sends a voltage signal to the PCM on circuit CCB08 (VT/WH) to deactivate the speed control if engaged.

The speed control deactivator switch, which is integral to the stoplamp switch, interrupts circuit CES09 (VT/OG) by removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

- DTC P1572 (Brake Pedal Switch Circuit) - sets when the PCM does not sense the proper sequence of the brake pedal input signal from both the stoplamp and deactivator switches when the brake pedal is pressed and released.
- DTC P1703 (Brake Switch Out of Self-Test Range) - sets when there is an open or short in the deactivator switch circuits or when there is an open or short in the stoplamp circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Speed control deactivator switch (integral to the stoplamp switch)
- Stoplamp switch
- PCM

PINPOINT TEST B: DTC P1572 OR DTC P1703

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 CHECK THE OPERATION OF THE STOPLAMPS	
• Ignition ON. • Operate the stoplamps. • **Do the stoplamps and high mount stoplamp operate correctly?**	**Yes** GO to B2 . **No** REFER to Section 417-01 .
B2 CHECK THE STOPLAMP SWITCH (BOO1 AND BOO2) PID	

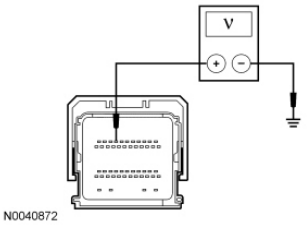
<table>
<tr><td>
• Enter the following diagnostic mode on the scan tool: PCM DataLogger.
• Monitor the PCM PIDs BOO (brake pedal top travel) and BPA (brake pedal bottom travel) while applying and releasing the brake pedal as follows:

<table>
<tr><th>Brake Pedal Position</th><th>BOO PID</th><th>BPA PID</th></tr>
<tr><td>Released</td><td>Off</td><td>Off</td></tr>
<tr><td>Applied lightly</td><td>On</td><td>Off</td></tr>
<tr><td>Applied firmly</td><td>On</td><td>On</td></tr>
</table>

• Do the PID values agree with the brake pedal positions?
</td><td>
Yes
GO to B7 .

No
For an incorrect BOO PID value, GO to B3 .

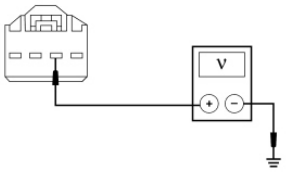
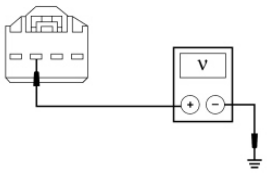
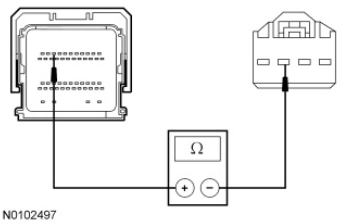
For an incorrect BPA PID value, GO to B4 .
</td></tr>
<tr><td colspan="2">B3 CHECK THE STOPLAMP SWITCH CIRCUIT FOR VOLTAGE</td></tr>
<tr><td>
• Ignition OFF.
• Disconnect: PCM C175b.
• Ignition ON.
• While applying the brake pedal, measure the voltage between the PCM C175b-8, circuit CCB08 (VT/WH), harness side and ground.



• Is the voltage greater than 10 volts with the brake pedal applied?
</td><td>
Yes
GO to B7 .

No
REPAIR the circuit for an open. CLEAR the DTCs. REPEAT the self-test.
</td></tr>
<tr><td colspan="2">B4 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH CIRCUIT FOR AN OPEN</td></tr>
<tr><td>
• Ignition OFF.
• Disconnect: Stoplamp Switch C278.
• Ignition ON.
• Measure the voltage between the stoplamp switch C278-2, circuit CBB42 (GN), harness side and ground.
</td><td>
Yes
GO to B5 .

No
REPAIR the circuit for an open. CLEAR the DTCs. TEST the system for normal operation.
</td></tr>
</table>

 N0038829 • **Is the voltage greater than 10 volts?**	
B5 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175b. • Ignition ON. • Measure the voltage between the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side and ground.  N0038830 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. **No** GO to B6 .
B6 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH SIGNAL CIRCUIT FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the PCM C175b-9, circuit CES09 (VT/OG), harness side and the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side.  N0102497 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new stoplamp switch. REFER to Section 417-01 . TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
B7 CHECK FOR CORRECT PCM OPERATION	
• Connect: All Disconnected Connectors. • Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may

• Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	have been caused by a loose or corroded connector.

Pinpoint Test C: The Speed Control Switches Do Not Operate Correctly

Refer to Wiring Diagrams Cell 31 , Speed Control for schematic and connector information.

Normal Operation

The PCM sends a signal through circuit VES10 (WH) to the speed control switch, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring.

- DTC P0579 (Cruise Control Multi-Function Input A Circuit Range/Performance) - sets when a speed control switch is stuck, or when the speed control switch circuits are shorted to voltage or ground.
- DTC P0581 (Cruise Control Multi-Function Circuit High) - sets when a speed control switch is stuck, or when the speed control switch circuits are shorted to voltage or ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Speed control switch
- PCM

PINPOINT TEST C: THE SPEED CONTROL SWITCHES DO NOT OPERATE CORRECTLY

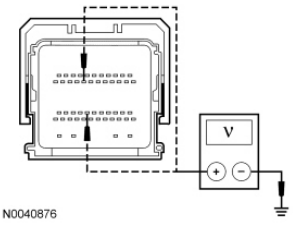
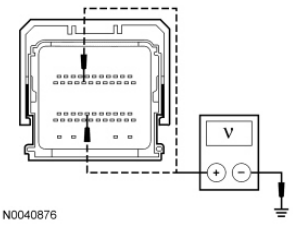
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

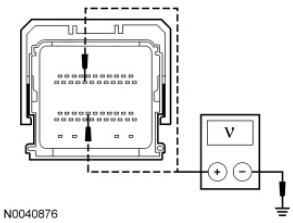
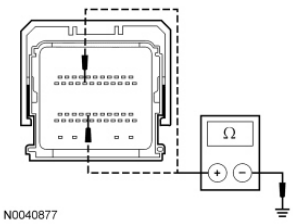
<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>C1 CHECK THE SPEED CONTROL SWITCH</td><td></td></tr>
<tr><td>• Enter the following diagnostic mode on the scan tool: PCM DataLogger.
• Press each speed control switch while monitoring the speed control switch PID (SCCS).

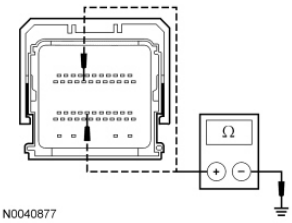
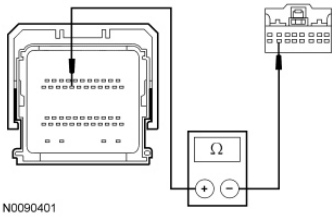
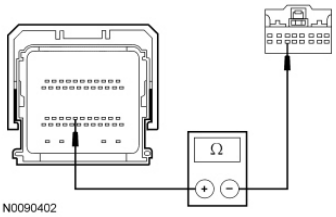
<table><tr><th>Speed Control Switch</th><th>SCCS PID Value</th></tr><tr><td>-</td><td>NONE Pressed</td></tr><tr><td>RES</td><td>RESUME</td></tr><tr><td>OFF</td><td>Off</td></tr><tr><td>ON</td><td>On</td></tr><tr><td>SET +</td><td>SET/+</td></tr><tr><td>SET -</td><td>SET/-</td></tr></table></td><td>Yes
GO to C10 .

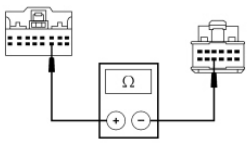
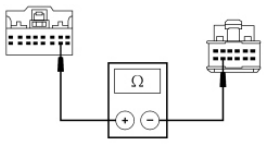
No
If only one switch does not display the correct PID value, INSTALL a new speed control switch. REFER to Speed Control Switch in this section. TEST the system for normal operation.

Otherwise, GO to C2 .</td></tr>
</table>

• **Does the PID value agree with the switch position?**	
C2 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175b. • Ignition ON. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-19, circuit VES10 (WH), harness side and ground; and between the PCM C175b-30, circuit RES08 (GN/BN), harness side and ground.  • **Is any voltage present?**	**Yes** TURN the parking lamps off. GO to C3 . **No** TURN the parking lamps off. GO to C5 .
C3 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO VOLTAGE WITH THE CLOCKSPRING DISCONNECTED	
• Ignition OFF. • Disconnect: Clockspring C218a. • Ignition ON. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-19, circuit VES10 (WH), harness side and ground; and between the PCM C175b-30, circuit RES08 (GN/BN), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** TURN the parking lamps off. GO to C4 .
C4 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE	

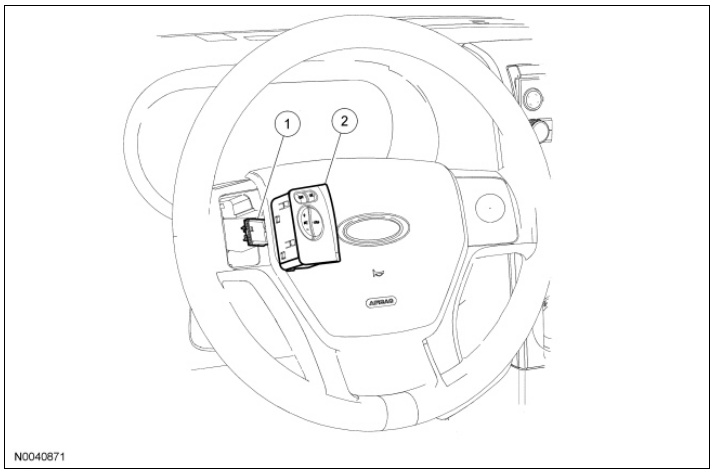
• Ignition OFF. • Connect: Clockspring C218a. • ⚠ **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.** • Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring C218b. • Connect the battery. • Ignition ON. • Turn the parking lamps on. • Measure the voltage between the PCM C175b-19, circuit VES10 (WH), harness side and ground; and between the PCM C175b-30, circuit RES08 (GN/BN), harness side and ground.  • **Is any voltage present?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . DISCONNECT the battery. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** GO to C10 .
C5 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO GROUND	
• Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring C218b. • Ignition OFF. • Measure the resistance between the PCM C175b-19, circuit VES10 (WH), harness side and ground; and between the PCM C175b-30, circuit RES08 (GN/BN), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C7 . **No** GO to C6 .
C6 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	

• Disconnect: Clockspring C218a. • Measure the resistance between the PCM C175b-19, circuit VES10 (WH), harness side and ground; and between the PCM C175b-30, circuit RES08 (GN/BN), harness side and ground.  N0040877 • **Are the resistances greater than 10,000 ohms?**	**Yes** INSTALL a new clockspring. REFER to Section 501-20B . INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C7 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR AN OPEN	
• Disconnect: Clockspring C218a. • Measure the resistance between the PCM C175b-19, circuit VES10 (WH), harness side and the clockspring C218a-15, circuit VES10 (WH), harness side.  N0090401 • Measure the resistance between the PCM C175b-30, circuit RES08 (GN/BN), harness side and the clockspring C218a-14, circuit RES08 (GN/BN), harness side.  N0090402 • **Are the resistances less than 5 ohms?**	**Yes** GO to C9 . **No** GO to C8 .
C8 CHECK THE CLOCKSPRING	
• Measure the resistance between the clockspring C218a pin 14, component side and the clockspring C218b pin 9, component side.	**Yes** GO to C9 . **No** INSTALL a new clockspring. INSTALL the driver air bag module. REFER to Section

 N0090098 • Measure the resistance between the clockspring C218a pin 15, component side and the clockspring C218b pin 8, component side.  N0090099 • **Are the resistances less than 5 ohms?**	501-20B . CLEAR the DTCs. REPEAT the self-test.
C9 CHECK THE STEERING WHEEL SWITCH HARNESS	
• Check the steering wheel switch harness for an open, short to ground or short to voltage. • **Are any of these conditions present?**	**Yes** REPAIR the steering wheel switch harness. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new speed control switch. REFER to Speed Control Switch in this section. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
C10 CHECK FOR CORRECT PCM OPERATION	
• Connect: All Disconnected Connectors. • Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

Speed Control Switch

NOTE: Explorer shown, Mountaineer similar.



Item	Part Number	Description
1	-	Speed control switch electrical connector (part of 3600)
2	9E740	Speed control switch

Removal and Installation

NOTE: It is not necessary to remove the driver air bag module during this procedure.

NOTE: Be careful not to allow the speed control switch electrical connector to fall back into the steering wheel.

1. Remove the speed control switch by pulling the switch toward the rear of the vehicle.
   - Disconnect the electrical connector.

2. To install, reverse the removal procedure.

Acronyms

4WD - Four-Wheel Drive

ABS - Acrylonitrile Butadiene Styrene

ABS - Anti-Lock Brake System

ACL - Air Cleaner

ACM - Audio Control Module

ACM - Audio Front Control Module

ALR - Automatic Locking Retractor

APIM - Accessory Protocol Interface Module

APP - Accelerator Pedal Position

ATC - Automatic Traction Control

AWD - All-Wheel Drive

BH - Bake Hardened Steel

BJB - Battery Junction Box

BPP - Brake Pedal Position

BSIA - Brake Shift Interlock Actuator

BTDC - Before Top Dead Center

CAN - Controller Area Network

CAN2 - Controller Area Network 2

CASS - Compressor Anti-Slugging Strategy

CCA - Cold Cranking Amps

CHT - Cylinder Head Temperature

CIP - Consumer Interface Processor

CKP - Crankshaft Position

CMCV - Charge Motion Control Valve

CMDTC - Continuous Memory Diagnostic Trouble Code

CMDTCs - Continuous Memory Diagnostic Trouble Codes

CMP - Camshaft Position

CMS - Catalyst Monitor Sensor

CPP - Clutch Pedal Position

D/A - Dual Action

DATC - Dual Automatic Temperature Control

DERU - Drive Engine Run-Up

DLC - Data Link Connector

DMM - Digital Multimeter

DRL - Daytime Running Lamps

DRM - Digital Rights Management

DSM - Driver Seat Module

DSO - District Special Order

DSP - Digital Signal Processing

EATC - Electronic Automatic Temperature Control

EBD - Electronic Brake Distribution

ECM - Engine Control Module

ECT - Engine Coolant Temperature

ECU - Electronic Control Unit

EEPROM - Electrically Erasable Programmable Read-Only Memory

EI - Electronic Ignition

ELR - Emergency Locking Retractor

EMTC - Electronic Manual Temperature Control

EONV - Engine Off Natural Vacuum

EOP - Engine Oil Pressure

EOT - Engine Oil Temperature

EPC - Electronic Pressure Control

ESC - Electronic Stability Control

ESN - Electronic Serial Number

ETB - Electronic Throttle Body

ETC - Electronic Throttle Control

EVA - Electronic Vibration Analyzer

EVAP - Evaporative Emission

FEAD - Front End Accessory Drive

FESM - Front End Sheet Metal

FET - Field-Effect Transistor

FICM - Fuel Injection Control Module

FP - Fuel Pump

FPDM - Fuel Pump Driver Module

FTP - Fuel Tank Pressure

FWD - Front Wheel Drive

GEM - Generic Electronic Module

GPS - Global Positioning System

GVWR - Gross Vehicle Weight Rating

HCU - Hydraulic Control Unit

HO2S - Heated Oxygen Sensor

HS - High Speed

HS-CAN - High Speed Controller Area Network

HSLA - High-Strength Low Alloy

HSS - High-Strength Steel

IAT - Intake Air Temperature

IC - Instrument Cluster

IDS - Integrated Diagnostic System

IFS - Inertia Fuel Shutoff

IKT - Integrated Keyhead Transmitter

IPC - Instrument Panel Cluster

IPM-A - Image Processing Module - A

KAM - Keep Alive Memory

KOEO - Key ON Engine OFF

KOER - Key ON Engine Running

KS - Knock Sensor

LCD - Liquid Crystal Display

LFC - Lamp Fault Code

LFCs - Lamp Fault Codes

LPC - Line Pressure Control

MACS - Mobile Air Conditioning Society

MAF - Mass Air Flow

MAP - Manifold Absolute Pressure

MEK - Methyl Ethyl Ketone

MIG - Metal Inert Gas

MIL - Malfunction Indicator Lamp

MPV - Multi-Purpose Vehicle

MS - Medium Speed

MS-CAN - Medium Speed Controller Area Network

MSS - Mode Select Switch

NERU - Neutral Engine Run-Up

NOX - Nitrogen Oxides

NVM - Non-Volatile Memory

O/D - Overdrive

OASIS - On-Line Automotive Service Information System

OBD - On-Board Diagnostic

OCS - Occupant Classification Sensor

OCS - Occupant Classification System

OCSM - Occupant Classification System Module

ORVR - On-Board Refueling Vapor Recovery

OSS - Output Shaft Speed

OTIS - One-Touch Integrated Start

OWC - One-Way Clutch

PAD - Passenger Air Bag Deactivation

PAM - Parking Aid Module

PATS - Passive Anti-Theft System

PC/ED - Powertrain Control/Emissions Diagnosis

PCA - Pressure Control Solenoid A

PCB - Pressure Control Solenoid B

PCC - Pressure Control Solenoid C

PDB - Power Distribution Box

PIN - Personal Identification Number

PMI - Programmable Module Installation

PRB - Power Running Board

PRBs - Power Running Boards

PSP - Power Steering Pressure

PTU - Power Transfer Unit

PVC - Polyvinyl Chloride

PWM - Pulse-Width Modulation

PZEV - Partial Zero Emissions Vehicle

RCM - Restraints Control Module

READ - Rear End Accessory Drive

RETM - Rear Entertainment Module

RFI - Radio Frequency Interference

RKE - Remote Keyless Entry

ROM - Read-Only Memory

ROW - Rest Of World

RP - Reverse Pressure

RSC® - Roll Stability Control

RWD - Rear Wheel Drive

SDARS - Satellite Digital Audio Receiver System

SFI - Sequential Multi-Port Fuel Injection

SJB - Smart Junction Box

SMC - Sheet-Molded Composite

SRS - Supplemental Restraint System

SSA - Shift Solenoid A

SSB - Shift Solenoid B

SSC - Shift Solenoid C

SSD - Shift Solenoid D

SSE - Shift Solenoid E

SSPCA - Shift Solenoid Pressure Control A

SSPCB - Shift Solenoid Pressure Control B

SSPCC - Shift Solenoid Pressure Control C

SSPCD - Shift Solenoid Pressure Control D

SSPCE - Shift Solenoid Pressure Control E

STRW - Squeeze-Type Resistance Spot Welding

TB - Throttle Body

TBC - Trailer Brake Control

TCC - Torque Converter Clutch

TCIL - Transmission Control Indicator Lamp

TCM - Transmission Control Module

TCS - Transmission Control Switch

TDC - Top Dead Center

TFT - Transmission Fluid Temperature

TP - Throttle Position

TPM - Tire Pressure Monitor

TPMS - Tire Pressure Monitoring System

TPO - Thermoplastic Olefin

TR - Transmission Range

TSB - Technical Service Bulletin

TSS - Turbine Shaft Speed

TTS - Text-To-Speech

TXV - Thermostatic Expansion Valve

USB - Universal Serial Bus

VC - Vehicle Certification

VCM - Vehicle Communication Module

VCT - Variable Camshaft Timing

VFS - Variable Force Solenoid

VID - Vehicle Identification

VIN - Vehicle Identification Number

VIP - Vehicle Interface Processor

VSM - Vehicle Security Module

VSS - Vehicle Speed Sensor

WMI - World Manufacturer Identifier

WOT - Wide Open Throttle

Alphabetical Index

4 | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W

4

4X4 Control Module (REMOVAL AND INSTALLATION, Four Wheel Drive (4WD) Systems)

A

A-Pillar Trim Panel (REMOVAL AND INSTALLATION, Interior Trim and Ornamentation)

Acceleration Control (DESCRIPTION AND OPERATION)

Acceleration Control (DIAGNOSIS AND TESTING)

Acceleration Control (Section Table of Contents)

Acceleration Control (SPECIFICATIONS)

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Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	1.2L (1.3 qt)

General Specifications

Item	Specification
Power Steering Gear	
Tie-rod articulation torque	1-3 Nm
Turning effort	4.5 kg (10 lb)
Turns lock-to-lock	3.70
Power Steering Pump	
Flow rate @ 74°-80°C (165°-175°F), engine speed set at 1,500 rpm and power steering analyzer set at 345 kPa (50 psi)	11.4-13.2L/min (2.5-2.9 gpm)
Flow rate-minimum @ 74°-80°C (165°-175°F), power steering analyzer set at 5,102 kPa (750 psi) and engine speed set at idle	4.35L/min (1.15 gpm)
Maximum pressure @ 74°-80°C (165°-175°F) and engine speed set at 2,100 rpm	1,172 kPa (170 psi)
Relief pressure	1,400-1,530 @ 500 rpm
Power Steering Purge Vacuum	
Air purge vacuum	68-85 kPa (20-25 in-Hg)

Steering System

The power steering system consists of the following components:

- Power steering pump
- Power steering fluid reservoir
- Steering gear
- Power steering lines
- Steering column
- Steering column shaft
- Power steering cooler (if equipped)

The power steering system transfers driver inputs at the steering wheel to the front wheels of the vehicle. The steering column, hydraulic system and linkages that transfer these driver inputs make up the steering system. Gearing and hydraulic assist are used to significantly reduce steering efforts.

For information on the power steering fluid reservoir, power steering pump, power steering lines and steering gear, refer to Section 211-02 .

For information on the steering wheel, steering column and steering column shaft, refer to Section 211-04 .

Steering System

Special Tool(s)

 ST1300-A	100W/12 Volt DC UV Lamp 164-R0751
 ST1396-A	Dial Thermometer 0-220°F 023-R0007 or equivalent
 ST2670-A	Evacuation Cap, Power Steering 211-265 or equivalent
 ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Principles of Operation

Power Steering

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is trapped between the pump vanes and moved to the high-pressure side of the pump, creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid

before returning it to the pump.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Fluid level • Tire pressure • Tires • Drive belt • Drive belt tensioner (if equipped) • Steering column alignment • Tie-rod ends • Suspension components • Steering column shaft U-joints • Steering column shaft bolts • Power steering reservoir screen or filter • Pressure lines, fittings or O-rings • Power steering return hoses and clamps • Steering gear • Power steering pump • Power steering fluid cooler (if equipped) • Power Steering Pressure (PSP) switch

3. Inspect the power steering fluid for the following conditions:
    - Aeration or foam: Purge the power steering system. Refer to Power Steering System Purging in this section.
    - Overheating or contamination: Flush the power steering system. Refer to Power Steering System Flushing in this section.

4. **NOTE:** It may be necessary to add power steering fluid to achieve the correct level.

   Check the fluid level and clean the power steering components.
   With the ignition OFF:

    - check the power steering fluid level and add fluid as necessary.
    - wipe off any visible signs of fluid or residue build up.
    - ***NOTICE:*** **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

Start the engine and turn the steering wheel from stop-to-stop several times.

5. Visually inspect the power steering hydraulic line/hose connections for damage or leaks.

- If a leak is detected at a threaded fitting or clamp plate joint, tighten to specification. If the leak is still evident, visually inspect the O-rings or Teflon® seals. Install new O-rings or Teflon® seals as necessary. Refer to Section 211-02 .
- If a leak is detected at a constant tension spring clamp, verify that the hose is not damaged and fully installed on the hose fitting. Make sure that the constant tension spring clamp is positioned 2 mm (0.078 in) from the end of the hose. If the leak remains, install a new constant tension spring clamp.
- If a leak is detected at a screw clamp joint, verify that the hose is not damaged and fully installed on the hose fitting and the clamp is positioned 2 mm (0.078 in) from the end of the hose before tightening the screw clamp. If the leak remains, install a new screw clamp. Refer to Section 211-02 .
- If a leak is detected at the Power Steering Pressure (PSP) switch, install a new switch as necessary.

6. Visually inspect the power steering components for leaks.

- If a leak is detected in the pressure or return line, install a new line. Refer to Section 211-02 .
- If a leak is detected in the power steering pump, install a new power steering pump. Refer to Section 211-02 .
- **NOTE:** On vehicles with rack-and-pinion steering gear, it may be necessary to remove the bellows boot clamp from the steering gear bellows boot to inspect for internal steering gear leaks.

  If a leak is detected in the steering gear, repair or install a new steering gear. Refer to Section 211-02 .
- If a leak is detected in the power steering reservoir, install a new reservoir. Refer to Section 211-02 .

7. For information on power steering leak detection, refer to Component Tests in this section.

8. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.

9. If the cause is not visually evident, verify the symptom and GO to Symptom Chart - Steering System or GO to Symptom Chart - NVH .

Steering System Symptom Definitions

Drift/Pull

Pull is described as a tugging sensation felt by the hands on the steering wheel that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with the hands off the steering wheel.

- A vehicle-related drift/pull on a flat road can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle, such as wind or road camber.

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Lack of Assist or Inconsistent Assist

Lack of assist or inconsistent assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving or during high-effort parking maneuvers.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or steering correction is completed.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Symptom Chart - Steering System

Symptom Chart - Steering System

Symptom Chart - NVH

Symptom Chart - NVH
NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Steering system cold start noise
- Blockage in the power steering fluid reservoir caused by power steering fluid contamination
- **NOTE:** Some noise during an extremely cold start (-12.2°C [-10°F]) is normal and should improve as the steering system warms up (usually within 60 seconds).
- **NOTE:** It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir screen.

  CHECK the power steering fluid reservoir for contamination. FLUSH the power steering system as necessary. REFER to Power Steering System Flushing in this section.
- Air in the steering hydraulic system (aerated fluid)
- CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test in this section. PURGE the air from the system. REFER to Power Steering System Purging in this section.

- Steering grunt or shudder - occurs when turning into or out of a turn at low speeds (temperature sensitive)

- Air in the steering hydraulic system (aerated fluid)

- CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system. REFER to Power Steering System Purging in this section.

- Steering gear or power steering hoses

- GO to Steering Gear Grunt/Shudder Component Test in this section.

- Steering system clonk - hydraulic knocking sound

- Air in the steering hydraulic system (aerated fluid)

- **NOTE:** Some amount of clonk noise is considered acceptable. If in doubt of the acceptability, compare to another vehicle.

  CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test in this section. PURGE the air from the system. REFER to Power Steering System Purging in this section.

- Power steering pump moan - loud humming noise occurs when the steering wheel is rotated to the stop position. Produces a 120-600 Hz frequency that changes with rpm

- Low fluid and/or air in the steering hydraulic system (aerated fluid)

- CHECK for leaks in the system. REFER to Power Steering Fluid Leak Test Component Test. PURGE the air from the system. REFER to Power Steering System Purging in this section. If a pump moan still exists, INSTALL a new power steering pump. REFER to Section 211-02 .

- Power steering fluid reservoir or screen is blocked or damaged

- **NOTE:** It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir screen.

  CHECK the power steering fluid reservoir for contamination. FLUSH the power steering system as necessary. REFER to Power Steering System Flushing in this section.

- Power steering line/hose grounded to chassis

- INSPECT the power steering lines/hoses. REPAIR as necessary.

- Power steering pump bolts loose

- TIGHTEN bolts to specification. REPAIR or INSTALL new brackets as necessary. REFER to Section 211-02 .

- Steering gear isolators

- INSPECT the isolators for wear or damage. REPAIR as necessary.

- Steering gear clunk - occurs only while cornering over a bump (can be temperature sensitive)

- Steering gear
- INSPECT the steering gear for loose mounting bolts. TIGHTEN to specification as necessary. REFER to Section 211-02 .
- Feedback (rattle, chuckle or knocking noise in the steering gear) - roughness is felt in the steering wheel when the vehicle is driven over rough surfaces
- Steering column shaft/U-joints damaged or worn
- INSTALL a new steering column shaft. REFER to Section 211-04 .
- Loose, damaged or worn tie-rod ends
- INSPECT and INSTALL new tie-rod ends as necessary. GO to Steering Linkage Component Test in this section.
- Steering gear insulators or mounting bolts loose or damaged
- TIGHTEN the bolts to specification or INSTALL new bolts as necessary. REFER to Section 211-02 .
- Steering column shaft bolts are loose
- TIGHTEN the bolts to specification. REFER to Section 211-04 .
- Steering column damaged or worn
- REPAIR or INSTALL a new steering column as necessary. REFER to Section 211-04 .
- Power steering hiss or whistle
- Steering column shaft-to-steering gear is binding or misaligned
- REPAIR or INSTALL a new steering column shaft as necessary. REFER to Section 211-04 .
- Grounded or loose steering column boot at the dash panel
- REPAIR as necessary.
- Damaged or worn steering gear input shaft and valve
- REPAIR or INSTALL a new steering gear as necessary. REFER to Section 211-02 .
- Restricted power steering lines/hoses
- INSTALL new power steering lines/hoses as necessary. REFER to Section 211-02 .
- Steering column rattle
- Loose bolts or attaching brackets
- TIGHTEN the bolts to specification.
- Loose, worn or insufficiently lubricated column bearings

- LUBRICATE bearings or INSTALL new steering column bearings or steering column as necessary. REFER to Section 211-04 .

- Steering shaft insulators damaged or worn

- INSTALL new insulators. REFER to Section 211-04 .

- Steering column shaft compressed or extended

- INSPECT the rubber spider coupling for damage. INSTALL a new steering column shaft. REFER to Section 211-04 .

- Steering gear squeak

- Incorrect power steering fluid in system

- If incorrect power steering fluid is suspected, FLUSH the power steering system. REFER to Power Steering System Flushing in this section. If noise persists after system flush, INSTALL a new steering gear. REFER to Section 211-02 .

- Steering gear rotary seal

- **NOTE:** VERIFY that the steering gear is the source of the noise. It may be necessary to replicate the customer operating conditions (fluid temperature, turning rate of steering wheel) to get the squeak to reoccur.

  INSTALL a new steering gear as necessary. REFER to Section 211-02 .

- Stone shield (if equipped)

- MAKE SURE that the stone shield is correctly installed and that it is not making contact with the steering shaft. REPOSITION stone shield or INSTALL a new stone shield as necessary.

- Steering column squeak, clicks or grinds

- Loose or misaligned steering column shrouds

- TIGHTEN or ALIGN the steering column shrouds.

- Steering wheel rubbing against steering column shrouds

- REPOSITION the steering column shrouds.

- Upper or lower steering column bearing

- INSTALL a new steering column or steering column bearings as necessary.

- Power steering pump noisy

- Power steering pump

- INSTALL a new power steering pump as necessary. REFER to Section 211-02 .

- Power steering pump noise (steering wheel turned fully to stop/lock)

- Power steering fluid flow into the bypass valve of the pump valve housing, with fluid temperature below 54°C (130°F)
- Acceptable condition.
- Power steering pump whine noise
- Aerated fluid
- CHECK for a leak in the system. REFER to Power Steering Fluid Leak Test Component Test in this section. PURGE the air from the system. REFER to Power Steering System Purging in this section.
- Damaged power steering pump
- INSTALL a new power steering pump as necessary. REFER to Section 211-02 .
- High speed shake or shimmy - occurs at high speeds
- Worn or damaged steering linkage components
- GO to Steering Linkage Component Test in this section.

Pinpoint Tests

Pinpoint Test A: Steering Has Lack of Assist or Inconsistent Assist

NOTE: Hard steering or lack of assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn, occur near the end of a turn or differ right to left.

This pinpoint test is intended to diagnose the following:
- Power steering fluid contamination
- Steering gear
- Power steering pump
- Power steering hoses

PINPOINT TEST A: STEERING HAS LACK OF ASSIST OR INCONSISTENT ASSIST

Test Step	Result / Action to Take
A1 CHECK FOR POWER STEERING FLUID CONTAMINATION	
• Check the power steering fluid for contamination. • **Is the power steering fluid contaminated?**	**Yes** FLUSH the power steering system. REFER to Power Steering System Flushing in this section. CHECK the system for normal operation. If assist concern still exists, GO to A2 . **No** GO to A2 .

A2 CHECK THE STEERING ASSIST WITH THE ENGINE RPM RAISED	
• *NOTICE:* **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.** • Set the engine at 2,100 rpm and turn the steering wheel fully to the left and right. • **Is steering assist fully restored to normal with the engine rpm raised?**	**Yes** INSTALL a new power steering pump. REFER to Section 211-02 . **No** GO to A3 .
A3 CHECK FOR A CHANGE OF ASSIST ON LEFT AND RIGHT TURNS	
• With the engine at idle, turn the steering wheel fully to the left and to the right. • **Does the steering assist change when turning from right to left?**	**Yes** INSTALL a new steering gear. REFER to Section 211-02 . **No** GO to A4 .
A4 CHECK THE STEERING LINES AND HOSES FOR RESTRICTIONS	
• Inspect the steering lines and hoses for damage, kinks or restrictions. • **Are the steering lines or hoses damaged, kinked or restricted?**	**Yes** INSTALL new lines or hoses as necessary. **No** GO to A5 .
A5 MONITOR THE ENGINE RPM CHANGES	
NOTICE: **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.** **NOTE:** Make sure that the vehicle is on a flat dry surface, all accessories are in the OFF position and that the steering system is at normal operating temperature. • Connect the scan tool. • Start the engine. • With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times. • Enter the following diagnostic mode on the scan tool: DataLogger - PCM. • Monitor the Engine Revolutions Per Minute (RPM) PID while turning the steering wheel quickly to the left stop position and then to the right stop position. • Note the engine rpm during the turns. • **Does the engine rpm change (even temporarily) more than 30 rpm when turning the steering wheel?**	**Yes** INSTALL a new steering gear. REFER to Section 211-02 . **No** INSTALL a new power steering pump. REFER to Section 211-02 .

Pinpoint Test B: Excessive Steering Wheel Play

This pinpoint test is intended to diagnose the following:

- Steering linkage
- Steering column shaft U-joints
- Steering gear

PINPOINT TEST B: EXCESSIVE STEERING WHEEL PLAY

Test Step	Result / Action to Take
B1 CHECK THE STEERING LINKAGE	
• Carry out the Steering Linkage Component Test in this section. • **Is the steering linkage OK?**	**Yes** GO to B2 . **No** INSTALL new steering linkage components as necessary. Refer to the appropriate section in Group 211 for the procedure.
B2 CHECK THE STEERING COLUMN SHAFT	
• Inspect the steering column shaft U-joints and fasteners for looseness. • **Are the U-joints and fasteners OK?**	**Yes** INSTALL a new steering gear as necessary. REFER to Section 211-02 . **No** TIGHTEN the steering column shaft fasteners or INSTALL a new steering column shaft. REFER to Section 211-04 .

Pinpoint Test C: Steering System Drift/Pull/Wander

This pinpoint test is intended to diagnose the following:

- Steering gear
- Steering column shaft
- Steering column shaft U-joints
- Steering gear mounts

PINPOINT TEST C: STEERING SYSTEM DRIFT/PULL/WANDER

Test Step	Result / Action to Take
C1 CHECK THE STEERING COLUMN SHAFT	
NOTE: Be sure to keep the clockspring centered when disconnecting the intermediate shaft. Refer to the appropriate section in Group 501 for the procedure. • Check the steering column and shaft for grounding. • Disconnect the steering column shaft at the steering column.	**Yes** GO to C2 . **No** INSTALL a new steering column shaft as necessary. REFER to Section 211-04 .

• Inspect the steering column shaft U-joints for looseness or wear. • **Are the steering column shaft U-joints OK?**	
C2 CHECK THE STEERING GEAR MOUNTING	
• Check the steering gear mounts for looseness or wear. • **Are the steering gear mounts OK?**	**Yes** GO to C3 . **No** INSTALL a new steering gear as necessary. REFER to Section 211-02 .
C3 CHECK THE STEERING GEAR	
• Carry out the Steering Gear Valve Component Test in this section. • **Is the steering gear valve OK?**	**Yes** REFER to Section 204-00 to diagnose suspension system drift/pull/wander. **No** REPAIR or INSTALL a new steering gear as necessary. REFER to Section 211-02 .

Component Tests

Power Steering Fluid Leak Test

NOTE: This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to Inspection and Verification in this section.

1. Remove the power steering pump reservoir cap and check the power steering fluid level. If necessary, add the specified power steering fluid.

2. Tightly install the Power Steering Evacuation Cap onto the reservoir and connect the Vacuum Pump Kit to the Evacuation Cap.

3. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

4. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), a leak is present.

5. Remove the Vacuum Pump Kit.

6. Start the engine and insert the Dial Thermometer into the Evacuation Cap.

7. ***NOTICE:*** **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

   With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.

8. Stop the engine and visually inspect the system for leaks.
   - If a leak is evident, repair as necessary.
   - If a leak is not evident, add the specified UV fluorescent tracer dye to the power steering fluid. Use 14.78 ml (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid.

9. Start the engine.

10. ***NOTICE:*** **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

    With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.

11. Stop the engine and inspect the system for traces of UV dye using the 100W/12 Volt DC UV Lamp. Repair as necessary.

Steering Gear Valve Test

1. With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 .
   - Raise the vehicle until the front wheels are off the ground.

2. **NOTE:** Do not hold the steering wheel while carrying out this step.

   Start the engine.

   - If the steering wheel rotates in either direction (with no hand input), install a new steering gear. Refer to Section 211-02 .

Steering Gear Grunt/Shudder Test

1. Place a Dial Thermometer in the power steering fluid reservoir.

2. With the engine cold, start the engine and set engine idle speed to 1,200 rpm.

3. ***NOTICE:*** **Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

   Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Slowly turn the steering wheel back and forth approximately one-twelfth of a full turn.

4. Turn the steering wheel another 90 degrees. Slowly turn the steering wheel back and forth approximately one-twelfth of a full turn.

5. Repeat the test with the power steering fluid at different temperatures until the temperature reaches 74-80°C (165-176°F).

6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.

7. If a loud grunt is heard or a strong shudder is felt, purge the power steering system. Refer to Power Steering System Purging in this section. If a loud grunt or strong shudder still exists, check the power steering lines/hoses for restrictions or damage and repair as necessary. Refer to Section 211-02 . If the lines/hoses are OK, install a new steering gear. Refer to Section 211-02 .

Steering Linkage Test

1. With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02 .

2. Using hand force only, check the inner and outer tie rods for vertical and lateral movement in the tie-rod ball studs/sockets.
    - If there is any lateral or vertical movement in the tie-rod ball studs/sockets (inner or outer), a new tie rod must be installed. Refer to the appropriate section in Group 211 for the procedure.

Power Steering System Flushing

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTICE: **Do not mix fluid types. Any mixture or any unapproved fluid may lead to seal deterioration and leaks. A leak may ultimately cause loss of fluid, which may result in a loss of power steering assist.**

1. Remove the power steering fluid reservoir cap.
2. Using a suitable suction device, remove the power steering fluid from the reservoir.
3. Release the clamp and disconnect the return hose from the reservoir.
   - Remove the clamp from the hose and allow the remaining fluid to drain out of the reservoir.
4. Plug the power steering fluid reservoir inlet port.
5. Attach an extension hose to the return hose.
6. **NOTE:** Do not reuse the power steering fluid that has been flushed from the power steering system.

   Place the open end of the extension hose into a suitable container.
7. If equipped with Hydro-Boost®, apply the brake pedal 4 times.
8. **NOTE:** Do not overfill the reservoir.

   Fill the reservoir as needed with the specified fluid.
9. ***NOTICE:*** **Do not allow the power steering pump to run completely dry of power steering fluid. Damage to the power steering pump may occur.**

   Start the engine while simultaneously turning the steering wheel to lock and then immediately turn the ignition switch to the OFF position.
10. **NOTE:** Avoid turning the steering wheel without the engine running as this may cause air to be pulled into the steering gear.

    NOTE: Do not overfill the reservoir.

    Fill the reservoir as needed with the specified fluid.
11. Repeat Steps 8 and 9, turning the steering wheel in the opposite direction each time, until the fluid exiting the power steering fluid return hose is clean and clear of foreign material.

12. Remove the extension hose from the return hose.

13. Remove the plug from the fluid reservoir inlet port.

14. Install the clamp and connect the power steering return hose to the reservoir.

15. **NOTE:** It is necessary to correctly fill the power steering system to remove any trapped air and completely fill the power steering system components.

    If, after correctly filling the power steering system, there is power steering noise accompanied by evidence of aerated fluid and there are no fluid leaks, it may be necessary to purge the power steering system. For additional information, refer to Power Steering System Purging in this section.

    Fill the power steering system. For additional information, refer to Power Steering System Filling in this section.

Power Steering System Purging

Special Tool(s)

 ST2670-A	Evacuation Cap, Power Steering 211-265
 ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

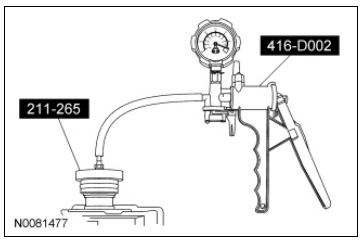
NOTICE: **If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition may occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.**

1. **NOTE:** A whine heard from the power steering pump can be caused by air in the system. The power steering purge procedure must be carried out prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid.

   Remove the power steering reservoir cap. Check the fluid.

2. Raise the front wheels off the floor. Refer to the appropriate section in Group 100 for the procedure.

3. Tightly insert the Power Steering Evacuation Cap into the reservoir and connect the Vacuum Pump Kit.



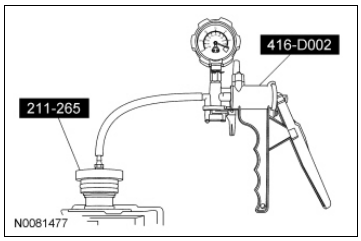
4. Start the engine.

5. Using the Vacuum Pump Kit, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
   - If the Vacuum Pump Kit does not maintain vacuum, check the power steering system for leaks before proceeding. For additional information, refer to Power Steering Fluid Leak Test in this section.

6. If equipped with Hydro-Boost®, apply the brake pedal 4 times.
7. ***NOTICE:*** **Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

   Cycle the steering wheel fully from stop-to-stop 10 times.
8. Stop the engine.
9. Release the vacuum and remove the Vacuum Pump Kit and the Power Steering Evacuation Cap.
10. **NOTE:** Do not overfill the reservoir.

    Fill the reservoir as needed with the specified fluid.
11. Start the engine.
12. Install the Power Steering Evacuation Cap and the Vacuum Pump Kit. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).



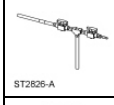
13. ***NOTICE:*** **Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

    Cycle the steering wheel fully from stop-to-stop 10 times.
14. Stop the engine, release the vacuum and remove the Vacuum Pump Kit and the Power Steering Evacuation Cap.
15. **NOTE:** Do not overfill the reservoir.

    Fill the reservoir as needed with the specified fluid and install the reservoir cap.
16. Visually inspect the power steering system for leaks.

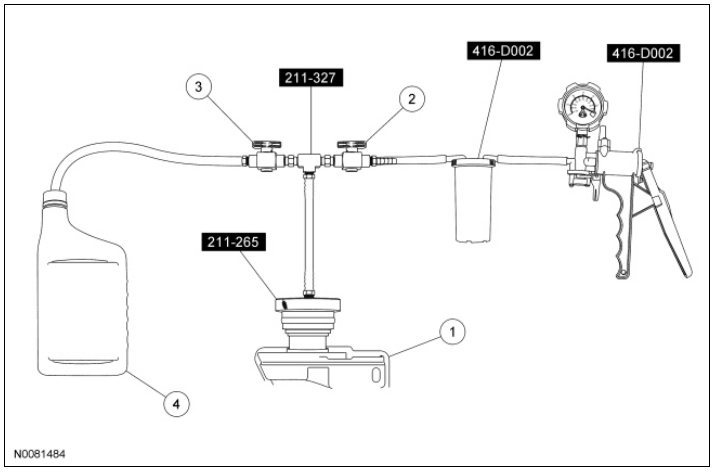
Power Steering System Filling

Special Tool(s)

 ST2670-A	Evacuation Cap, Power Steering 211-265
 ST2826-A	Fill Adapter Manifold, Power Steering 211-327
 ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Description
1	Power steering fluid reservoir
2	Control valve (vacuum side)
3	Control valve (fluid container side)
4	Fluid container

1. ***NOTICE:*** **If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.**

Remove the power steering fluid reservoir cap.

2. Install the Power Steering Evacuation Cap, Power Steering Fill Adapter Manifold and Vacuum Pump Kit as shown in the illustration.

3. **NOTE:** The Power Steering Fill Adapter Manifold control valves are in the OPEN position when the points of the handles face the center of the Power Steering Fill Adapter Manifold.

   Close the Power Steering Fill Adapter Manifold control valve (fluid side).

4. Open the Power Steering Fill Adapter Manifold control valve (vacuum side).

5. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

6. Observe the Vacuum Pump Kit gauge for 30 seconds.

7. If the Vacuum Pump Kit gauge reading drops more than 3 kPa (0.88 in-Hg), correct any leaks in the power steering system or the Power Steering Evacuation Cap, Power Steering Fill Adapter Manifold and Vacuum Pump Kit before proceeding.

8. **NOTE:** The Vacuum Pump Kit gauge reading will drop slightly during this step.

   Slowly open the Power Steering Fill Adapter Manifold control valve (fluid side) until power steering fluid completely fills the hose and then close the control valve.

9. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.

10. Close the Power Steering Fill Adapter Manifold control valve (vacuum side).

11. Slowly open the Power Steering Fill Adapter Manifold control valve (fluid side).

12. Once power steering fluid enters the fluid reservoir and reaches the minimum fluid level indicator line on the reservoir, close the Power Steering Fill Adapter Manifold control valve (fluid side).

13. Remove the Power Steering Evacuation Cap, Power Steering Fill Adapter Manifold and Vacuum Pump Kit.

14. Install the reservoir cap.

15. ***NOTICE:*** **Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

    NOTE: There will be a slight drop in the power steering fluid level in the reservoir when the engine is started.

    Start the engine and turn the steering wheel from stop-to-stop.

16. Turn the ignition switch to the OFF position.

17. **NOTE:** Do not overfill the reservoir.

    Remove the reservoir cap and fill the reservoir with the specified fluid.

18. Install the reservoir cap.

Material

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	1.2L (2.5 pt) [a]
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-

[a] Capacities listed are average system capacities and may vary.

Torque Specifications

Description	Nm	lb-ft	lb-in
Engine wiring bracket nuts	20	-	177
Fan clutch wiring harness bracket-to-engine bolt	7	-	62
Fluid cooler hose bracket bolt	18	-	159
Inner tie rod	100	74	-
Lower arm forward nut	400	296	-
Lower arm rearward nut	200	148	-
Lower steering column shaft-to-steering gear bolt	48	35	-
Oil drip shield bolts	15	-	133
Power steering fluid reservoir bolt	9	-	80
Power steering pump bolts (4.0L)	25	18	-
Power steering pump bolts (4.6L)	20	-	177
Power steering pump pulley bolts (4.0L)	25	18	-
Power steering pump supply hose bracket bolt	11	-	97
Pressure line bracket-to-crossmember bolt	12	-	106
Pressure line bracket-to-engine bolt (4.0L)	11	-	97
Pressure line bracket-to-engine nut (4.6L)	11	-	97
Pressure line-to-pump fitting	75	55	-
Shock absorber lower bolt	350	258	-
Stabilizer bar link nut	35	26	-
Steering gear-to-crossmember bolts	350	258	-
Steering line clamp plate nut	25	18	-
Tie-rod jam nut	80	59	-
Tie-rod end nuts	103	76	-

SECTION 211-02: Power Steering

2009 Explorer/Mountaineer/Explorer Sport Trac Workshop Manual

DESCRIPTION AND OPERATION

Procedure revision date: 08/13/2008

Power Steering

The power steering system consists of the following components:

- Power steering pump
- Power steering fluid reservoir
- Power steering pressure and return lines/hoses
- Power steering fluid cooler
- Power steering gear
- Inner tie rod
- Steering gear turn tubes

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is then trapped between the pump vanes and moved to the high-pressure side of the pump creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

Power Steering

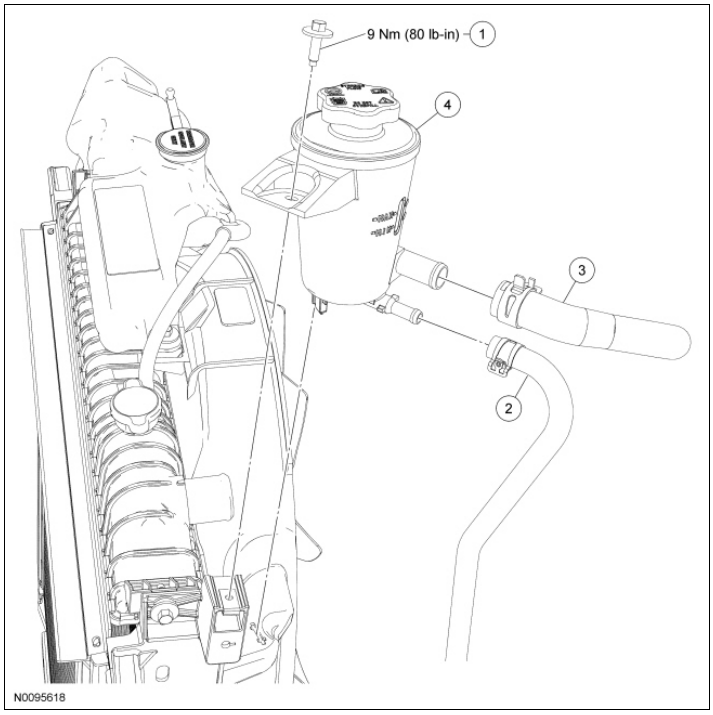
Refer to Section 211-00 .

Power Steering Fluid Reservoir

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: 4.0L engine shown, 4.6L engine similar.



Item	Part Number	Description
1	W503924	Power steering fluid reservoir bolt
2	3D746	Power steering fluid cooler
3	3691	Power steering pump supply hose
4	3R700	Power steering fluid reservoir

Removal and Installation

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. Using a suitable suction device, remove the power steering fluid from the reservoir.

2. Remove the power steering fluid reservoir bolt.
    - To install, tighten to 9 Nm (80 lb-in).

3. Release the power steering pump supply hose clamp and disconnect the hose.

4. Release the power steering fluid cooler hose clamp and disconnect the hose.

5. Remove the power steering fluid reservoir.

6. To install, reverse the removal procedure.

7. Fill the power steering system. For additional information, refer to Section 211-00 .

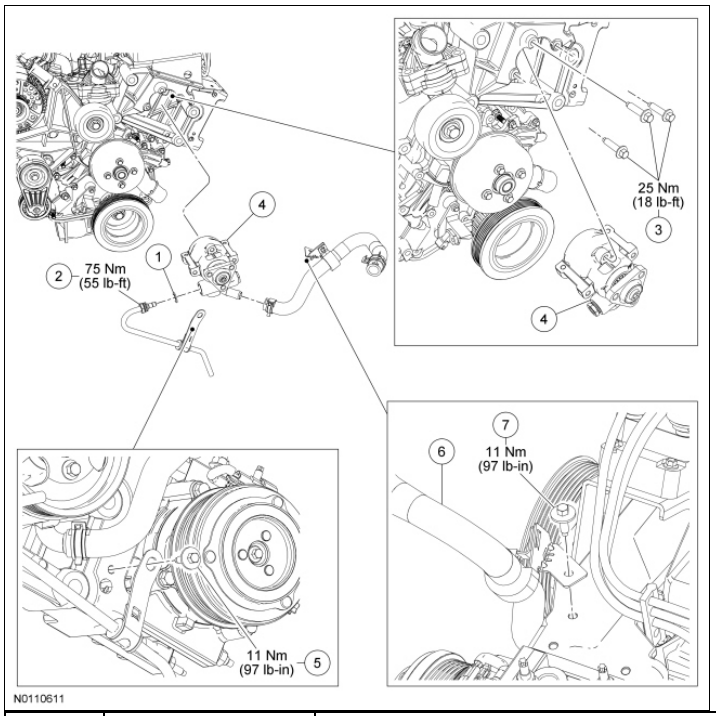
Power Steering Pump - 4.0L

Special Tool(s)

 ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	388898	Teflon® seal
2	-	Pressure line-to-pump fitting (part of 3A719)
3	W700839	Power steering pump bolts (3 required)
4	3A674	Power steering pump
5	W503924	Pressure line bracket-to-engine bolt
6	3691	Power steering pump supply hose
7	W503924	Power steering pump supply hose bracket bolt

Removal

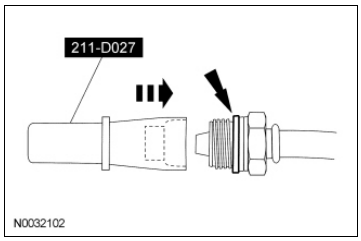
NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. Using a suitable suction device, remove the power steering fluid from the reservoir.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
3. Remove the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley - 4.0L in this section.
4. Remove the pressure line bracket-to-engine bolt.
5. Remove the power steering pump supply hose bracket bolt.
6. Release the power steering pump supply hose clamp and disconnect the hose.
7. Disconnect the pressure line-to-pump fitting.
    - Remove and discard the Teflon® seal.
8. Remove the 3 bolts and the power steering pump.

Installation

1. **NOTE:** A new Teflon® seal must be installed.

   Using the Teflon® Seal Installer Set, install a new Teflon® seal to the pressure line fitting.



2. Position the power steering pump and install the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).
3. Connect the pressure line-to-pump fitting.
    - Tighten to 75 Nm (55 lb-ft).
4. Connect the power steering pump supply hose.
5. Install the power steering pump supply hose bracket bolt.
    - Tighten to 11 Nm (97 lb-in).
6. Install the pressure line bracket-to-engine bolt.
    - Tighten to 11 Nm (97 lb-in).
7. Install the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley - 4.0L in this section.

8. Fill the power steering system. For additional information, refer to Section 211-00 .

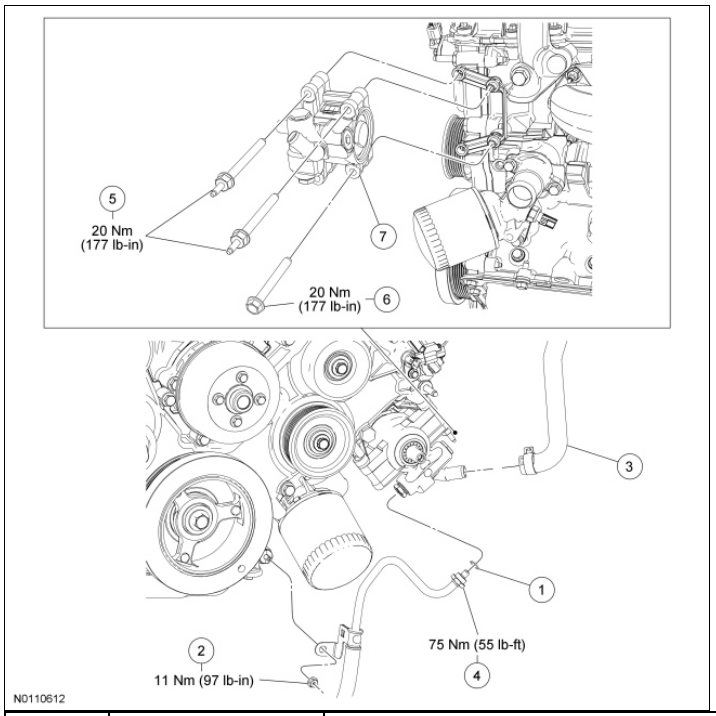
Power Steering Pump - 4.6L

Special Tool(s)

 ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	388898	Teflon® seal
2	N805320	Pressure line bracket-to-engine nut
3	3691	Power steering pump supply hose
4	-	Pressure line-to-pump fitting (part of 3A719)
5	W707225	Power steering pump bolts (2 required)
6	W706447	Power steering pump bolt
7	3A696	Power steering pump

Removal and Installation

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. Using a suitable suction device, remove the power steering fluid from the reservoir.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

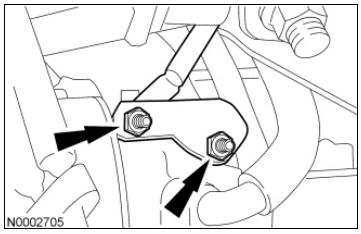
3. Remove the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley - 4.6L in this section.

4. Remove the pressure line bracket-to-engine nut.

5. Compress the clamp and disconnect the power steering pump supply hose.

6. Disconnect the pressure line-to-pump fitting.
   - Remove and discard the Teflon® seal.

7. Remove the 2 engine wiring bracket nuts and position the wiring harness and ground cable aside.

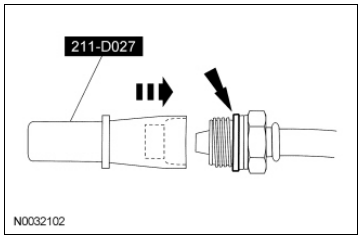


8. Remove the 3 bolts and the power steering pump.

Installation

1. **NOTE:** A new Teflon® seal must be installed.

   Using the Teflon® Seal Installer Set, install a new Teflon® seal on the pressure line-to-pump fitting.



2. Position the power steering pump and install the 3 bolts.
   - To install, tighten to 20 Nm (177 lb-in).

3. Position the ground cable and engine wiring bracket. Install the 2 nuts.
   - Tighten to 20 Nm (177 lb-in).

4. Connect the pressure line-to-pump fitting.
   - Tighten to 75 Nm (55 lb-ft).

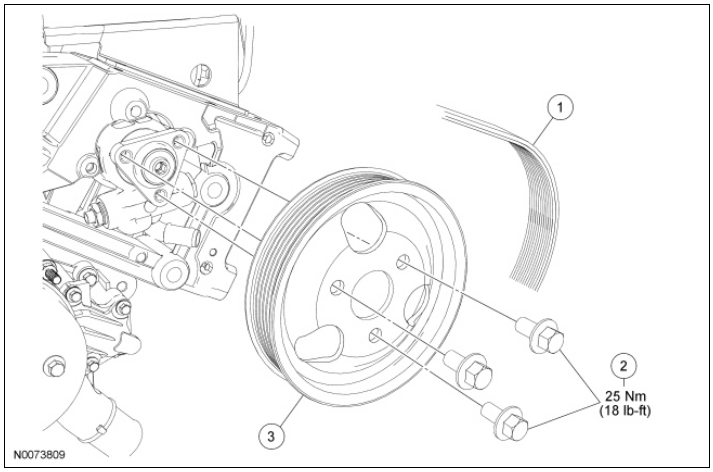
5. Connect the power steering pump supply hose.

6. Install the pressure line bracket-to-engine nut.
    - Tighten to 11 Nm (97 lb-in).

7. Install the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley - 4.6L in this section.

8. Fill the power steering system. For additional information, refer to Section 211-00 .

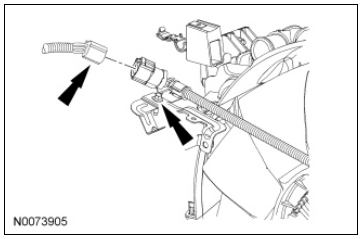
Power Steering Pump Pulley - 4.0L



Item	Part Number	Description
1	8620	Accessory drive belt
2	N605784	Power steering pump pulley bolts (3 required)
3	3A733	Power steering pump pulley

Removal and Installation

1. Disconnect the fan clutch electrical connector, remove the fan clutch wiring harness bracket bolt and position the harness aside.
    - To install, tighten to 7 Nm (62 lb-in).



2. Loosen the 3 power steering pump pulley bolts.

3. Rotate the tensioner and remove the engine accessory drive belt from the power steering pump pulley.

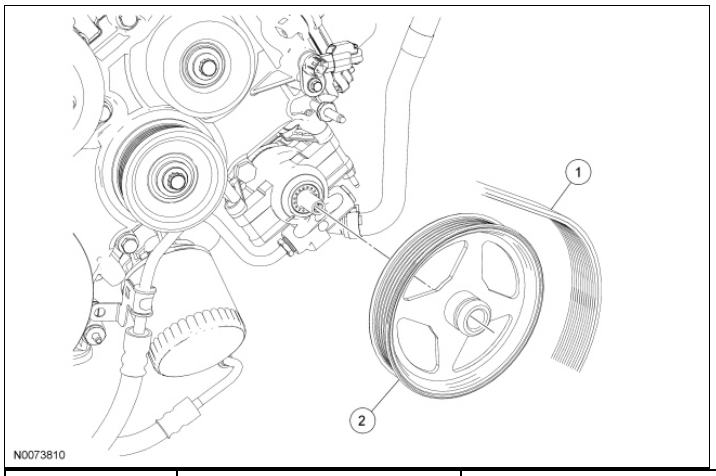
4. Remove the 3 bolts and the power steering pump pulley.
    - To install, tighten to 25 Nm (18 lb-ft).

5. To install, reverse the removal procedure.

Power Steering Pump Pulley - 4.6L

Special Tool(s)

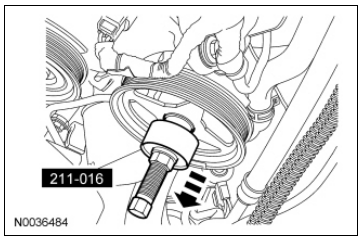
 ST1586-A	Installer, Power Steering Pump Pulley 211-185 (T91P-3A733-A)
 ST1290-A	Remover, Power Steering Pump Pulley 211-016 (T69L-10300-B)



Item	Part Number	Description
1	8620	Accessory drive belt
2	3A733	Power steering pump pulley

Removal

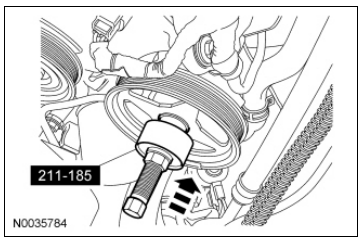
1. Remove the engine air cleaner outlet pipe. For additional information, refer to Section 303-12 .
2. Rotate the tensioner and remove the engine accessory drive belt from the power steering pump pulley.
3. Using the Power Steering Pump Pulley Remover, remove the pulley.



Installation

1. ***NOTICE:*** **Do not install a power steering pump pulley that has been removed and installed twice or pulley failure and/or pump damage may occur. Inspect the pulley for paint marks in the web area near the hub. If there are 2 paint marks, discard the pulley and install a new one. If there is 1 paint mark or no paint marks, use a paint pencil to mark the web area of the pulley near the hub.**

   Using the Power Steering Pump Pulley Installer, install the pulley.



2. Rotate the tensioner and install the engine accessory drive belt on the power steering pump pulley. For additional information on accessory drive belt routing, refer to Section 303-05 .

3. Install the engine air cleaner outlet pipe. For additional information, refer to Section 303-12 .

Power Steering Pump to Steering Gear Pressure Line

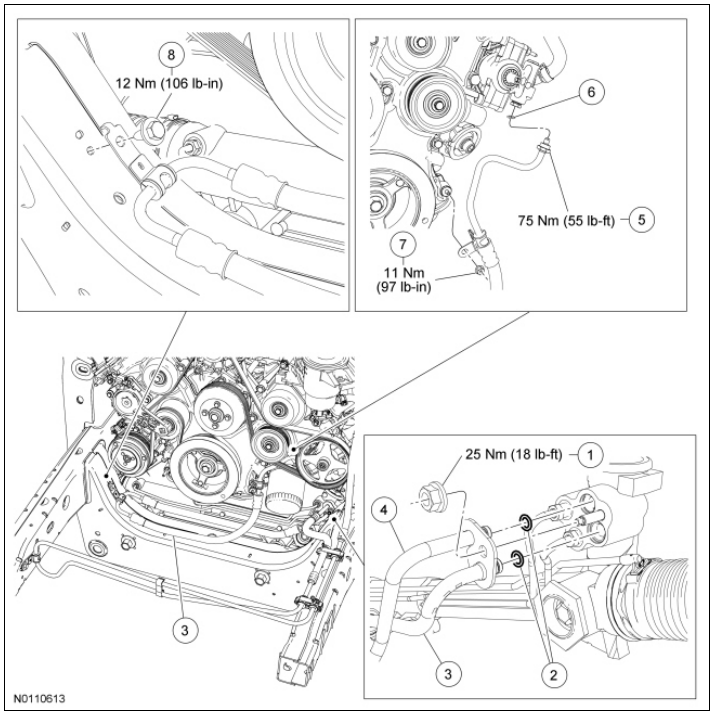
Special Tool(s)

 ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: 4.6L engine shown, 4.0L engine similar.



Item	Part Number	Description
1	W520413-S	Steering line clamp plate nut
2	N803257	O-ring seals (2 required)
3	3A719	Pressure line
4	3D746	Power steering fluid cooler

5	-	Pressure line-to-pump fitting (part of 3A719)
6	388898	Teflon® seal
7	N805320/ W503924	Pressure line bracket-to-engine nut/bolt (4.6L engine/4.0L engine)
8	W710617	Pressure line bracket-to-crossmember bolt

Removal

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley - 4.0L or Power Steering Pump Pulley - 4.6L in this section.

3. Remove the steering line clamp plate nut.

4. Rotate the steering line clamp plate and disconnect the power steering fluid cooler from the steering gear.
   - Discard the O-ring seal.

5. Disconnect the pressure line from the steering gear.
   - Discard the O-ring seal.

6. Remove the pressure line bracket-to-engine nut (4.6L) or bolt (4.0L).

7. Remove the pressure line bracket-to-crossmember bolt.

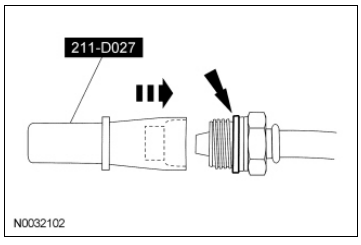
8. Disconnect the pressure line-to-pump fitting.
   - Remove and discard the Teflon® seal.

9. Remove the pressure line.

Installation

1. **NOTE:** A new Teflon® seal must be installed.

   Using the Teflon® Seal Installer Set, install a new Teflon® seal on the pressure line fitting.



2. Position the pressure line and connect the pressure line-to-pump fitting.
   - Tighten to 75 Nm (55 lb-ft).

3. Install the pressure line bracket-to-engine nut (4.6L) or bolt (4.0L).
   - Tighten to 11 Nm (97 lb-in).

4. **NOTE:** New O-rings must be installed whenever the pressure line and fluid cooler are disconnected from the steering gear.

   Install a new O-ring seal and position the pressure line to the steering gear.

5. Install the pressure line bracket-to-crossmember bolt.
   - Tighten to 12 Nm (106 lb-in).

6. Install a new O-ring seal and position the power steering fluid cooler to the steering gear. Rotate the steering line clamp plate into position.

7. Install the steering line clamp plate nut.
   - Tighten to 25 Nm (18 lb-ft).

8. Install the power steering pump pulley. For additional information, refer to Power Steering Pump Pulley - 4.0L or Power Steering Pump Pulley - 4.6L in this section.

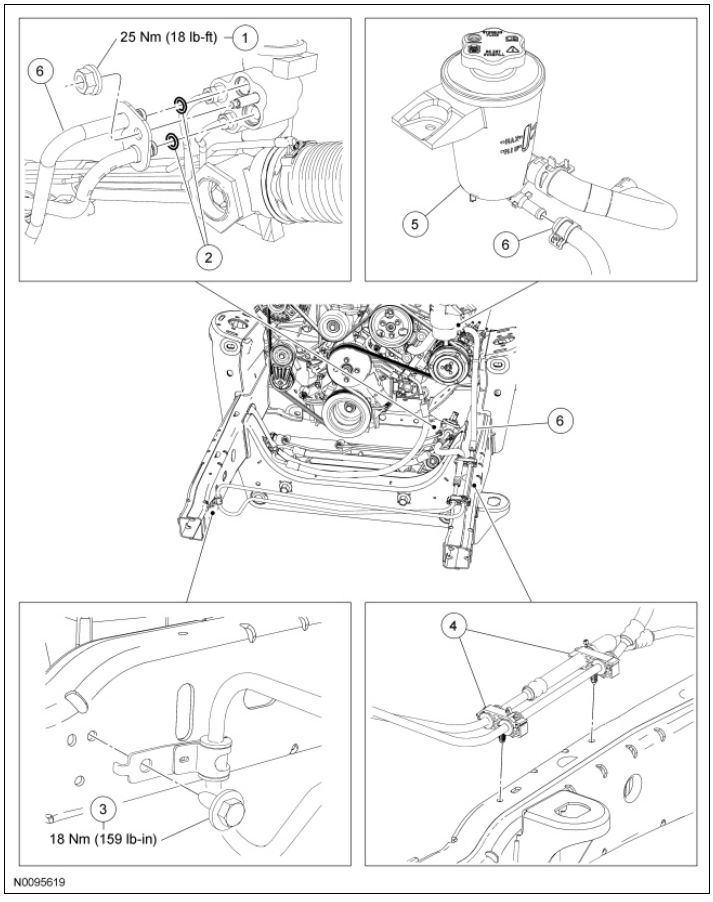
9. Fill the power steering system. For additional information, refer to Section 211-00 .

Power Steering Fluid Cooler

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: 4.0L engine shown, 4.6L engine similar.



Item	Part Number	Description
1	W520143	Steering line clamp plate nut
2	N803257	O-ring seals (2 required)
3	W710617	Power steering fluid cooler hose bracket bolt
4	-	Power steering fluid cooler hose braces (2 required)
5	3R700	Power steering fluid reservoir

6	3D746	Power steering fluid cooler

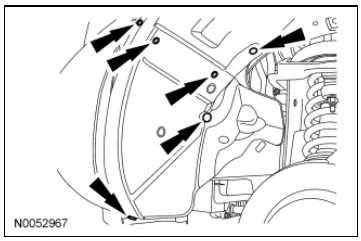
Removal and Installation

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

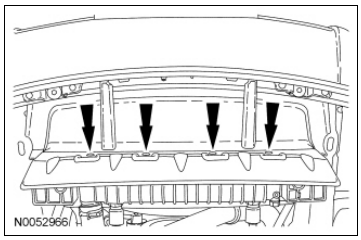
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Release the power steering fluid cooler clamp and disconnect the fluid cooler from the fluid reservoir.

3. Remove the LH front splash shield screws, pin-type retainers and the splash shield.



4. Remove the lower radiator air deflector pushpins and the air deflector.



5. Remove the 2 power steering fluid cooler hose braces.

6. Remove the power steering fluid cooler hose bracket bolt.
   - To install, tighten to 18 Nm (159 lb-in).

7. Remove the steering line clamp plate nut.
   - To install, tighten to 25 Nm (18 lb-ft).

8. Rotate the steering line clamp plate and disconnect the power steering fluid cooler from the steering gear.
   - Discard the O-ring seal.

9. Remove the power steering fluid cooler.

10. **NOTE:** New O-ring seals must be installed whenever the power steering pressure and fluid cooler line is disconnected from the steering gear.

    To install, reverse the removal procedure.

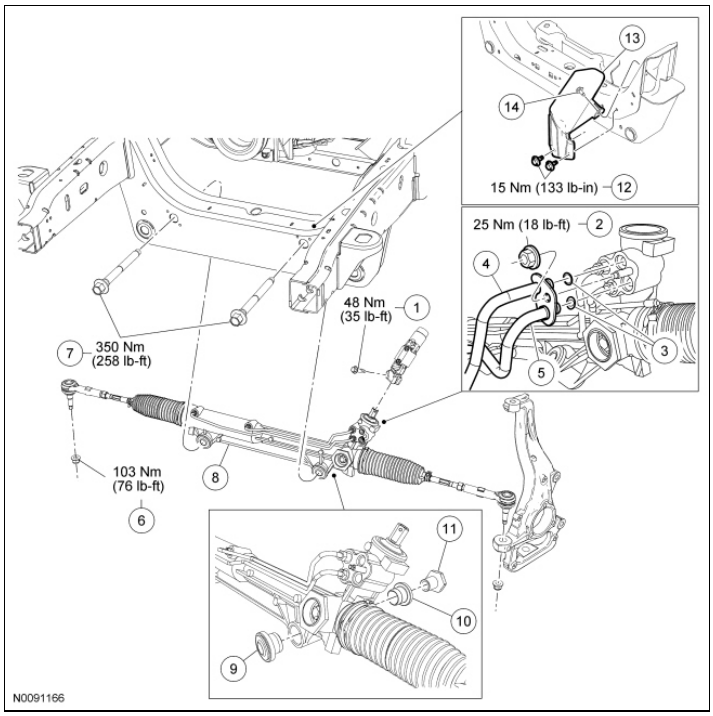
11. Fill the power steering system. For additional information, refer to Section 211-00 .

Steering Gear

Special Tool(s)

 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)

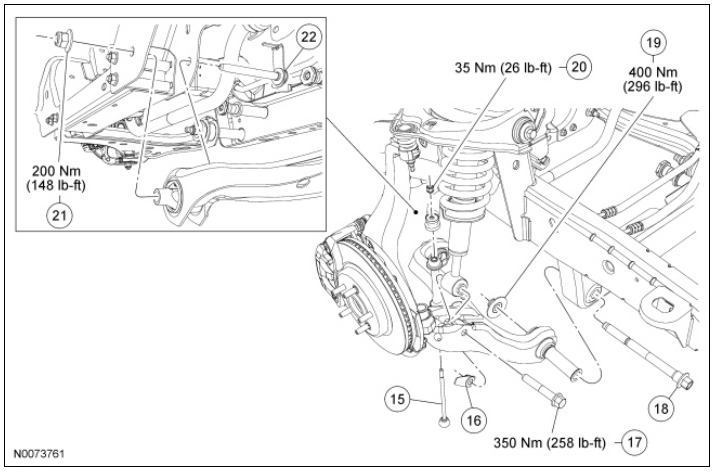
Steering Gear (View 1 of 2)



Item	Part Number	Description
1	W710570	Lower steering column shaft-to-steering gear bolt
2	W520413	Steering line clamp plate nut
3	N803257	O-ring seals (2 required)
4	3F780	Power steering fluid cooler
5	3A719	Power steering pressure line
6	W520215	Tie-rod end nut (2 required)
7	W710466	Steering gear-to-crossmember bolts (2 required)
8	3504	Steering gear
9	3C716A	Forward steering gear bushing (2 required)
10	3C716B	Rearward steering gear bushing (2 required)
11	W710283	Steering gear-to-crossmember nut (2 required)

12	W707079	Oil shield-to-crossmember bolts (2 required)
13	6N634	Oil shield
14	W709571	Oil shield pin-type retainer

Steering Gear (View 2 of 2)



Item	Part Number	Description
15	5495	Stabilizer bar link bolt
16	W710747	Shock absorber lower flagnut
17	W710775	Shock absorber lower bolt
18	W711505	Lower arm forward bolt
19	W710796	Lower arm forward nut
20	5C491	Stabilizer bar link nut
21	W707254	Lower arm rearward nut
22	W711533	Lower arm rearward flag bolt

Removal and Installation

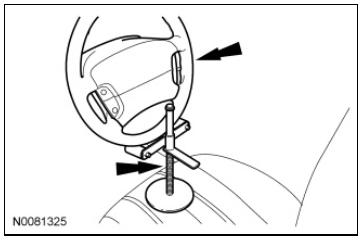
All vehicles

NOTICE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. ***NOTICE:*** **Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the clockspring may result. If there is evidence that the lower shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   NOTE: Use a steering wheel holding device (such as Hunter® 28-75-1 or equivalent).

   Using a suitable holding device, hold the steering wheel in the straight-ahead position.



2. Remove the front tires and wheels. For additional information, refer to Section 204-04 .

3. If equipped, remove the 2 bolts, pin-type retainer and the oil shield.
   - To install, tighten to 15 Nm (133 lb-in).

4. Remove and discard the lower steering column shaft-to-steering gear bolt.
   - To install, tighten the new bolt to 48 Nm (35 lb-ft).

5. Disconnect the lower steering column shaft from the steering gear.

6. Remove the steering line clamp plate nut.
   - To install, tighten to 25 Nm (18 lb-ft).

7. Rotate the steering line clamp plate and disconnect the power steering pressure line and fluid cooler.

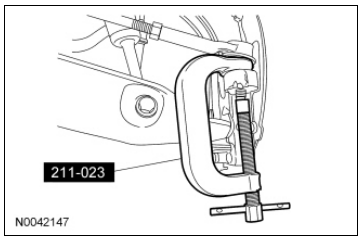
8. **NOTE:** New O-rings must be installed whenever the power steering line and fluid cooler are disconnected from the steering gear.

   Remove and discard the 2 O-rings.

9. Remove and discard the 2 tie-rod end nuts.
   - To install, tighten the new nuts to 103 Nm (76 lb-ft).

10. ***NOTICE:*** **Use care when installing the C-Frame and Screw or damage to the tie-rod end boot may occur.**

    Using the C-Frame and Screw, separate the 2 tie-rod ends from the wheel knuckle.



11. Remove the 2 steering gear-to-crossmember nuts and bolts.
    - To install, tighten to 350 Nm (258 lb-ft).

Four-Wheel Drive (4WD) vehicles

NOTE: On Four-Wheel Drive (4WD) vehicles, the following steps (LH lower arm only) must be carried out to provide clearance to remove the steering gear.

12. Remove the shock absorber lower bolt and flagnut.
    - Discard the flagnut.
    - To install, tighten to 350 Nm (258 lb-ft).

13. *NOTICE:* **Do not tighten the LH lower arm nuts and bolts until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies or incorrect clamp load or bushing damage may occur.**

    NOTE: It is not necessary to disconnect the LH lower ball joint.

    Remove and discard the lower arm forward bolt and nut and the lower arm rearward flag bolt and nut.

    - To install the new lower arm forward bolt and nut, tighten to 400 Nm (296 lb-ft).
    - To install the new lower arm rearward flag bolt and nut, tighten to 200 Nm (148 lb-ft).

14. Remove the stabilizer bar link nut and the link.
    - Discard the stabilizer bar link nut.
    - To install, tighten the new nut to 35 Nm (26 lb-ft).

All vehicles

15. Remove the steering gear from the LH side of the vehicle.

16. If a new steering gear is being installed, remove the 4 steering gear bushings and the 2 nuts.

17. *NOTICE:* **On Four-Wheel Drive (4WD) vehicles, do not tighten the LH lower arm nuts and bolts until the installation procedure is complete and the weight of the vehicle is resting on the wheel and tire assemblies or incorrect clamp load bushing damage may occur.**

    To install, reverse the removal procedure.

    - Install 2 new O-ring seals and new flag nuts.
    - Fill the power steering system. For additional information, refer to Section 211-00 .
    - Check and, if necessary, set the front toe. For additional information, refer to Section 204-00 .

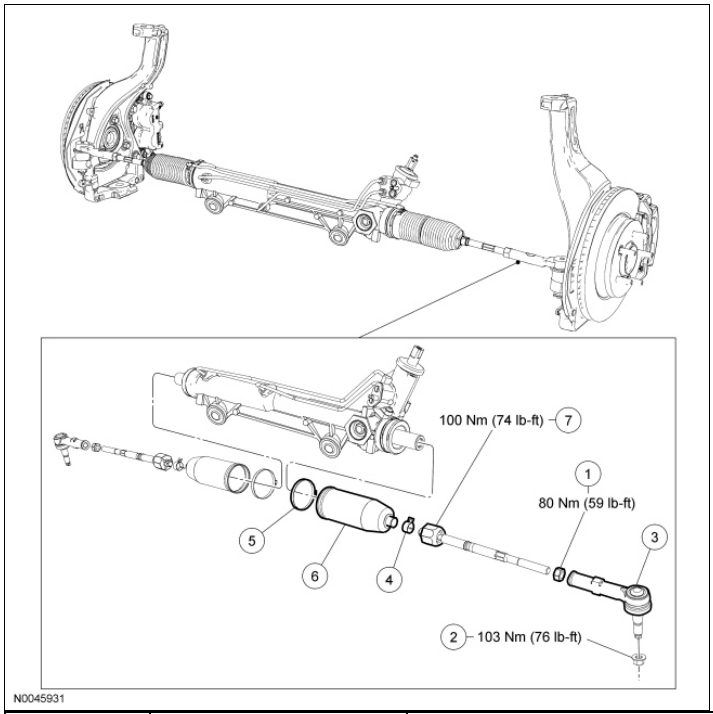
Inner Tie Rod

Special Tool(s)

 ST1525-A	Boot Clamp Pliers 205-D067 (D87P-1098-A) or equivalent
 ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Item	Part Number	Description
1	-	Tie-rod end jam nut (part of 3290)
2	W520215	Tie-rod end nut
3	3290	Tie-rod end
4	3C560	Outer bellows boot clamp
5	3C650	Inner bellows boot clamp

6	3K661	Steering gear bellows boot
7	3280	Inner tie rod

Removal

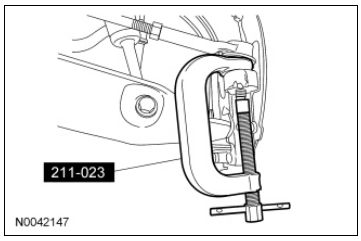
NOTICE: **The boots and clamps are designed to provide an airtight seal and protect the internal components of the steering gear. If the seal is not airtight the vacuum generated during turning will draw water and contamination into the gear causing damage. Zip ties do not produce an airtight seal and must not be used.**

NOTICE: **The inner ball joint grease is not compatible with water and foreign material trapped in the grease will degrade the life of the joint.**

NOTICE: **If present, the orientation of the vent tube must be noted so the boots and vent tubes can be installed in the correct location. Incorrect venting may lead to internal component damage.**

1. Remove the front tire and wheel. For additional information, refer to Section 204-04 .
2. Loosen the tie-rod end jam nut.
3. Remove and discard the tie-rod end nut.
4. ***NOTICE:*** **Use care when installing the C-Frame and Screw or damage to the tie-rod end boot may occur.**

   Using the C-Frame and Screw, separate the tie-rod end from the wheel knuckle.



5. **NOTE:** Count the number of turns required to remove the tie-rod end for reference during installation.

   Remove the tie-rod end.
6. Remove the tie-rod end jam nut.
7. **NOTE:** A new outer bellows boot clamp must be installed.

   Using the Boot Clamp Pliers, remove and discard the outer bellows boot clamp.
8. **NOTE:** A new inner bellows boot clamp must be installed.

   Using the Boot Clamp Pliers, remove and discard the inner bellows boot clamp.
9. Remove the steering gear bellows boot.
10. ***NOTICE:*** **Place the steering gear at the center position. Use an appropriate-sized crowfoot wrench on the flat of the rack gear to resist rotation and to prevent damage during removal and installation of the inner tie rod.**

NOTE: If repairing the RH side, it will be necessary to pull back the LH inner tie-rod boot to hold the steering gear.

NOTE: An assistant may be needed for removal of the RH inner tie rod.

While holding the steering gear rack, use an appropriate-sized crowfoot wrench to remove the inner tie rod.

11. *NOTICE:* **Thoroughly remove any abrasive material. This material is extremely harmful to the steering gear.**

    Thoroughly clean and inspect all the parts to be reused. Install new parts as necessary.

Installation

1. *NOTICE:* **Place the steering gear at the center position. Use an appropriate-sized crowfoot wrench on the flat of the rack gear to resist rotation and to prevent damage during the installation of the inner tie rod.**

   NOTE: An assistant may be needed for installation of the RH inner tie rod.

   Using an appropriate-sized crowfoot wrench, install the inner tie rod.

   - Tighten to 100 Nm (74 lb-ft).

2. **NOTE:** Apply steering gear grease to the steering gear bellows boot groove in the inner tie rod.

   NOTE: Make sure the steering gear bellows boot is positioned correctly over the steering gear housing bead and the groove in the inner tie rod.

   NOTE: Make sure the steering gear bellows boot is not twisted and the vent tube (if equipped) is securely inserted into the vent nipple of the steering gear bellows boot.

   Install the steering gear bellows boot.

3. Using the Boot Clamp Pliers, install a new inner bellows boot clamp.

4. **NOTE:** Make sure the end of the steering gear bellows is positioned between the 2 grooves on the inner tie rod or an internal leak can result.

   Install a new outer bellows boot clamp.

5. Thread the tie-rod end jam nut onto the inner tie rod.

6. **NOTE:** Install the tie-rod end the same number of turns as recorded during the removal.

   Install the tie-rod end to the inner tie rod.

7. Tighten the tie-rod end jam nut.
   - Tighten to 80 Nm (59 lb-ft).

8. Position the tie-rod end to the wheel knuckle and install a new tie-rod end nut.
   - Tighten to 103 Nm (76 lb-ft).

9. Check and, if necessary, align the front end. For additional information, refer to Section 204-00 .

Torque Specifications

Description	Nm	lb-ft	lb-in
Lower steering column shaft-to-steering gear bolt	47	35	-
Lower steering column shaft-to-upper steering column shaft bolt	47	35	-
Steering column support bracket nuts	15	-	133
Steering wheel bolt	40	30	-
Upper steering column shaft-to-steering column bolt	30	22	-
Upper steering column shaft dash seal bolts	12	-	106

SECTION 211-04: Steering Column

2009 Explorer/Mountaineer/Explorer Sport Trac Workshop Manual

DESCRIPTION AND OPERATION

Procedure revision date: 08/13/2008

Steering Column

The steering column system consists of the following components:

- Steering wheel
- Steering column
- Upper and lower steering column shafts
- Steering column switches
- Ignition lock cylinder

The steering column is the mechanical linkage between the steering wheel and the steering gear. It contains various switches and is able to tilt to suit driver preference. The steering wheel is mounted to a shaft which passes through the center of the steering column to the upper steering shaft. The upper steering shaft then connects to the lower steering shaft, which is connected to the steering gear. The upper and lower connections utilize U-joint type knuckles. The steering shaft is centered by roller ball bearings within the steering column. The tilt function of the steering column is controlled by a mechanical lever on the underside of the steering column, which uses a cam to lock and unlock the steering column. When the tilt column lever is unlocked, the steering column can then be adjusted to various positions. The steering column switches (multifunction and ignition) are mounted to the steering column. These switches are covered by the upper and lower steering column shrouds.

NOTE: If the deployable steering column electrical connector becomes damaged or the deployable steering column has deployed, a new overlay wiring harness must be installed. Make sure to follow the installation instructions that are included in the service kit.

This vehicle is equipped with a deployable steering column. The deployable steering column includes a deployable device that, once deployed, reduces the amount of force necessary to collapse the steering column during a crash event. The deployable device is activated by the Restraints Control Module (RCM) depending on when the module detects a crash event force exceeding a programmed limit and the position of the driver seat. **After deployment, a new steering column must be installed.** Refer to Steering Column in this section.

Steering Column

Refer to Section 211-00 .

Steering Wheel Wrap Bonding

Material

Item	Specification
Instant Gel Adhesive TA-19	WSK-M2G402-A4

1. **NOTE:** If re-adhering leather to the front side of the steering wheel only, it will not be necessary to remove the steering wheel. Steering wheel removal is necessary only when repairing loose leather on the backside of the steering wheel.

   If necessary remove the steering wheel. For additional information, refer to Steering Wheel in this section.

2. Position the loose leather out of the way.

3. Apply the specificed adhesive evenly over the wheel spoke.

4. Position the loose leather back into the original position.

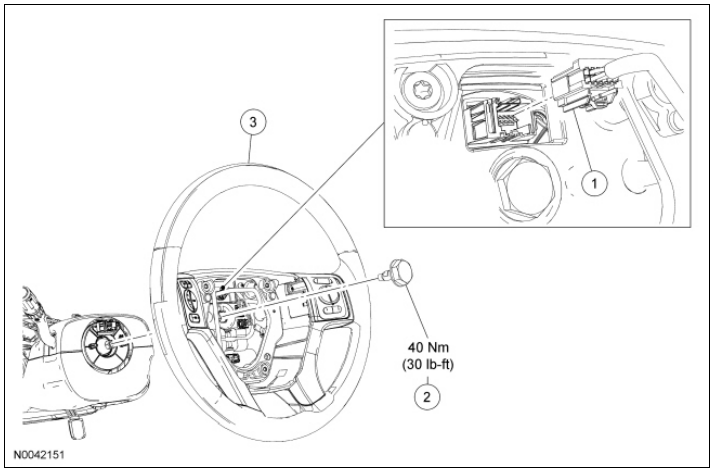
5. **NOTE:** The adhesive should be completely set after 5 minutes. Do not pull on the repair area.

   Smooth the leather and tuck in for neat appearance.

   - Apply pressure (for at least 30 seconds) until the leather is bonded to the wheel spoke.

6. If removed, Install the steering wheel. For additional information, refer to Steering Wheel in this section.

Steering Wheel



Item	Part Number	Description
1	-	Steering wheel switches electrical connector (part of 9C888)
2	W705985	Steering wheel bolt
3	3600	Steering wheel

Removal and Installation

1. Place the steering wheel in the straight-ahead position and turn the ignition switch to the OFF position.

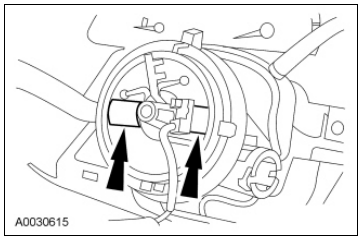
2. Remove the driver air bag module. For additional information, refer to Section 501-20B .

3. Disconnect the steering wheel switches electrical connector.

4. Remove the steering wheel bolt and the steering wheel.
   - Discard the bolt.
   - To install, tighten the new bolt to 40 Nm (30 lb-ft).

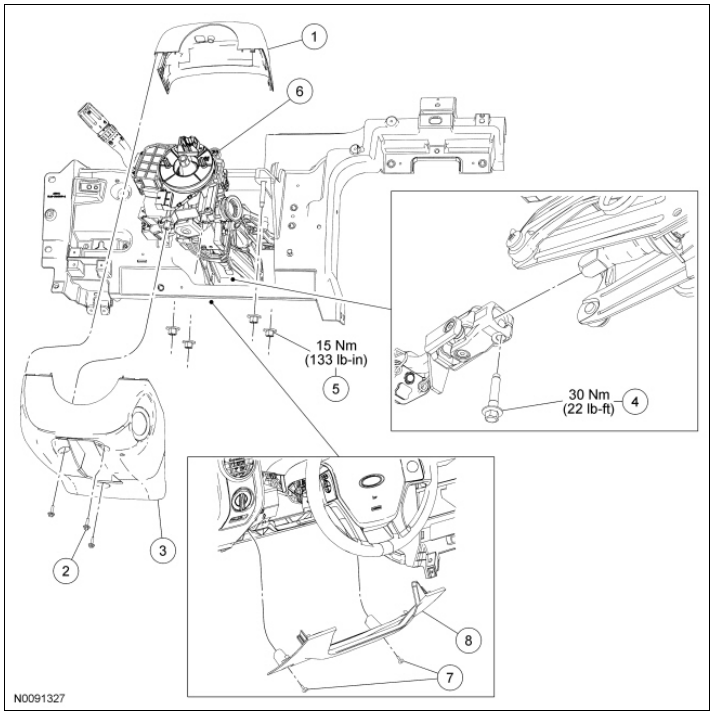
5. ***NOTICE:*** **Do not allow the clockspring to turn from its removal position or damage to the clockspring may occur.**

   Tape the clockspring center rotor to the outer housing to keep it from rotating.

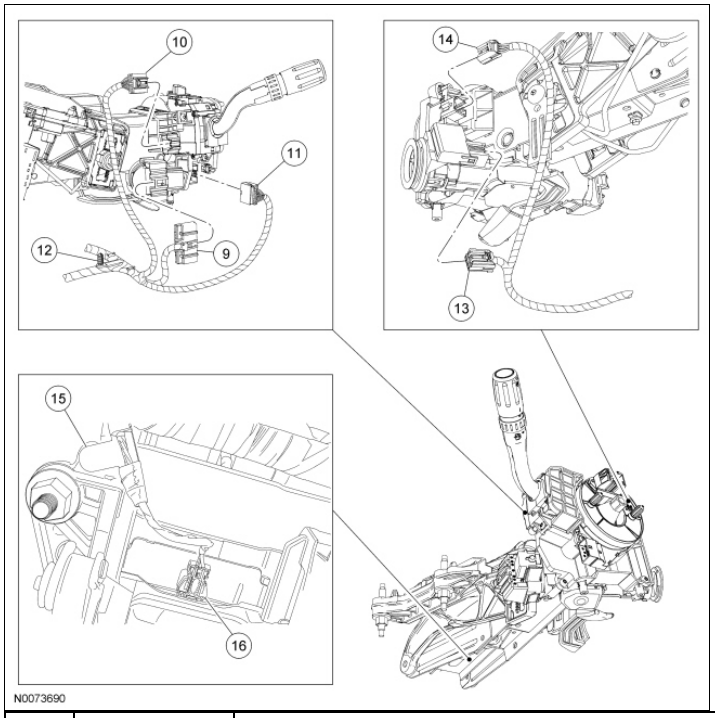


6. To install, reverse the removal procedure.

Steering Column



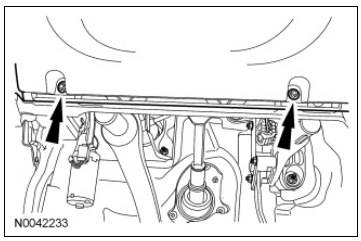
Item	Part Number	Description
1	3F914	Upper steering column shroud
2	W707658	Lower steering column shroud screw (3 required)
3	3F914	Lower steering column shroud
4	N808684	Upper steering column shaft-to-steering column bolt
5	N806423	Steering column support bracket nut (4 required)
6	3C529	Steering column
7	W705314	Steering column opening cover screws (3 required)
8	04459	Steering column opening cover



Item	Part Number	Description
9	-	Ignition switch electrical connector (part of 14401)
10	-	Multifunction switch electrical connector (part of 14401)
11	-	Clockspring electrical connector (part of 14401)
12	-	Wiring harness retainer (part of 14401)
13	-	Passive Anti-Theft System (PATS) electrical connector (part of 14401)
14	-	Steering angle sensor electrical connector (part of 14401)
15	-	Wiring harness retainer (part of 14401)
16	-	Steering column adaptive load safety device electrical connector (part of 14401)

Removal and Installation

1. Remove the steering wheel. For additional information, refer to Steering Wheel in this section.
2. Remove the 2 bolts and the steering column opening cover.



3. Disconnect the multifunction switch, ignition switch and clockspring electrical connectors.
4. Disconnect the steering angle sensor electrical connector.
5. Disconnect the Passive Anti-Theft System (PATS) electrical connector.

6. Detach the wiring harness retainer and position the wiring harness aside.

7. ***NOTICE:*** **The steering column is equipped with a safety device located at the bottom side of the column support. Make sure that the electrical connector and wiring retainer are disconnected prior to removing the column support-to-instrument panel nuts or damage to the safety device or wiring may occur.**

   Using a suitable tool, squeeze the connector at the sides and disconnect the steering column adaptive load safety device electrical connector.

   - Detach the wiring retainer.

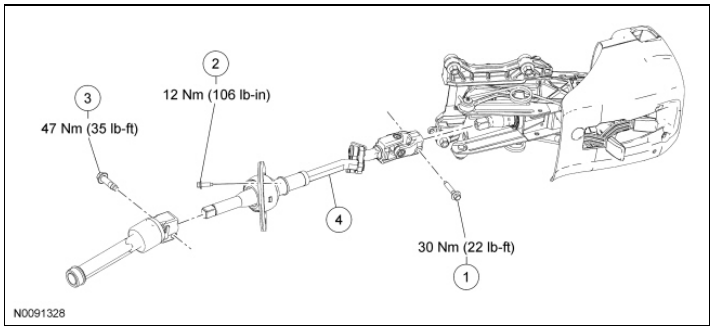
8. Remove and discard the upper steering column shaft-to-steering column bolt.
   - To install, tighten the new bolt to 30 Nm (22 lb-ft).

9. Remove and discard the 4 steering column support bracket nuts and the steering column.
   - To install, tighten the new nuts to 15 Nm (133 lb-in).

10. Remove the steering column.

11. To install, reverse the removal procedure.

Steering Column Shaft - Upper



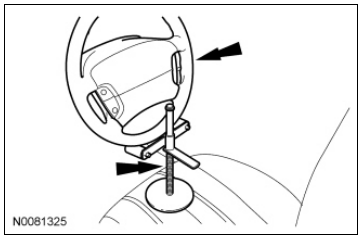
Item	Part Number	Description
1	N808684	Upper steering column shaft-to-steering column bolt
2	W611624	Upper steering column shaft dash seal bolt (3 required)
3	W710570	Lower steering column shaft-to-upper steering column shaft bolt
4	3E751	Upper steering column shaft

Removal and Installation

1. ***NOTICE:*** **Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the clockspring may result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   NOTE: Use a steering wheel holding device (such as Hunter® 28-75-1 or equivalent).

   Using a suitable holding device, hold the steering wheel in the straight-ahead position.



2. ⚠ **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Remove and discard the upper steering column shaft-to-steering column bolt.

   - To install, tighten the new bolt to 30 Nm (22 lb-ft).

3. Remove the 3 upper steering column shaft dash seal bolts.

- To install, tighten to 12 Nm (106 lb-in).

4. ⚠ **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

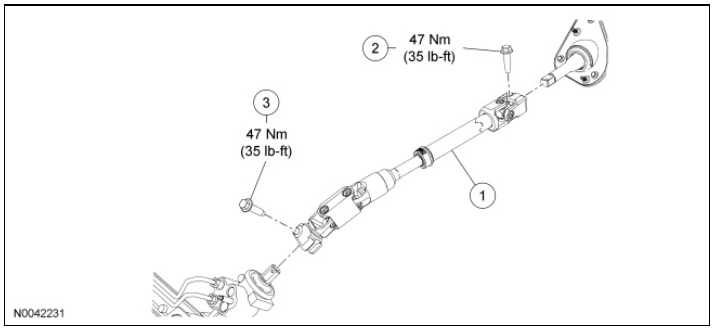
   Remove and discard the lower steering column shaft-to-upper steering column shaft bolt.

   - To install, tighten the new bolt to 47 Nm (35 lb-ft).

5. Remove the upper steering column shaft.

6. To install, reverse the removal procedure.

Steering Column Shaft - Lower



Item	Part Number	Description
1	3C662	Lower steering column shaft
2	W710570	Lower steering column shaft-to-upper steering column shaft bolt
3	W710570	Lower steering column shaft-to-steering gear bolt

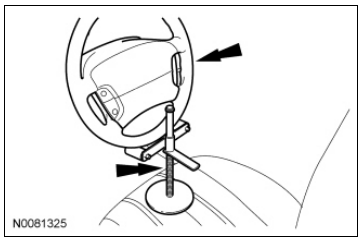
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. ***NOTICE:*** **Do not allow the steering column shaft to rotate while the steering column shaft is disconnected or damage to the clockspring can result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to Section 501-20B .**

   NOTE: Use a steering wheel holding device (such as Hunter® 28-75-1 or equivalent).

   Using a suitable holding device, hold the steering wheel in the straight-ahead position.



3. ⚠ **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Remove and discard the lower steering column shaft-to-upper steering column shaft bolt.

   - To install, tighten the new bolt to 47 Nm (35 lb-ft).

4. ⚠ **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Remove and discard the lower steering column shaft-to-steering gear bolt.

   - To install, tighten the new bolt to 47 Nm (35 lb-ft).

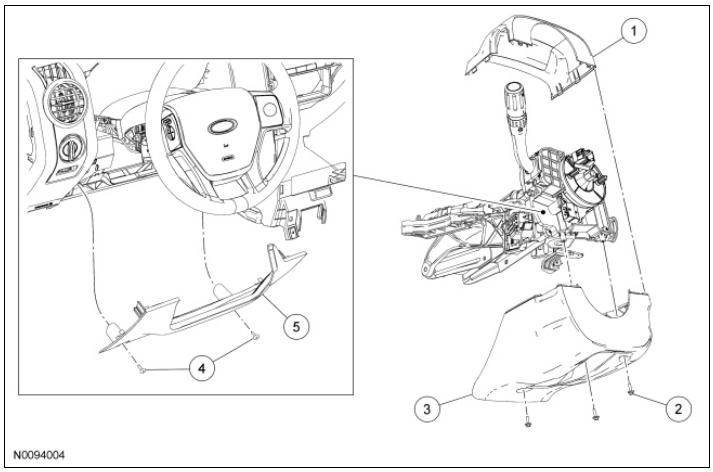
5. Remove the lower steering column shaft.

6. Inspect the lower steering column shaft for boot damage or separation from the shaft tube.
   - If damage or separation of the lower steering column shaft is evident, install a new lower steering column shaft.

7. To install, reverse the removal procedure.

Steering Column Shroud

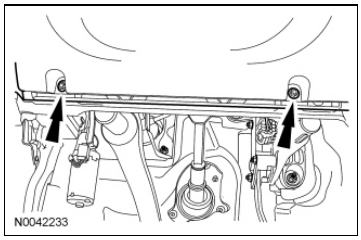
NOTE: Steering wheel is removed for clarity.



Item	Part Number	Description
1	3530	Upper steering column shroud
2	W705314	Lower steering column shroud screw (3 required)
3	3530	Lower steering column shroud
4	W705314	Steering column opening cover screws (2 required)
5	04459	Steering column opening cover

Removal and Installation

1. Remove the 2 screws and the steering column opening cover.



2. Remove the 3 screws and the upper and lower steering column shrouds.

3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Multifunction switch screws	3	27

Steering Column Switches

The steering column switches consist of the following:

- Multifunction switch
- Ignition switch

The steering column switches receive driver inputs and send signals to various components. The multifunction switch controls the windshield wipers, hazard flasher, turn signal, headlamp low/high beam and headlamp dimmer/flash-to-pass. The ignition switch is used in conjunction with the lock cylinder key to start the vehicle. When the lock cylinder key is switched to different positions, it moves linkages which enable the ignition switch to send battery voltage to various components.

Steering Column Switches

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2574-A	Flex Probe Kit 105-R0258 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also identified as the Generic Electronic Module (GEM).

Ignition Switch

The ignition switch is controlled by the ignition lock cylinder with a key. When the ignition lock cylinder is turned using the key, a mechanical connection positions the ignition switch to the selected position and allows the ignition switch to send voltage to specific components.

Multifunction Switch

The multifunction switch (high beam/low beam, flash-to-pass, turn signal and windshield wiper) controls the various components electrically. The headlamp switch sends constant voltage to the headlamps when placed in the ON position, while the flash-to-pass is a momentary switch used to send voltage to the headlamp high beams only. The headlamp high beam/low beam switch sends voltage to the low or high beam headlamps while the headlamps are on. The turn signal switch portion of the multifunction switch operates the left and right turn signals. The windshield wiper switch function uses a ground signal to activate the various wiper modes and the wiper/washer.

Key Release Interlock Actuator

The key release interlock actuator (also known as the key removal inhibit solenoid) is an electronically controlled solenoid that prevents the ignition key from being removed from the ignition cylinder unless the transmission selector lever is in the PARK position. The actuator is part of the ignition switch.

When the transmission selector lever is placed in a position other than PARK, the park detection switch (internal to the transmission selector lever) closes and the key release interlock engages. This prevents the ignition key from being removed from the ignition cylinder.

When the transmission selector lever is placed in the PARK position, the park detection switch opens and the key release interlock disengages, allowing the ignition key to be removed from the ignition cylinder.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Multifunction switch • Ignition key • Ignition switch • Ignition key turning effort	• Smart Junction Box (SJB) fuse 8 (15A) • Wiring, terminals or connectors • Instrument cluster • Passive Anti-Theft System (PATS) module • Wiring harness

NOTE: For multifunction switch concerns, refer to one of the following sections:

- Exterior Lighting, Section 417-01 .
- Wipers and Washers, Section 501-16 .

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.
9. If the DTCs retrieved are related to the concern, go to Smart Junction Box (SJB) DTC Chart. For all other DTCs, refer to Section 419-10 .
10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Smart Junction Box (SJB) DTC Chart

DTC	Description	Source	Action
B1359	Ignition RUN/ACC Circuit Failure	Smart Junction Box (SJB)	GO to Pinpoint Test B .
B1363	Ignition START Circuit Failure	SJB	GO to Pinpoint Test D .
B1555	Ignition RUN/START Circuit Failure	SJB	GO to Pinpoint Test C .

Symptom Chart

Symptom Chart

Pinpoint Test

Pinpoint Test A: No Power in All Ignition Switch Positions

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch receives fused battery voltage from Smart Junction Box (SJB) fuse 8 (15A) through circuit SBP08 (VT/RD). The ignition switch has 4 possible states:

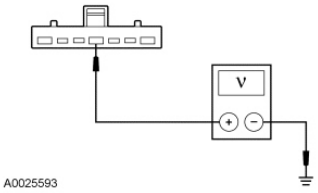
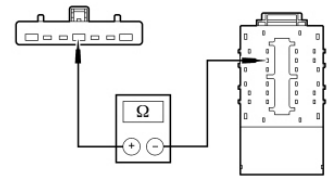
- OFF
- RUN/ACC
- RUN/START
- START

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Ignition switch

PINPOINT TEST A: NO POWER IN ALL IGNITION SWITCH POSITIONS

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
A1 CHECK FOR VOLTAGE TO THE IGNITION SWITCH	
• Disconnect: Ignition Switch C250. • Measure the voltage between ignition switch C250-4, circuit SBP08 (VT/RD), harness side and ground.  A0025593 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation. **No** VERIFY that SJB fuse 8 (15A) is OK. If OK, GO to A2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible cause of the circuit short. TEST the system for normal operation.
A2 CHECK CIRCUIT SBP08 (VT/RD) FOR AN OPEN	
• Disconnect: SJB C2280c. • Measure resistance between ignition switch C250-4, circuit SBP08 (VT/RD), harness side and SJB C2280c-22, circuit SBP08 (VT/RD), harness side.  N0042597 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR or INSTALL a new SJB as necessary. TEST the system for normal operation. **No** REPAIR circuit SBP08 (VT/RD). TEST the system for normal operation.

Pinpoint Test B: No Power in ACC/RUN

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

When placed in ACC, the ignition switch provides voltage to the Smart Junction Box (SJB) on circuit CDC33 (VT/GN). When placed in RUN, the ignition switch provides voltage to the SJB and the instrument cluster on circuit CDC34 (WH/OG).

- DTC B1359 Ignition RUN/ACC Circuit Failure - If the SJB detects an open circuit, a short to voltage or a short to ground on the RUN/ACC circuit, DTC B1359 will be set.

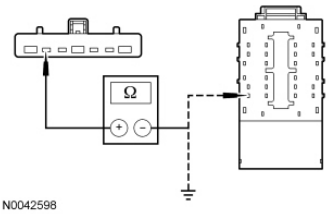
This pinpoint test is intended to diagnose the following:

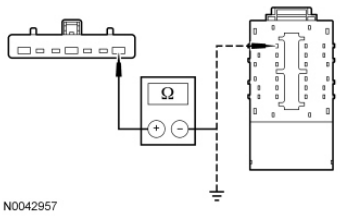
- Wiring, terminals or connectors

- Ignition switch
- SJB

PINPOINT TEST B: NO POWER IN ACC/RUN

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
B1 RETRIEVE DTCs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self Test. • Record DTCs. • **Is DTC B1359 or B1555 present?**	**Yes** If only DTC B1359 is present, GO to B2 . If only DTC B1555 is present, GO to B3 . If both DTCs are present, GO to B4 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
B2 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280c. • Disconnect: Ignition Switch C250. • Measure resistance between: ♦ ignition switch C250-6, circuit CDC33 (VT/GN), harness side and SJB C2280c-5, circuit CDC33 (VT/GN), harness side. ♦ ignition switch C250-6, circuit CDC33 (VT/GN), harness side and ground.  • **Are the resistances less than 5 ohms between the components and greater than 10,000 ohms to ground?**	**Yes** GO to B4 . **No** REPAIR circuit CDC33 (VT/GN). CLEAR the DTCs. REPEAT the self-test.
B3 CHECK CIRCUIT CDC34 (WH/OG) FOR AN OPEN OR A SHORT TO GROUND	

• Ignition OFF. • Disconnect: SJB C2280c. • Disconnect: Ignition Switch C250. • Measure resistance between: ♦ ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280c-26, circuit CDC34 (WH/OG), harness side. ♦ ignition switch C250-1, circuit CDC34 (WH/OG), harness side and ground.  • **Are the resistances less than 5 ohms between the ignition switch and the SJB , and greater than 10,000 ohms between the ignition switch and ground?**	**Yes** GO to B4 . **No** REPAIR circuit CDC34 (WH/OG). CLEAR the DTCs. REPEAT the self-test.
B4 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the ignition switch OK?**	**Yes** GO to B5 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. CLEAR the DTCs. REPEAT the self-test.
B5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC B1555

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

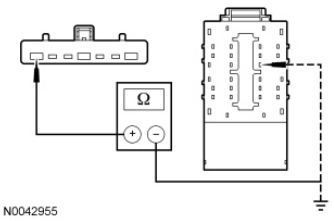
When placed in RUN, the ignition switch provides voltage to the Smart Junction Box (SJB) and the instrument cluster on circuit CDC34 (WH/OG). When placed in START, the ignition switch provides voltage to the SJB on circuit CDC35 (BU/WH).

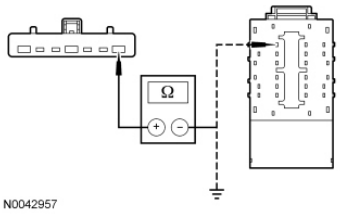
- DTC B1555 Ignition RUN/START Circuit Failure - If the SJB detects an open circuit, a short to voltage or a short to ground on the RUN/START circuit, DTC B1555 will be set.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST C: DTC B1555

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
C1 RETRIEVE DTCs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self Test. • Record DTCs. • **Is DTC B1363 or B1555 present?**	**Yes** If only DTC B1363 is present, GO to C2 . If only DTC B1555 is present, GO to C3 . If both DTCs are present, GO to C4 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
C2 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280c. • Disconnect: Ignition Switch C250. • Measure the resistance between: ♦ ignition switch C250-7, circuit CDC35 (BU/WH), harness side and SJB C2280c-19, circuit CDC35 (BU/WH), harness side. ♦ ignition switch C250-7, circuit CDC35 (BU/WH), harness side and ground.  • **Are the resistances less than 5 ohms between the components and greater than 10,000 ohms to ground?**	**Yes** GO to C4 . **No** REPAIR circuit CDC35 (BU/WH). CLEAR the DTCs. REPEAT the self-test.

C3 CHECK CIRCUIT CDC34 (WH/OG) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280c. • Disconnect: Ignition Switch C250. • Measure resistance between: ♦ ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280c-26, circuit CDC34 (WH/OG), harness side. ♦ ignition switch C250-1, circuit CDC34 (WH/OG), harness side and ground.  • **Are the resistances less than 5 ohms between the components and greater than 10,000 ohms to ground?**	**Yes** GO to C4 . **No** REPAIR circuit CDC34 (WH/OG). CLEAR the DTCs. REPEAT the self-test.
C4 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the ignition switch OK?**	**Yes** GO to C5 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC B1363

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

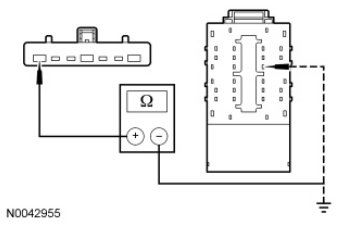
When placed in START, the ignition switch provides voltage to the Smart Junction Box (SJB) on circuit CDC35 (BU/WH).

- DTC B1363 Ignition START Circuit Failure - If the SJB detects an open circuit, a short to voltage or a short to ground on the START circuit, DTC B1363 will be set.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST D: B1363

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
D1 RETRIEVE THE SJB DTCs	
• Connect the scan tool. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self Test. • Record DTCs. • **Is DTC B1363 present?**	**Yes** GO to D2 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
D2 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN OR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280c. • Disconnect: Ignition Switch C250. • Measure resistance between: ♦ ignition switch C250-7, circuit CDC35 (BU/WH), harness side and SJB C2280c-19, circuit CDC35 (BU/WH), harness side. ♦ ignition switch C250-7, circuit CDC35 (BU/WH), harness side and ground.  	**Yes** GO to D3 . **No** REPAIR circuit CDC35 (BU/WH). CLEAR the DTCs. REPEAT the self-test.

• **Is the resistance less than 5 ohms between the components, and greater than 10,000 ohms to ground?**	
D3 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Component Test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the ignition switch OK?**	**Yes** GO to D4 . **No** INSTALL a new ignition switch. REFER to Ignition Switch in this section. CLEAR the DTCs. REPEAT the self-test.
D4 CHECK FOR CORRECT SJB OPERATION	
• Inspect the SJB connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. ♦ spread terminals. • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Ignition Key Cannot Be Removed from the Ignition Lock Cylinder

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

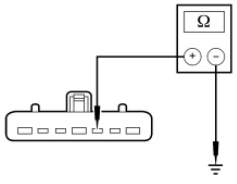
When the transmission selector lever is placed in a position other than PARK, the key release interlock actuator (part of the ignition switch assembly) prevents the key from being removed from the ignition lock cylinder. The key release interlock actuator receives fused battery voltage from Smart Junction Box (SJB) fuse 8 (15A) along circuit SBP08 (VT/RD). Ground for the solenoid is provided along circuit CDC41 (WH/BN), through the park detection switch (internal to the transmission selector lever) and then along circuit GD138 (BK/WH). When the transmission selector lever is placed in a position other than PARK, the park detection switch applies ground to circuit CDC41 (WH/BN). This prevents the key from being removed from the ignition lock cylinder.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Ignition switch
- Transmission selector lever

PINPOINT TEST E: THE IGNITION KEY CANNOT BE REMOVED FROM THE IGNITION LOCK CYLINDER

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take

E1 CHECK THE TRANSMISSION SELECTOR LEVER	
• Ignition ON. • Apply the brake pedal. • Move the transmission selector lever from PARK, through all ranges and back to PARK. • **Can the transmission selector lever be moved freely into and out of the PARK position?**	**Yes** GO to E2 . **No** REFER to Section 307-05 to diagnose the automatic transmission external controls.
E2 CHECK THE IGNITION SWITCH	
• Carry out the Ignition Switch Mechanical Check. • **Is the ignition switch and ignition lock cylinder OK?**	**Yes** GO to E3 . **No** INSTALL a new ignition switch or ignition lock cylinder as necessary. For new ignition switch, REFER to Ignition Switch in this section. For new ignition lock cylinder, REFER to Section 501-14 .
E3 CHECK THE PARK DETECTION SWITCH	
• Place the transmission selector lever in the PARK position. • Ignition OFF. • Disconnect: Transmission Selector Lever C2008. • **Can the ignition key be removed from the ignition lock cylinder?**	**Yes** INSTALL a new transmission selector lever. REFER to Section 307-05 . TEST the system for normal operation. **No** GO to E4 .
E4 CHECK CIRCUIT CDC41 (WH/BN) FOR A SHORT TO GROUND	
• Disconnect: Ignition Switch C250. • Measure the resistance between ignition switch C250-3, circuit CDC41 (WH/BN), harness side and ground.  N0065439 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation. **No** REPAIR circuit CDC41 (WH/BN). TEST the system for normal operation.

Pinpoint Test F: The Ignition Key Can Be Removed from the Ignition Lock Cylinder Regardless of Transmission Selector Lever Position

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Normal Operation

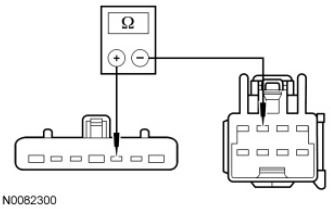
When the transmission selector lever is placed in a position other than PARK, the key release interlock actuator (part of the ignition switch assembly) prevents the key from being removed from the ignition lock cylinder. The key release interlock actuator receives fused battery voltage from Smart Junction Box (SJB) fuse 8 (15A) along circuit SBP08 (VT/RD). Ground for the solenoid is provided along circuit CDC41 (WH/BN), through the park detection switch (internal to the transmission selector lever) and then along circuit GD138 (BK/WH). When the transmission selector lever is placed in a position other than PARK the park detection switch applies ground to circuit CDC41 (WH/BN). This prevents the key from being removed from the ignition lock cylinder.

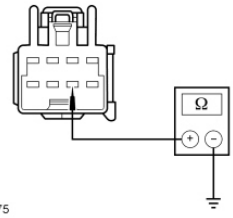
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch
- Transmission selector lever

PINPOINT TEST F: THE IGNITION KEY CAN BE REMOVED FROM THE IGNITION LOCK CYLINDER REGARDLESS OF TRANSMISSION SELECTOR LEVER POSITION

NOTICE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

Test Step	Result / Action to Take
F1 CHECK CIRCUIT CDC41 (WH/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Transmission Selector Lever C2008. • Disconnect: Ignition Switch C250. • Measure the resistance between ignition switch C250-3 circuit CDC41 (WH/BN), harness side and transmission selector lever C2008-3, circuit CDC41 (WH/BN), harness side.  N0082300 • **Is the resistance less than 5 ohms?**	**Yes** GO to F2 . **No** REPAIR circuit CDC41 (WH/BN). TEST the system for normal operation.
F2 CHECK CIRCUIT 1205 (BK) FOR AN OPEN	
• Measure the resistance between transmission selector lever C2008-6, circuit GD138 (BK/WH), harness side and ground.	**Yes** GO to F3 . **No** REPAIR circuit CDC138 (BK/WH). TEST the system for normal operation.

 • **Is the resistance less than 5 ohms?**	
F3 CHECK THE PARK DETECTION SWITCH	
• Connect: Ignition Switch C250. • Ignition ON. • Apply the parking brake and place the transmission selector lever in the NEUTRAL position. • Connect a fused jumper wire between transmission selector lever C2008-3, circuit CDC41 (WH/BN), harness side and transmission selector lever C2008-6, circuit GD138 (BK/WH) harness side. • **Can the ignition key be removed from the lock cylinder?**	**Yes** INSTALL a new ignition switch. REFER to Ignition Switch in this section. TEST the system for normal operation. **No** INSTALL a new transmission selector lever. REFER to Section 307-05 . TEST the system for normal operation.

Component Tests

Ignition Switch - Mechanical

The following conditions can cause difficulty in operating the ignition switch and lock cylinder:

- Burrs on the lock cylinder key
- Insufficient lube on the lock cylinder
- Binding lock cylinder
- Burrs or foreign material around the rack-and-pinion actuator in the lock cylinder housing
- Insufficient lube on the actuator (do not apply lubricant to the inside of the ignition switch)
- Binding ignition switch

Carry out the following test to determine if the ignition switch and lock cylinder are operating correctly.

1. If the ignition key can be removed, inspect the ignition key for any burrs, damage or incorrect cut. Have a new ignition key made as necessary. If the ignition key cannot be removed, continue with Step 2.

2. Turn the key to the ACC position and then the RUN position.
   - If the ignition key turns to the ACC and RUN position, continue with Step 3.
   - If the ignition key will not turn to the ACC and RUN position, continue with Step 4.

3. **NOTE:** The ignition switch and lock cylinder should return from the START position back to the RUN position without assistance.

   Turn the ignition key to the START position and release the key.

   - If the ignition switch and lock cylinder return from the START position back to the RUN position without assistance, the ignition switch is operating correctly at this time.

- If the ignition switch and lock cylinder do not return from the START position back to the RUN position without assistance, continue with Step 4.

4. Remove the ignition lock cylinder. Refer to Section 501-14 .

5. Rotate the ignition lock cylinder through all of the switch positions.
   - If the lock cylinder operates correctly, continue with Step 6.
   - If the lock cylinder does not operate correctly, install a new ignition lock cylinder. Refer to Section 501-14 .

6. Check for binding or sticking ignition switch actuating rod, burrs around the rack-and-pinion actuator in the ignition lock cylinder housing or insufficient lubrication.
   - If there is sufficient lubrication and there are no burrs, binding or sticking conditions; install a new ignition switch. Refer to Ignition Switch in this section.
   - If there is insufficient lubrication, burrs, binding or sticking conditions; repair or lubricate as necessary.

Ignition Switch - Electrical

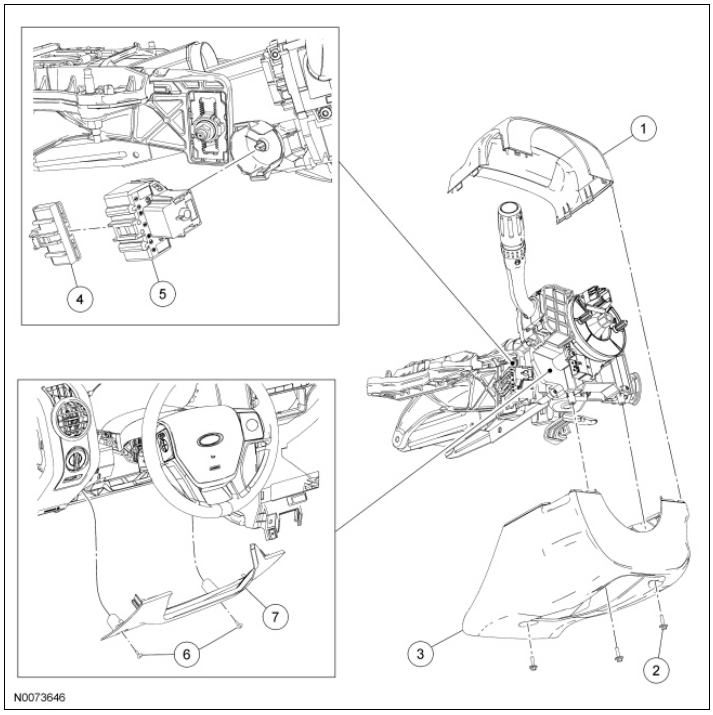
Refer to Wiring Diagrams Cell 149 for component testing.

Multifunction Switch - Electrical

Refer to Wiring Diagrams Cell 149 for component testing.

Ignition Switch

NOTE: Steering wheel removed for clarity.

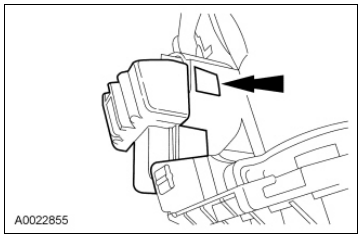


Item	Part Number	Description
1	3530	Upper steering column shroud
2	W705314	Lower steering column shroud screw (3 required)
3	3530	Lower steering column shroud
4	-	Ignition switch electrical connector (part of 14401)
5	W706952	Ignition switch
6	W705314	Steering column opening cover screws (2 required)
7	04459	Steering column opening cover

Removal and Installation

NOTICE: **Do not remove the ignition lock cylinder and the ignition switch at the same time or damage to the column may result.**

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to Section 501-20B .
2. Remove the 2 screws and the steering column opening cover.
3. Remove the 3 screws and the upper and lower steering column shrouds.
4. Disconnect the ignition switch electrical connector.
5. Push the 2 locking tabs inward and remove the ignition switch.

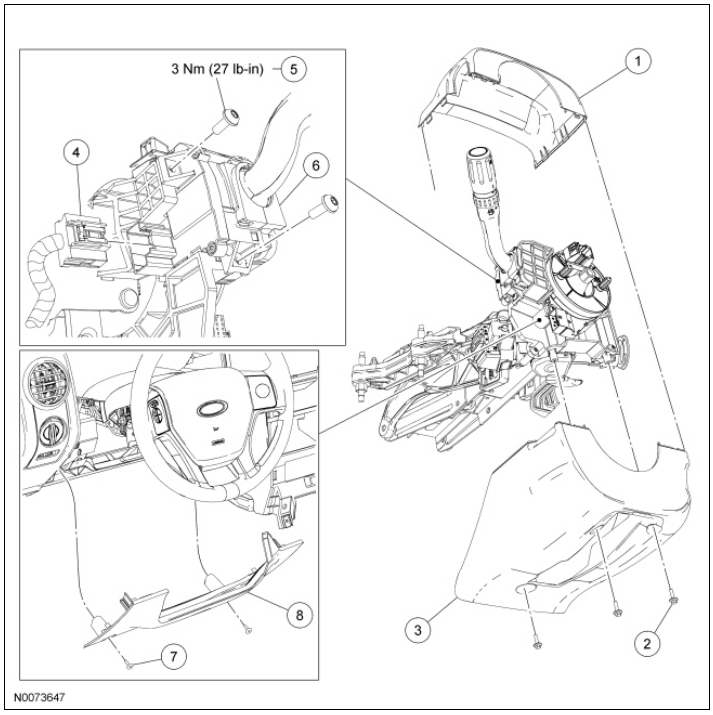


6. To install, reverse the removal procedure.

7. Repower the SRS . For additional information, refer to Section 501-20B .

Steering Column Multifunction Switch

NOTE: Steering wheel removed for clarity.



Item	Part Number	Description
1	3530	Upper steering column shroud
2	W705314	Lower steering column shroud screw (3 required)
3	3530	Lower steering column shroud
4	-	Multifunction switch electrical connector (part of 14401)
5	W706952	Multifunction switch screw (2 required)
6	3K359	Multifunction switch
7	W705314	Steering column opening cover screw (2 required)
8	04459	Steering column opening cover

Removal and Installation

NOTICE: **Do not remove the ignition lock cylinder and the ignition switch at the same time or damage to the column may result.**

1. Remove the 2 screws and the steering column opening cover.

2. Remove the 3 screws and the upper and lower steering column shrouds.

3. Disconnect the multifunction switch electrical connector.

4. Remove the 2 multifunction switch screws and the multifunction switch.
    - To install, tighten to 3 Nm (27 lb-in).

5. To install, reverse the removal procedure.

Steering Column Lock Module

Removal and Installation

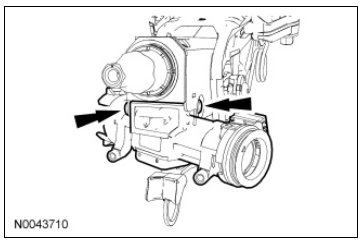
NOTICE: **Do not remove the ignition lock cylinder and the ignition switch at the same time or damage to the column may result.**

1. Remove the ignition switch. For additional information, refer to Ignition Switch in this section.

2. Remove the clockspring. For additional information, refer to Section 501-20B .

3. **NOTE:** Clean all metal shavings and foreign material after cutting slots in the steering column lock module bolts.

   Cut slots into the heads of the 2 steering column lock module bolts.



4. Remove the 2 steering column lock module bolts.
   - Discard the bolts.

5. Remove the steering column lock module clamp.

6. Remove the steering column lock module.

7. To install, reverse the removal procedure.
   - Align the ribs on the steering column lock module with the window of the steering column tube.
   - Align the locating pin with the slot on the locating bracket of the steering column.
   - Tighten the 2 new bolts until the heads of the bolts shear off.

Material

Item	Specification	Fill Capacity
A/C Cooling Coil Coating YN-29	-	-
A/C System Flushing Solvent YN-23	-	-
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	266 ml (9 fl oz) (vehicles without auxiliary systems)
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	473 ml (16 fl oz) (vehicles with auxiliary systems)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	0.77 kg (27 oz) (1.7 lb) (vehicles without auxiliary systems)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	1.25 kg (44 oz) (2.75 lb) (vehicles with auxiliary systems)

General Specifications

Item	Specification
A/C Compressor Magnetic Clutch	
Air gap clearance	0.35-0.65 mm (0.014-0.026 in)
A/C Compressor With Auxiliary A/C	
Rotation	Clockwise
Type	Halla FS20 piston
A/C Compressor Without Auxiliary A/C	
Rotation	Clockwise
Type	Halla FS18 piston
A/C Cycling Switch [a]	
Closed status	290 kPa (42 psi)
Open status	145-159 kPa (21-23 psi)

A/C Pressure Relief Valve [a]	
Open pressure	3,792-4,137 kPa (550-600 psi)
Evaporator Core Orifice With Auxiliary A/C	
Color	Black
Evaporator Core Orifice Without Auxiliary A/C	
Color	Red
Refrigerant System Dye	
R-134a Leak Detection Dye 164-R6060 or 164-R6081	-

[a] Manifold gauge set pressures may vary slightly depending on the distance between the service gauge port valve and the A/C pressure relief valve, the A/C cycling switch and the pressure cutoff switch location.

Climate Control System

⚠ WARNING: Take the following precautions when repairing an air conditioning system containing R-134a:

- Always wear safety goggles.
- Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and will freeze skin tissue.
- Never allow refrigerant R-134a gas to escape in quantity in an occupied space. It will displace the oxygen needed to support life.
- Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but it decomposes when exposed to high temperatures such as a torch flame. During decomposition it releases irritating and toxic gasses (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.

Failure to follow these instructions may result in serious personal injury.

NOTICE: **To avoid damaging the vehicle or Air Conditioning (A/C) components, the following precautions must be observed.**

- The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so can contaminate the shop bulk refrigerant and other vehicles.
- Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These 2 types of refrigerant must never be mixed. Doing so can damage the A/C system.
- Charge the A/C system with the engine running only at the low-pressure side to prevent refrigerant slugging from damaging the A/C compressor.
- Use only R-134a refrigerant. Due to environmental concerns, when the A/C system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. Federal, State/Provincial and/or local laws REQUIRE that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as ASE or Mobile Air Conditioning Society (MACS). Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the instructions provided by the equipment manufacturer when removing refrigerant from or charging the A/C system.
- Refrigerant R-134a must not be mixed with air for leak testing or used with air for any other purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.
- A number of manufacturers are producing refrigerant products that are described as direct substitutes for Refrigerant R-134a. The use of any unauthorized substitute refrigerant can severely damage the A/C components. If repair is required, use only new or recycled Refrigerant R-134a.

NOTICE: **To avoid contamination of the Air Conditioning (A/C) system:**

- Never open or loosen a connection before recovering the refrigerant.
- When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.
- Evacuate a system that has been opened to install a new component or one that has discharged through leakage before charging.
- Seal open fittings with a cap or plug immediately after disconnecting a component from the system.
- Clean the outside of the fittings thoroughly before disconnecting a component from the system.

- Do not remove the sealing caps from a new component until ready to install.
- Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use and install the cap immediately after using. Store the oil in a clean, moisture-free container.
- Install a new O-ring seal before connecting an open fitting. Coat the fitting and O-ring seal with mineral oil before connecting.
- When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that can chafe the line.
- Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.
- When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.
- Do not open a refrigerant system or uncap a new component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.

The manual climate control system heats or cools the vehicle depending on the function selector switch position and the temperature selected.

- The function selector switch position determines heating or cooling, air distribution and enables blower motor operation.
- The temperature control setting determines the air temperature.
- The blower motor switch varies the blower motor speed.

The Dual Automatic Temperature Control (DATC) system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.
- The driver side and passenger side temperature settings can be individually controlled.

The system components are the following:

- A/C compressor
- A/C compressor clutch assembly
- A/C condenser core
- A/C evaporator core
- Suction accumulator
- Connecting refrigerant lines
- A/C evaporator core orifice
- A/C cycling switch
- A/C pressure transducer
- Heater core and evaporator core housing
- HVAC module - DATC
- Manual climate control assembly
- Blower switch (manual system)
- Temperature blend door actuator(s)
- Blower motor resistor or speed control module
- Blower motor
- Ambient temperature sensor
- In-vehicle temperature sensor
- Solar radiation sensor
- Auxiliary connecting refrigerant lines
- Auxiliary heater core and evaporator core housing

- Auxiliary A/C evaporator core
- Auxiliary climate control assembly
- Auxiliary blower motor
- Auxiliary blower motor resistor

Climate Control System Operation

Manual Climate Control System

The manual climate control system operation is determined by the settings on the climate control assembly. The climate control assembly includes a serviceable function selector switch and blower motor switch. The temperature control switch, A/C request switch and rear window defrost switch are integral to the climate control assembly and are serviced as an assembly.

The blower motor switch:

- sets the front blower motor speed.
- directs the blower motor path to ground through the blower motor resistor to allow blower motor operation in LO, MED-LO and MED-HI.
- actuates the high speed blower motor relay, giving the blower motor a direct path to ground which allows the blower motor to operate in HI.

The temperature control switch:

- is a potentiometer that outputs a variable voltage to the temperature blend door actuator to set the position of the temperature blend door.
- initiates closing of the heater control valve. When set to full COOL, a lever on the temperature blend door pivot shaft depresses the pintle of the heater control valve vacuum switch. The heater control valve vacuum switch then applies vacuum to the heater control valve, closing off engine coolant flow to the heater core.
- is serviced only with the climate control assembly.

The function selector switch setting:

- determines where the system airflow is directed.
- enables blower motor operation.
- enables auxiliary blower motor operation, if equipped, by supplying voltage to the auxiliary blower motor relay.
- commands A/C compressor operation in MAX A/C, FLOOR/DEFROST and DEFROST.

The A/C request switch:

- can command the A/C compressor on when the function selector switch is in PANEL, FLOOR/PANEL and FLOOR when the A/C request switch is pressed.
- is inoperative in MAX A/C, OFF, FLOOR/DEFROST and DEFROST.
- indicator illuminates when the function selector switch is in MAX A/C and cannot be toggled.
- indicator does not illuminate in OFF and cannot be toggled.
- indicator does not illuminate in FLOOR/DEFROST and DEFROST and cannot be toggled. The A/C compressor will not operate if the outside air temperature is below -1°C (30°F). The A/C compressor will resume operation when the outside air temperature rises above 2°C (35°F).
- is serviced only with the climate control assembly.

Dual Automatic Temperature Control (DATC) System

The DATC system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.
- The temperature control setting determines the desired air temperature.
- The blower motor control override buttons vary the blower motor speed.
- The driver side and passenger side temperature settings can be individually controlled.

The DATC system operation is determined by the settings on the HVAC module - DATC . The DATC system automatically maintains a selected temperature for vehicle interior comfort, including capabilities to maintain separate temperature settings for the driver and front passenger. The electronic temperature control capabilities are achieved by splitting the air distribution system internally and utilizing 2 individually operated temperature blend doors. The DATC system is composed of the HVAC module - DATC , solenoid and manifold assembly, blower motor speed control, 4 vacuum control motors, 2 temperature blend door actuators, in-car temperature sensor, ambient air temperature sensor and solar radiation sensor to control the various functions.

When the HVAC module - DATC is set to AUTO:

- the air distribution direction, heater control valve operation and blower motor speed are automatically controlled based on the temperature(s) selected.

The HVAC module - DATC manual override settings:

- allow the air distribution direction to be manually selected.
- allow the blower motor speed to be manually selected.
- allow RECIRCULATION mode to be manually selected except in FLOOR/DEFROST and DEFROST. The A/C request can be cancelled by pressing the A/C request switch, turning the indicator off.
- allow A/C compressor operation to be manually selected except in FLOOR/DEFROST and DEFROST.

The HVAC module - DATC also includes:

- an EXT button to monitor ambient (outside) air temperature. By pressing the EXT button the ambient temperature will be displayed on the HVAC module - DATC display until the EXT button is pressed again.
- a F°/C° temperature conversion button to toggle the temperature being displayed from Fahrenheit and Celsius.
- a rear window defrost button (Explorer only). Refer to Section 501-11 .

Dual temperature control can be enabled in AUTO or in all manual override settings. When the HVAC module - DATC is set to DUAL:

- the DATC system enables varying temperatures to be selected by the driver and the front passenger. Dual temperature control is indicated by the presence of 2 temperature settings on the HVAC module - DATC display. To return to single temperature control press the DUAL button, turning the DUAL button indicator off and the front passenger temperature display off.
- the air distribution direction and the blower motor speed cannot be varied between the driver and front passenger. Only the temperature settings can be varied.
- the system will favor the driver temperature setting if the driver and front passenger temperature set

points vary greatly.

External Temperature Display

The external temperature is displayed when the EXT button is pressed. While the actual external temperature can vary continuously, the value that is displayed will update at a specific rate depending on whether or not the engine is "hot" and whether or not the vehicle is moving.

When the external temperature is rising, the display will update slowly.

Updates (when the actual external temperature is higher than currently displayed value) will be limited to 0.6°C (1°F) every 20 seconds while the vehicle is moving at greater than 40 km/h (25 mph) for more than 90 seconds OR 0.6°C (1°F) every 20 minutes if the vehicle is not moving at this speed. This is to prevent the heat from the engine compartment from affecting the accuracy of the display.

When the external temperature is dropping, the display will update quickly.

Updates (when the actual external temperature is lower than currently displayed value) will only be limited to 0.6°C (1°F) every 2 seconds (regardless of vehicle speed). Consequently the display will essentially follow the drop experienced by the external temperature thermistor.

Auxiliary Climate Control System

NOTE: Auxiliary climate control system not available on Sport Trac model.

An auxiliary climate control system is available as optional equipment. The auxiliary climate control system operation is determined by the settings on the front auxiliary climate control assembly. The auxiliary climate control assemblies include a blower motor switch, temperature control switch and air distribution mode switch, none of which can be individually serviced.

On vehicles with manual climate control the auxiliary blower motor operation is enabled when the function selector switch is in any position except OFF. The auxiliary system air can be cooled below ambient temperature only when A/C compressor operation has been requested by the settings of the climate control assembly of the base (front) system. The auxiliary system air can be heated at any time, the heater control valve does not affect the auxiliary climate control system operation.

On vehicles with DATC the auxiliary blower motor is operational regardless of the DATC system setting. The auxiliary system air can be cooled below ambient temperature only when A/C compressor operation has been requested by the settings of the HVAC module - DATC . The auxiliary system air can be heated at any time, the heater control valve operation does not affect the auxiliary climate control system.

The front auxiliary climate control assembly:

- blower motor switch controls the auxiliary blower motor speed. The blower motor speed can be set to OFF, MED-LO, MED-HI or HI.
- air distribution mode switch toggles airflow between the overhead vents and the floor vent by outputting signals to the auxiliary airflow mode door actuator which positions the auxiliary airflow mode door in all blower motor switch positions. Back-lit icons on the front climate control display indicate the source of the auxiliary system airflow.
- temperature control switch is a potentiometer that outputs a variable voltage to the auxiliary temperature blend door actuator to set the position of the auxiliary temperature blend door in all blower motor switch positions. The temperature of the auxiliary system air may be affected by the manual climate control assembly or HVAC module - DATC settings (as equipped). When A/C

compressor operation has not been initiated (A/C compressor commanded on) by the manual climate control assembly or the HVAC module - DATC (as equipped), the auxiliary climate control system cannot cool the air below that of the ambient temperature.

System Airflow Description - Manual Climate Control

MAX A/C

When MAX A/C is selected:

- the air inlet door vacuum control motor is at full vacuum, closing off outside air and admitting only recirculated air.
- the panel door vacuum control motor is at full vacuum and the defrost door and floor door vacuum control motors are at no vacuum, directing airflow to the instrument panel A/C registers. A small amount of airflow from the floor duct, defroster duct and side window demisters will be present.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core. Otherwise, blended air temperature is available.
- air will be drawn from the recirculated air inlet by the blower motor. When the temperature selection is in the full COOL position, the airflow will be diverted past the heater core and then into the passenger compartment through the instrument panel A/C registers.
- the A/C request switch will be illuminated and will be disabled.
- The A/C compressor will not operate if the outside air temperature is below -1°C (30°F). The A/C compressor will resume operation when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.
- the auxiliary blower motor is enabled, if equipped.

PANEL

When PANEL is selected:

- the air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the panel door vacuum control motor is at full vacuum and the defrost door and floor door vacuum control motors are at no vacuum, directing airflow to the instrument panel A/C registers. A small amount of airflow from the floor duct, defroster duct and side window demisters will be present.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core. Otherwise, blended air temperature is available.
- the A/C request switch will be enabled. The A/C compressor can operate and the indicator will be illuminated if the A/C request switch is selected and if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.
- the auxiliary blower motor is enabled, if equipped.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the panel door and floor door vacuum control motors are at full vacuum and the defrost door vacuum control motor is at no vacuum, directing airflow to the floor duct and the instrument panel A/C registers. A small amount of airflow from the defroster duct and side window demisters will be

present.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core. Otherwise, blended air temperature is available.
- the A/C request switch will be enabled. The A/C compressor can operate and the indicator will be illuminated if the A/C request switch is selected and if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.
- the auxiliary blower motor is enabled, if equipped.

OFF

When OFF is selected:

- the air inlet door vacuum control motor is at full vacuum, closing off outside air from entering the passenger compartment.
- the defrost door vacuum control motor is at full vacuum and the panel door and floor door vacuum control motors are at no vacuum, closing off airflow to the passenger compartment outlets.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core.
- the A/C request switch is disabled.
- the blower motor is OFF.
- the auxiliary blower motor is disabled, if equipped.

FLOOR

When FLOOR is selected:

- the air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the floor door and defrost door vacuum control motors are at full vacuum and the panel door vacuum control motors are at no vacuum, directing airflow to the floor duct and the defroster duct. A small amount of airflow from the instrument panel A/C registers, defroster duct and side window demisters will be present.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core. Otherwise, blended air temperature is available.
- the A/C request switch will be enabled. The A/C compressor can operate and the indicator will be illuminated if the A/C request switch is selected and if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.
- the auxiliary blower motor is enabled, if equipped.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- the air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the floor door vacuum control motor is at full vacuum and the defrost door and panel door vacuum control motors are at no vacuum, directing airflow to the floor duct, the defroster duct and the side window demisters. A small amount of airflow from the instrument panel A/C registers will be present.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core. Otherwise, blended air temperature is available.

- the A/C request switch will not illuminate and will be disabled. To reduce fogging, the A/C compressor will operate automatically if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.
- the auxiliary blower motor is enabled, if equipped.

DEFROST

When DEFROST is selected:

- the air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the floor door, panel door and defrost door vacuum control motors are at no vacuum, directing airflow to the defroster duct and the side window demisters. A small amount of airflow from the instrument panel A/C registers and floor duct will be present.
- the heater control valve is at full vacuum when the temperature selection is in the full COOL position, preventing the flow of hot coolant to the heater core. Otherwise, blended air temperature is available.
- the A/C request switch will not illuminate and will be disabled. To reduce fogging, the A/C compressor will operate automatically if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.
- the auxiliary blower motor is enabled, if equipped.

System Airflow Description - Dual Automatic Temperature Control (DATC) System

AUTO

When AUTO is selected:

- the temperature control setting(s) is/are manually set to the desired setting(s).
- the air inlet door vacuum control motor is controlled by the HVAC module - DATC , based on the temperature settings.
- the mode door vacuum control motors are controlled by the HVAC module - DATC , based on the temperature settings.
- the heater control valve is by the HVAC module - DATC based on the temperature settings.
- the A/C request is controlled by the HVAC module - DATC based on the temperature settings. The A/C compressor will not operate if the outside air temperature is below -1°C (30°F). The A/C compressor will resume operation when the outside air temperature rises above 2°C (35°F).
- the A/C request switch or the RECIRC button, if pressed, will transfer the system to manual operation.
- the blower motor is ON. The blower motor speed is automatically controlled by the HVAC module - DATC based on the temperature settings, but can be manually overridden.

OFF

When OFF is selected:

- the air inlet door vacuum control motor is at full vacuum, closing off outside air to the passenger compartment.
- the defrost door vacuum control motor is at full vacuum and the floor door and panel door vacuum control motors are at no vacuum, closing off airflow to the passenger compartment outlets.

- the heater control valve is at full vacuum, preventing the flow of hot coolant to the heater core.
- the blower motor is OFF.

PANEL

When PANEL is selected:

- the RECIRC button is enabled. If the RECIRC button is pressed (indicator ON) the air inlet door vacuum control motor is at full vacuum, closing off outside air to the passenger compartment. If the RECIRC button is not selected (indicator OFF), the air inlet door vacuum control motor will be at no vacuum, admitting only outside air into the passenger compartment.
- the defrost door and panel door vacuum control motors are at full vacuum and the floor door vacuum control motor is at no vacuum, directing airflow to the instrument panel A/C registers. A small amount of airflow from the floor duct, defroster duct and side window demisters will be present.
- the heater control valve is controlled by the HVAC module - DATC based on the temperature settings.
- temperature control can be adjusted by directing the airflow through and around the heater core. Only when A/C compressor operation has been selected by pressing the A/C request switch (indicator ON) can the airflow temperature be cooled below that of the ambient (outside) air temperature.
- the A/C request switch is enabled. When the A/C request switch is pressed (indicator ON), the A/C compressor can operate if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the RECIRC button is enabled. If the RECIRC button is pressed (indicator ON), the air inlet door vacuum control motor is at full vacuum, closing off outside air to the passenger compartment. If the RECIRC button is not selected (indicator OFF) the air inlet door vacuum control motor will be at no vacuum, admitting only outside air into the passenger compartment.
- the defrost door, panel door and floor door vacuum control motors are at full vacuum, directing airflow to the instrument panel A/C registers and to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- the heater control valve is controlled by the HVAC module - DATC based on the temperature settings.
- temperature control can be adjusted by directing the airflow through and around the heater core. Only when A/C compressor operation has been selected by pressing the A/C request switch (indicator ON) can the airflow temperature be cooled below that of the ambient (outside) air temperature.
- the A/C request switch is enabled. When the A/C request switch is pressed (indicator ON), the A/C compressor can operate if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.

FLOOR

When FLOOR is selected:

- the RECIRC button is enabled. If the RECIRC button is pressed (indicator ON), the air inlet door vacuum control motor is at full vacuum, closing off outside air to the passenger compartment. A RECIRC door time-out strategy will be used to prevent fogging and the RECIRC function will

automatically be turned off after approximately 4 minutes. If the RECIRC button is not selected (indicator OFF), the air inlet door vacuum control motor will be at no vacuum, admitting only outside air into the passenger compartment.
- the defrost door and floor door vacuum control motors are at full vacuum and the panel door vacuum control motor is at no vacuum, directing airflow to the floor duct. A small amount of airflow from the instrument panel A/C registers, defroster duct and side window demisters will be present.
- the heater control valve is controlled by the HVAC module - DATC based on the temperature settings.
- temperature control can be adjusted by directing the airflow through and around the heater core. Only when A/C compressor operation has been selected by pressing the A/C request switch (indicator ON) can the airflow temperature be cooled below that of the ambient (outside) air temperature.
- the A/C request switch is enabled. When the A/C request switch is pressed (indicator ON), the A/C compressor can operate if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- the RECIRC button is disabled. The air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the floor door vacuum control motor is at full vacuum and the defrost door and panel door vacuum control motors are at no vacuum, directing airflow to the floor duct, defroster duct and side window demisters. A small amount of airflow from the instrument panel A/C registers will be present.
- the heater control valve is controlled by the HVAC module - DATC based on the temperature settings.
- temperature control can be adjusted by directing the airflow through and around the heater core.
- the A/C request switch will be disabled and will not illuminate. The A/C compressor will operate automatically if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.

DEFROST

When DEFROST is selected:

- the RECIRC button is disabled. The air inlet door vacuum control motor is at no vacuum, admitting only outside air into the passenger compartment.
- the floor door, defrost door and panel door vacuum control motors are at no vacuum, directing airflow to the defroster duct and side window demisters. A small amount of airflow from the instrument panel A/C registers and the floor duct will be present.
- the heater control valve is controlled by the HVAC module - DATC based on the temperature settings.
- temperature control can be adjusted by directing the airflow through and around the heater core.
- the A/C request switch will be disabled and will not illuminate. The A/C compressor will operate automatically if the outside air temperature is not below -1°C (30°F). If the outside air temperature has gone below -1°C (30°F), A/C compressor operation will resume when the outside air temperature rises above 2°C (35°F).
- the blower motor is ON.

Climate Control System

Special Tool(s)

 ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
 ST2574-A	Flex Probe Kit 300-NUD105-R025DE or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST1474-A	Pressure Test Kit 014-R1072 or equivalent
 ST1928-A	R-134a Manifold Gauge Set 176-R032A or equivalent
 ST2351-A	Refrigerant Leak Detector 216-00001 or equivalent
 ST3094-A	Test Light SGT27000 or equivalent 250-300 mA incandescent bulb test lamp
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

Compressor Anti-Slugging Strategy (CASS)

Liquid refrigerant may accumulate in the A/C compressor under certain conditions. To alleviate damage to the A/C compressor, Compressor Anti-Slugging Strategy (CASS) is utilized.

CASS is initiated only under specific conditions:

- The ignition is off for more than 8 hours
- The ambient temperature is above -4°C (25°F)
- Battery voltage is above 8.5 volts during engine cranking

When these conditions are present, the PCM will activate the A/C control relay prior to cranking of the engine. The A/C control relay engages the A/C compressor for approximately 4-15 A/C compressor

revolutions or a maximum of 2 seconds (depending upon vehicle application), allowing the liquid refrigerant to be pushed from the A/C compressor. CASS is initiated by the PCM regardless of the climate system settings.

The Refrigerant Cycle

During stabilized conditions (A/C system shutdown), the refrigerant is in a vaporized state and pressures are equal throughout the system. When the A/C compressor is in operation, it increases pressure on the refrigerant vapor, raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the condenser core.

The condenser core, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The liquid refrigerant, still at high pressure, exits from the bottom of the condenser core and enters the inlet side of the evaporator core orifice.

The evaporator core orifice is the restriction in the refrigerant system that creates the low pressure drop in the evaporator core and separates the high- and low-pressure sides of the A/C system. As the liquid refrigerant leaves this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the evaporator core, it absorbs heat from the passenger compartment airflow passing over the plate/fin sections of the evaporator core. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler passenger compartment air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The suction accumulator is designed to remove moisture from the refrigerant and to prevent any liquid refrigerant that may not have been vaporized in the evaporator core from reaching the A/C compressor. The A/C compressor is designed to pump refrigerant vapor only, as liquid refrigerant will not compress and can damage the A/C compressor.

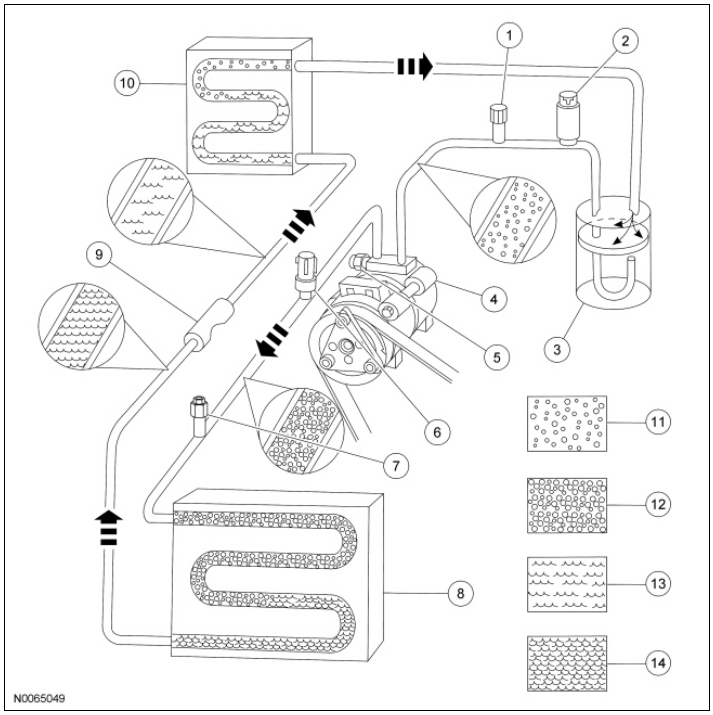
The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

The A/C cycling switch interrupts compressor operation before the external temperature of the evaporator core gets low enough to cause the condensed water vapor (excess humidity) to turn to ice. It does this by monitoring low side line pressure. It is known that a refrigerant pressure of approximately 210 kPa (30 psi) will yield an operating temperature of 0°C (32°F). The A/C cycling switch controls system operation in an effort to maintain this temperature.

The high side line pressure is also monitored so that A/C compressor operation can be interrupted if system pressure becomes too high.

The A/C pressure relief valve will open and vent refrigerant to relieve unusually high system pressure.

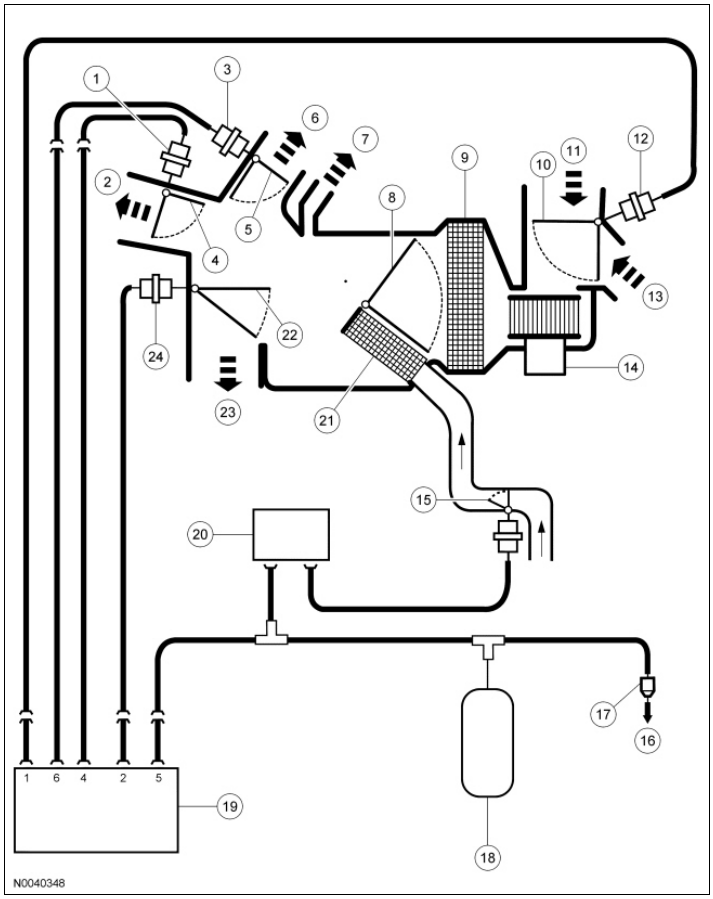
Clutch Cycling Orifice Tube Type Refrigerant System



Item	Description
1	A/C charge valve port (low side)
2	A/C cycling switch
3	Suction accumulator
4	A/C compressor
5	A/C compressor pressure relief valve
6	A/C pressure transducer
7	A/C charge valve port (high side)
8	Condenser core
9	Evaporator core orifice tube
10	Evaporator core
11	Low-pressure vapor
12	High-pressure vapor
13	Low-pressure liquid
14	High-pressure liquid

Vacuum System

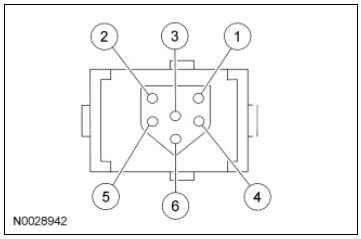
Vacuum Schematic - Manual Climate Control System



Item	Part Number	Description
1	18A318	Vacuum control motor - panel door
2	-	Panel airflow
3	18A318	Vacuum control motor - defrost door
4	-	Panel door (full vacuum position)
5	-	Defrost door (full vacuum position)
6	-	Defrost airflow
7	-	Side window demister airflow
8	-	Temperature blend door (full heat position)
9	19860	Evaporator core (part of 19850)
10	-	Air inlet door (full vacuum position)
11	-	Outside air inlet
12	18A318	Vacuum control motor - air inlet door
13	-	Recirculated air inlet
14	19805	Blower motor
15	18495	Heater control valve (full vacuum position)
16	-	Vacuum source
17	-	A/C vacuum check valve
18	19A566	Vacuum reservoir
19	19B888	Function selector switch
20	-	Heater control valve vacuum switch
21	18476	Heater core
22	-	Floor door (full vacuum position)

23	-	Floor airflow
24	18A318	Vacuum control motor - floor door

Vacuum Connector End View - Function Selector Switch



Port No.	Hose Color	Function
1	White	Air inlet door
2	Blue	Floor door
3	-	Not used
4	Red	Panel door
5	Black	Vacuum source
6	Yellow	Defrost door

Vacuum Application Chart - Manual Climate Control

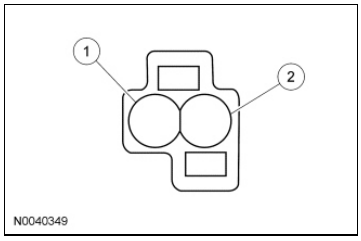
Port No.	Color	Function	Function Selector Switch Position						
			MAX A/C	PANEL	FLOOR/ PANEL	OFF	FLOOR	FLOOR/ DEF	DEF
1	White	Air inlet door	V	NV	NV	V	NV	NV	NV
2	Blue	Floor door	NV	NV	V	NV	V	V	NV
3 [a]	-	None	V	V	V	V	V	V	NV
4	Red	Panel door	V	V	V	NV	NV	NV	NV
5	Black	Vacuum source	V	V	V	V	V	V	V
6	Yellow	Defrost door	NV	NV	NV	V	V	NV	NV

[a] Vacuum port 3 is not currently used and is sealed by the vacuum harness connector when connected to the function selector switch.

V = Vacuum

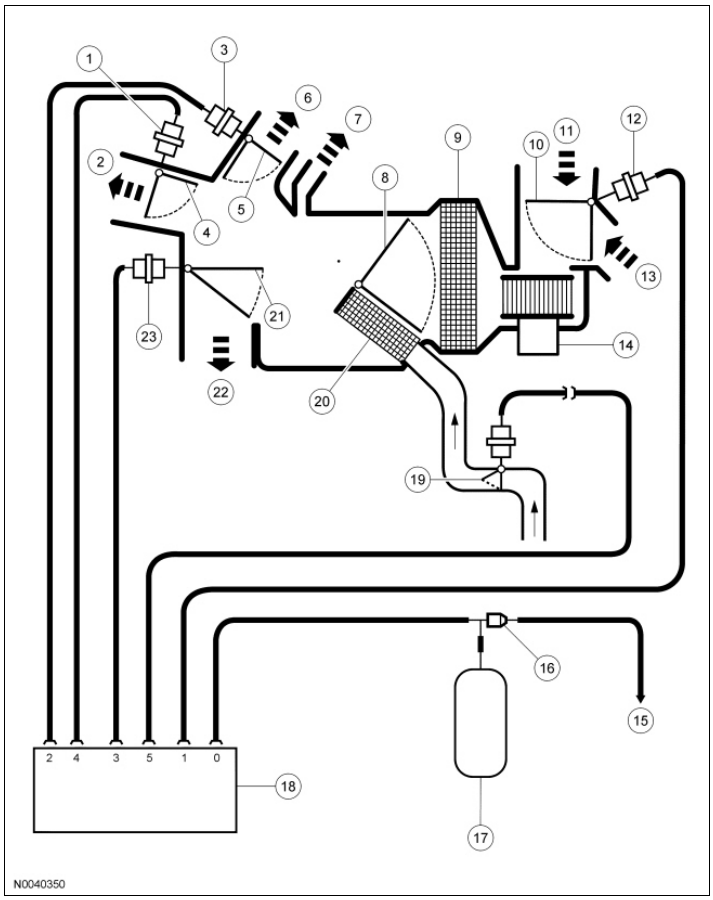
NV= No Vacuum

Vacuum Connector End View - Heater Control Valve Vacuum Switch



Item	Hose Color	Function
1	Gray	Heater control valve
2	Black	Vacuum source

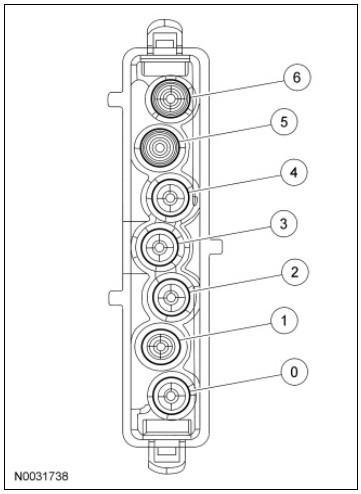
Vacuum Schematic - Dual Automatic Temperature Control (DATC) System



Item	Part Number	Description
1	18A318	Vacuum control motor - panel door
2	-	Panel airflow
3	18A318	Vacuum control motor - defrost door
4	-	Panel door (full vacuum position)
5	-	Defrost door (full vacuum position)
6	-	Defrost airflow
7	-	Side window demister airflow
8	-	Temperature blend door (full heat position)
9	19860	Evaporator core (part of 19850)

10	-	Air inlet door (full vacuum position)
11	-	Outside air inlet
12	18A318	Vacuum control motor - air inlet door
13	-	Recirculated air inlet
14	19805	Blower motor
15	-	Vacuum source
16	-	A/C vacuum check valve
17	19A566	Vacuum reservoir
18	19D611	Solenoid and manifold assembly
19	18495	Heater control valve
20	18476	Heater core
21	-	Floor door (full vacuum position)
22	-	Floor airflow
23	18A318	Vacuum control motor - floor door

Vacuum Connector End View - Solenoid and Manifold Assembly



Port No.	Hose Color	Function
0	Black	Vacuum source
1	White	Air inlet door
2	Yellow	Defrost door
3	Blue	Floor door
4	Red	Panel door
5	Gray	Heater control valve
6	-	Not used

Vacuum Application Chart - Dual Automatic Temperature Control (DATC)

Color	Function	Manual Override Buttons					
		OFF	PANEL	FLOOR/ PANEL	FLOOR	FLOOR/ DEFROST	DEFROST
Black	Vacuum source	V	V	V	V	V	V
White [a]	Air inlet door	V	V/NV	V/NV	V/NV	NV	NV
Yellow	Defrost door	V	V	V	V	NV	NV
Blue	Floor door	NV	NV	V	V	V	NV
Red	Panel door	NV	V	V	NV	NV	NV
Gray	Heater control valve [b]	V	V/NV	V/NV	V/NV	V/NV	V/NV

[a] The dual automatic temperature control (DATC) system may be manually set to enable or disable the recirculation of cabin air by pressing the RECIRCULATION manual override button in all manual override modes except OFF, DEFROST and FLOOR/DEFROST.
[b] The automatic temperature control solenoid and manifold will supply vacuum and close the heater control valve depending on the HVAC module - DATC settings and ambient conditions in any setting except OFF.

Inspection and Verification

1. Verify the customer concern by operating the climate control system to duplicate the condition.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Loose, missing or damaged A/C compressor drive belt • A/C compressor inoperative • Loose, misrouted or damaged vacuum lines • Broken or leaking vacuum control motor [a] • Discharged A/C system • Broken or leaking refrigerant lines [a]	• Smart Junction Box (SJB) fuse(s): ♦ 18 (10A) ♦ 20 (10A) ♦ 28 (10A) • Battery Junction Box (BJB) fuse(s): ♦ 16 (40A) ♦ 18 (30A) ♦ 35 (10A) ♦ 40 (15A) • Blower motor • Loose or disconnected A/C clutch connector • Circuitry open/shorted • Disconnected, loose fitting or incorrectly installed electrical connectors and pins

[a] A leak in the vacuum control circuit may occur during acceleration (slow leak), may exist at all times (large leak) and may exist only when specific functions are selected (indicating a leak in that portion of the circuit). The vacuum hoses used in the passenger compartment control circuit are constructed from PVC plastic material. The vacuum hoses used in the engine compartment are constructed of Hytrel®. Because of the materials used, never pinch the vacuum hoses off during diagnosis to locate a leak. A golf tee can be used as a plug when it is necessary to plug one end of the vacuum hose for leak test purposes.

3. As pinpoint tests and measurements are being carried out, be sure to inspect for any disconnected, loose-fitting or incorrectly installed component, module and in-line electrical connectors and pins.
4. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

6. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the VCM .

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to Section 418-00 to diagnose no response from the PCM or HVAC module - Dual Automatic Temperature Control (DATC).

8. Carry out the network test.
   - If the scan tool responds with no communication from one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the Continuous Memory Diagnostic Trouble Codes (CMDTCs).

9. Carry out the self-test diagnostics from the PCM or HVAC module - DATC .

10. **NOTE:** Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to the PCM DTC Chart.

    If any of the DATC DTCs retrieved are related to the concern, go to the HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart. If the PCM DTCs retrieved are related to the concern, go to the PCM DTC Chart. For all other DTCs, refer to Section 419-10 .

11. If no DTCs related to the concern are retrieved, go to the GO to Symptom Chart - Climate Control Systems or GO to Symptom Chart - NVH .

DTC Charts

PCM DTC Chart

DTC	Description	Action to Take
P0532	A/C Pressure Refrigerant Sensor A Circuit Low	GO to Pinpoint Test A .
P0533	A/C Refrigerant Pressure Sensor A Circuit High	GO to Pinpoint Test A .
P0645	Air Conditioning Clutch Relay (A/CCR) Control Circuit	GO to Pinpoint Test B .

P1464	A/C Demand Out Of Self Test Range	If the HVAC selector was not in the OFF position, place it in the OFF position, CLEAR the DTCs and REPEAT the self-test. If the DTC does not return, ignore the DTC and continue diagnostics. If the DTC returns, GO to Pinpoint Test N . [a]
All Other DTCs	-	REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

[a] PCM DTC P1464 will set if the function selector is in PANEL with A/C button pressed, DEFROST or MAX A/C mode when the on-demand self test is being run.

HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart

NOTE: Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to the PCM DTC Chart.

DTC	Description	Action to Take
B1251	Air Temperature Internal Sensor Circuit Open	GO to Pinpoint Test D .
B1253	Air Temperature Internal Sensor Circuit Short to Ground	GO to Pinpoint Test D .
B1255	Air Temperature External Sensor Circuit Open	GO to Pinpoint Test E .
B1257	Air Temperature External Sensor Circuit Short to Ground	GO to Pinpoint Test E .
B1259	Solar Radiation Sensor Circuit Open	GO to Pinpoint Test F .
B1261	Solar Radiation Sensor Circuit Short to Ground	GO to Pinpoint Test F .
B1676	Battery Pack Voltage Out of Range	GO to Pinpoint Test G .
B2266	Left Side Blend Door Circuit Failure	GO to Pinpoint Test C .
B2267	Right Side Blend Door Circuit Failure	GO to Pinpoint Test C .
B2477	Module Configuration Failure	Configure HVAC module - Dual Automatic Temperature Control (DATC).

Symptom Chart - Climate Control Systems

Symptom Chart - Climate Control Systems

Symptom Chart - NVH

Symptom Chart - NVH

NOTE: NVH symptoms will be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04 . Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for

the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

ConditionPossible SourcesAction

- Noisy A/C compressor
- A/C compressor clutch air gap out of specification
- CHECK and ADJUST the A/C compressor clutch gap if necessary. REFER to Air Conditioning (A/C) Clutch Air Gap Adjustment in this section. TEST the system for normal operation.
- If the A/C compressor clutch gap is OK, INSTALL an A/C compressor clutch. REFER to Section 412-01 . TEST the system for normal operation.
- A/C compressor pulley bearing worn
- INSPECT the A/C compressor pulley bearing for roughness. If bearing roughness is found, INSTALL an A/C compressor pulley. REFER to Section 412-01 . TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: DTC P0532 or P0533

Refer to Wiring Diagrams Cell 23 for schematic and connector information.

Refer to Wiring Diagrams Cell 24 for schematic and connector information.

Normal Operation

Under normal operation, the A/C pressure transducer receives a ground from the PCM. A 5-volt reference voltage is supplied to the A/C pressure transducer from the PCM. The A/C pressure transducer then sends a voltage to the PCM to indicate the A/C pressure.

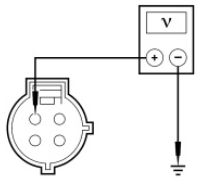
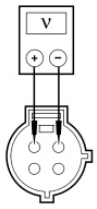
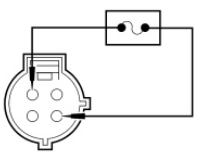
- DTC P0532 (A/C Pressure Refrigerant Sensor A Circuit Low) - The A/C pressure transducer inputs a voltage to the PCM. If the voltage is below the calibrated level, this DTC sets.
- DTC P0533 (A/C Pressure Refrigerant Sensor A Circuit High) - The A/C pressure transducer inputs a voltage to the PCM. If the voltage is above the calibrated level, this DTC sets.

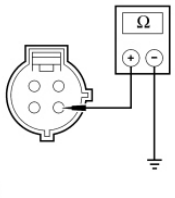
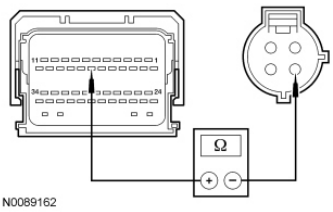
This pinpoint test is intended to diagnose the following:

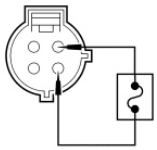
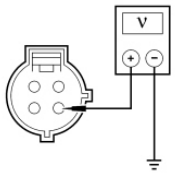
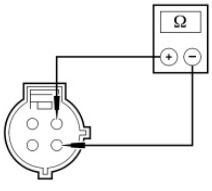
- Wiring, terminals or connectors
- A/C pressure transducer
- PCM

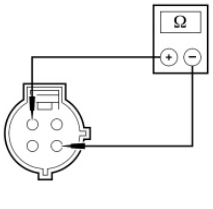
PINPOINT TEST A: DTC P0532 OR P0533

Test Step	Result / Action to Take
A1 CHECK THE PCM OUTPUT VOLTAGE	

• Ignition OFF. • Disconnect: A/C Pressure Transducer C1078. • Ignition ON. • Measure the voltage between ground and A/C pressure transducer C1078-2, circuit LE423 (GN/VT), harness side.  N0082573 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** GO to A2 . **No** If the voltage is less than 4.7 volts, REPAIR circuit LE423 (GN/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the voltage is greater than 5.1 volts, REPAIR circuit LE423 (GN/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A2 CHECK THE PCM SENSOR GROUND	
• Measure the voltage between A/C pressure transducer C1078-1, circuit RE407 (YE/VT), harness side and A/C pressure transducer C1078-2, circuit LE423 (GN/VT), harness side.  A0047632 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** If diagnosing **DTC P0532** , GO to A3 . If diagnosing **DTC P0533** , GO to A6 . **No** REPAIR circuit RE407 (YE/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A3 CHECK THE A/C PRESSURE TRANSDUCER HIGH	
• Enter the following diagnostic mode on the scan tool: A/C Pressure (ACP_PRESS) PCM PID. • While observing the ACP_PRESS PCM PID, connect a fused jumper between A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C1078-2, circuit LE423 (GN/VT), harness side.  N0082574	**Yes** INSTALL a new A/C pressure transducer. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to A4 .

• **Does the ACP_PRESS PCM PID voltage read greater than 4 volts?**	
A4 CHECK CIRCUIT VH433 (VT/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: PCM C175B. • Measure the resistance between ground and A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side.  A0047688 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to A5 . **No** REPAIR circuit VH433 (VT/OG) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A5 CHECK CIRCUIT VH433 (VT/OG) FOR AN OPEN	
• Measure the resistance between A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side and PCM C175B-18, circuit VH433 (VT/OG), harness side.  N0089162 • **Is the resistance less than 5 ohms?**	**Yes** GO to A8 . **No** REPAIR circuit VH433 (VT/OG) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A6 CHECK THE A/C PRESSURE TRANSDUCER LOW	
• Enter the following diagnostic mode on the scan tool: A/C Pressure (ACP_PRESS) PCM PID. • While observing the ACP_PRESS PCM PID, connect a fused jumper between A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C1078-1, circuit RE407 (YE/VT), harness side.	**Yes** INSTALL a new A/C pressure transducer. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to A7 .

 A0008127 • **Does the ACP_PRESS PCM PID voltage read less than 4.9 volts?**	
A7 CHECK CIRCUIT VH433 (VT/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175B. • Ignition ON. • Measure the voltage between ground and A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side.  A0047689 • **Is any voltage present?**	**Yes** REPAIR circuit VH433 (VT/OG) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to A8 .
A8 CHECK CIRCUIT VH433 (VT/OG) FOR A SHORT TO CIRCUIT LE423 (GN/VT) OR RE407 (YE/VT)	
• Ignition OFF. • **NOTE: For DTC P0532 only.** • Measure the resistance between A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C1078-1, circuit RE407 (YE/VT), harness side.  N0082575 • **NOTE: For DTC P0533 only.** • Measure the resistance between A/C pressure transducer C1078-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C1078-2, circuit LE423 (GN/VT), harness side.	**Yes** GO to A9 . **No** REPAIR circuit VH433 (VT/OG) for a short to circuit LE423 (GN/VT) or RE407 (YE/VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 N0082576 • **Is the resistance greater than 10,000 ohms?**	
A9 CHECK THE PCM CONNECTION	
• Clear the DTCs. • Disconnect all the PCM connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. ♦ incorrectly seated connector. • Connect and correctly seat all the PCM connectors. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P0645

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

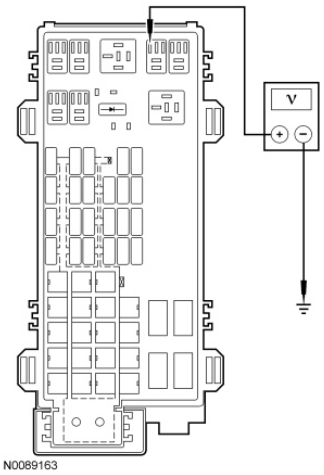
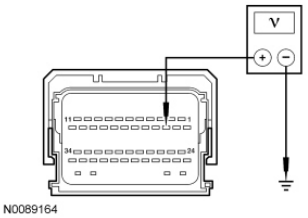
Under normal operation, voltage is provided to the A/C clutch relay coil. When A/C is requested and A/C line pressures allow, a ground is provided to the A/C clutch relay coil from the PCM, energizing the A/C clutch relay.

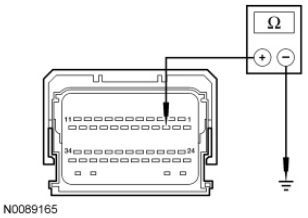
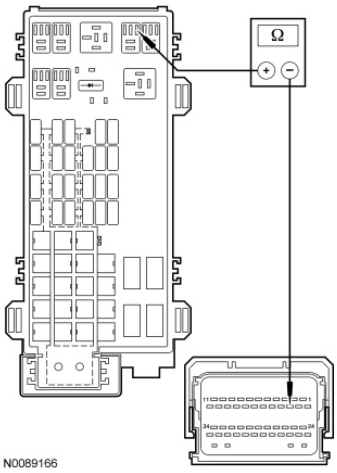
- DTC P0645 (A/C Clutch Relay Control Circuit) - The DTC sets when the PCM grounds the relay circuit, excessive current draw is detected on the relay circuit or, with the relay circuit not grounded by the PCM, voltage is not detected on the relay circuit the PCM expects to detect voltage coming through the relay coil to the relay circuit.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- A/C clutch relay
- PCM

PINPOINT TEST B: DTC P0645

Test Step	Result / Action to Take
B1 CHECK THE VOLTAGE TO THE A/C CLUTCH RELAY	

• Ignition OFF. • Disconnect: A/C Clutch Relay. • Ignition ON. • Measure the voltage between ground and the A/C clutch relay socket pin 2, circuit CBB40 (YE/GN).  N0089163 • **Is the voltage greater than 10 volts?**	**Yes** CARRY OUT the A/C clutch relay component test. Refer to Wiring Diagrams Cell 149 for component testing. If the relay tests OK, GO to B2 . **No** REPAIR circuit CBB40 (YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B2 CHECK CIRCUIT CH302 (WH/BN) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175B. • Ignition ON. • Measure the voltage between ground and PCM C175B-14, circuit CH302 (WH/BN), harness side.  N0089164 • **Is any voltage present?**	**Yes** REPAIR circuit CH302 (WH/BN) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to B3 .
B3 CHECK CIRCUIT CH302 (WH/BN) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and PCM C175B-14, circuit CH302 (WH/BN), harness side.	**Yes** GO to B4 . **No** REPAIR circuit CH302 (WH/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 N0089165 • **Is the resistance greater than 10,000 ohms?**	
B4 CHECK CIRCUIT CH302 (WH/BN) FOR AN OPEN	
• Measure the resistance between A/C clutch relay socket, circuit CH302 (WH/BN) and PCM C175B-14, circuit CH302 (WH/BN), harness side.  N0089166 • **Is the resistance less than 5 ohms?**	**Yes** GO to B5 . **No** REPAIR circuit 321 (GY/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B5 CHECK THE PCM CONNECTION	
• Clear the DTCs. • Disconnect all the PCM connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. ♦ incorrectly seated connector. • Connect and correctly seat all the PCM connectors. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTC B2266 or B2267

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the temperature blend door actuator, the HVAC module supplies voltage and ground to the temperature blend door actuators through the door actuator motor circuits. To reverse the temperature blend door actuator rotation, the HVAC module reverses the voltage and ground circuits.

The temperature blend door actuator feedback resistors are supplied a ground from the HVAC module and a 5-volt reference voltage on the temperature blend door actuator reference circuits. The HVAC module reads the voltage on the temperature blend door actuator feedback circuits to determine the temperature blend door actuator position by the position of the actuator feedback resistor wiper arm.

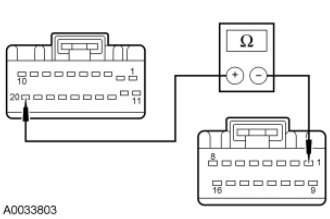
During an actuator calibration cycle, the HVAC module drives the temperature blend door until the door reaches both internal stops in the HVAC case. If the temperature blend door is temporarily obstructed or binding during a calibration cycle, the HVAC module may interpret this as the actual end of travel for the door. When this condition occurs and the HVAC module commands the actuator to its end of travel, the airflow temperature may not be as warm or cold as expected.

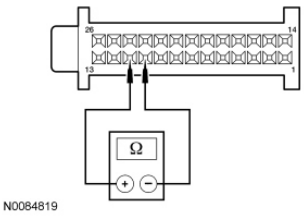
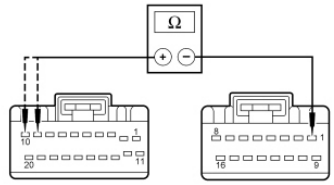
- DTC B2266 (Left Side Blend Door Circuit Failure) - The module senses no change in actuator feedback voltage when the actuator motor has been energized.
- DTC B2267 (Right Side Blend Door Circuit Failure) - The module senses no change in actuator feedback voltage when the actuator motor has been energized.

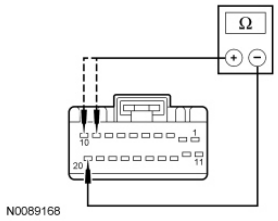
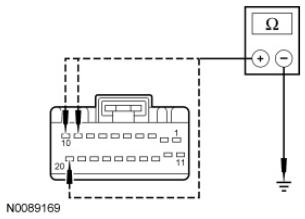
This pinpoint test is intended to diagnose the following:

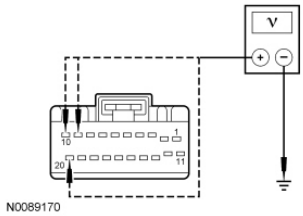
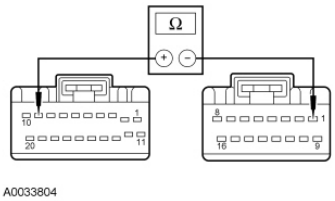
- Wiring, terminals or connectors
- Blend door actuator
- HVAC module - Dual Automatic Temperature Control (DATC)
- Stuck or bound linkage or door

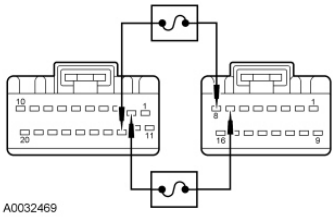
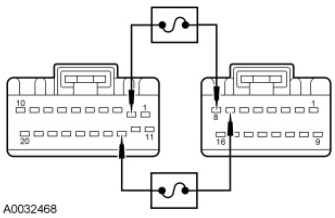
PINPOINT TEST C: DTC B2266 OR B2267

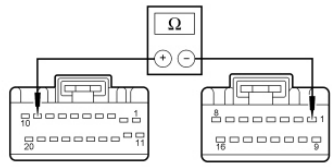
Test Step	Result / Action to Take
C1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE	
• Disconnect: HVAC Module - DATC C228A. • Disconnect: HVAC Module - DATC C228B. • Measure the resistance between HVAC module - DATC C228A-20, circuit LH111 (BN/WH), harness side and HVAC module - DATC C228B-1, circuit RH111 (GY/BU), harness side.  A0033803 • **Is the resistance greater than 500 ohms?**	**Yes** GO to C3 . **No** GO to C2 .
C2 CHECK CIRCUITS RH111 (GY/BU) AND LH111 (BN/WH) FOR A SHORT TOGETHER	

NOTE: Access to the connector in the following step is difficult. Before performing this step, visually inspect the actuator and its harness for obvious damage. If no damage is evident, proceed with the test. • Disconnect: RH blend door actuator C2092. • Measure the resistance between HVAC module - DATC C228A-11, circuit LH111 (BN/WH), harness side and HVAC module - DATC C228A-10, circuit RH111 (GY/BU), harness side.  N0084819 • **Is the resistance greater than 500 ohms?**	**Yes** INSTALL a new RH actuator. REFER to Section 412-01 . TEST the system for normal operation. **No** CARRY OUT the Temperature Blend Door Actuator component test on the LH blend door actuator in this section. If a new actuator is installed, CONNECT the actuator electrical connector before the HVAC module connector(s). This will allow the new actuator to be calibrated when the HVAC module is reconnected. If the actuator tests OK, REPAIR circuits LH111 (BN/WH) and RH111 (GY/BU) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C3 CHECK THE POTENTIOMETER LOW- AND HIGH-SIDE RESISTANCE	
• Measure the **low-side** resistance between HVAC module - DATC C228B-1, circuit RH111 (GY/BU), harness side and the following: ♦ **For DTC B2266** , HVAC module - DATC C228A-9, circuit VH440 (BU/BN), harness side. ♦ **For DTC B2267** , HVAC module - DATC C228A-10, circuit VH441 (WH/BN), harness side.  N0089167 • Measure the **high-side** resistance between HVAC module - DATC C228A-20, circuit LH111 (BN/WH), harness side and the following:	**Yes** GO to C4 . **No** CARRY OUT the Temperature Blend Door Actuator component test in this section. If a new actuator is installed, CONNECT the actuator electrical connector before the HVAC module connector(s). This will allow the new actuator to be calibrated when the HVAC module is reconnected. If the actuator tests OK and: If the **low-side** resistance only is greater than 5,500 ohms, REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the **low-side** resistance only is less than 250 ohms, REPAIR circuit VH440 (BU/BN) or VH411 (VT/GN) for a short to circuit RH111 (GY/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If the **high-side** resistance only is greater than 5,500 ohms, REPAIR circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

♦ **For DTC B2266** , HVAC module - DATC C228A-9, circuit VH440 (BU/BN), harness side. ♦ **For DTC B2267** , HVAC module - DATC C228A-10, circuit VH441 (WH/BN), harness side.  N0089168 • **Is the resistance between 250 and 5,500 ohms?**	If the **high-side** resistance only is less than 250 ohms, REPAIR circuits circuit VH440 (BU/BN) or VH411 (VT/GN) for a short to circuit LH111 (BN/WH). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If both the **high-side and low-side** resistance is greater than 5,500 ohms, REPAIR circuit VH440 (BU/BN) or VH411 (VT/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C4 CHECK CIRCUIT LH111 (BN/WH), VH440 (BU/BN) OR CIRCUIT VH441 (WH/BN) FOR A SHORT TO GROUND	
• Measure the resistance between ground and the following: ♦ HVAC module - DATC C228A-20, circuit LH111 (BN/WH), harness side. ♦ **For DTC B2266** , HVAC module - DATC C228A-9, circuit VH440 (BU/BN), harness side. ♦ **For DTC B2267** , HVAC module - DATC C228A-10, circuit VH441 (WH/BN), harness side.  N0089169 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to C5 . **No** REPAIR circuit LH111 (BN/WH), VH441 (WH/BN) or VH440 (BU/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C5 CHECK CIRCUIT LH111 (BN/WH), VH440 (BU/BN) OR CIRCUIT VH441 (WH/BN) FOR A SHORT TO VOLTAGE	

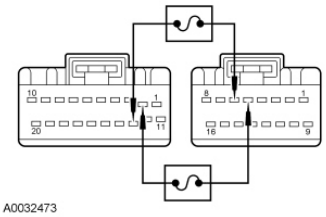
• Ignition ON. • Measure the voltage between ground and the following: ♦ HVAC module - DATC C228A-20, circuit LH111 (BN/WH), harness side. ♦ **For DTC B2266** , HVAC module - DATC C228A-9, circuit VH440 (BU/BN), harness side. ♦ **For DTC B2267** , HVAC module - DATC C228A-10, circuit VH441 (WH/BN), harness side.  N0089170 • **Are any voltages present?**	**Yes** REPAIR circuit RH111 (GY/BU), VH441 (WH/BN) or VH440 (BU/BN) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** **For DTC B2266** , GO to C6 . **For DTC B2267** , GO to C7 .
C6 CHECK THE BLEND DOOR ACTUATOR OPERATION	
NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short. • With the fused jumper connections made as directed below, measure the resistance between HVAC module - DATC C228B-1, circuit RH111 (GY/BU), harness side and HVAC module - DATC C228A-9, circuit VH440 (BU/BN), harness side.  A0033804 • Connect fused jumper wires between: ♦ HVAC module - DATC C228B-8, circuit CH239 (BU/WH), harness side and HVAC module - DATC C228A-13, circuit SBP28 (GN/RD), harness side.	**Yes** INSPECT for broken door and linkage. REPAIR as necessary. If no condition is found, GO to C9 . **No** GO to C8 .

♦ HVAC module - DATC C228B-7, circuit CH237 (VT/GY), harness side and HVAC module - DATC C228A-2, circuit GD145 (BK/BU), harness side.  A0032469 • Remove the fused jumpers. • Connect fused jumper wires between: ♦ HVAC module - DATC C228B-7, circuit CH237 (VT/GY), harness side and HVAC module - DATC C228A-13, circuit SBP28 (GN/RD), harness side. ♦ HVAC module - DATC C228B-8, circuit CH239 (BU/WH), harness side and HVAC module - DATC C228A-2, circuit GD145 (BK/BU), harness side.  A0032468 • **Does the resistance increase and decrease when the jumpers are connected?**	
C7 CHECK THE BLEND DOOR ACTUATOR OPERATION	
NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short. • With the fused jumper connections made as directed below, measure the resistance between HVAC module - DATC C228B-1, circuit RH111 (GY/BU), harness side and HVAC module - DATC C228A-10, circuit VH441 (WH/BN), harness side.	**Yes** INSPECT for broken door and linkage. REPAIR as necessary. If no condition is found, GO to C9 . **No** GO to C8 .



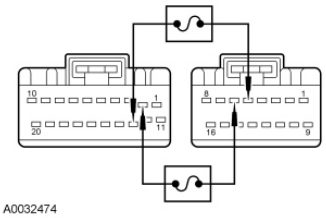
A0033804

- Connect fused jumper wires between:
  - HVAC module - DATC C228B-6, circuit CH213 (BN/GN), harness side and HVAC module - DATC C228A-13, circuit SBP28 (GN/RD), harness side.
  - HVAC module - DATC C228B-5, circuit CH211 (YE), harness side and HVAC module - DATC C228A-2, circuit GD145 (BK/BU), harness side.



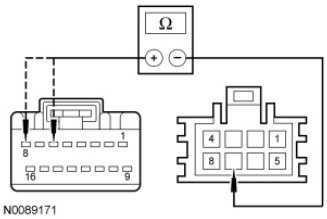
A0032473

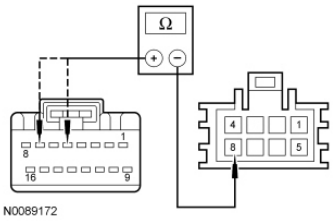
- Remove the fused jumpers.
- Connect fused jumper wires between:
  - HVAC module - DATC C228B-5, circuit CH211 (YE), harness side and HVAC module - DATC C228A-13, circuit SBP28 (GN/RD), harness side.
  - HVAC module - DATC C228B-6, circuit CH213 (BN/GN), harness side and HVAC module - DATC C228A-2, circuit GD145 (BK/BU), harness side.



A0032474

- **Does the resistance increase and decrease when the jumpers are**

connected?	
C8 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN	
NOTE: Access to the connector in the following step is difficult. Before performing this step, visually inspect the actuator and its harness for obvious damage. If no damage is visually evident, proceed with the test. • Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091. • Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092. • Measure the resistance between: ♦ **For DTC B2266** , HVAC module - DATC C228B-8, circuit CH239 (BU/WH), harness side and temperature blend door actuator C2091-7, circuit CH239 (BU/WH), harness side. ♦ **For DTC B2267** , HVAC module - DATC C228B-6, circuit CH213 (BN/GN), harness side and temperature blend door actuator C2092-7, circuit CH213 (BN/GN), harness side.  N0089171 • Measure the resistance between: ♦ **For DTC B2266** , HVAC module - DATC C228B-7, circuit CH237 (VT/GY), harness side and temperature blend door actuator C2091-8, circuit CH237 (VT/GY), harness side. ♦ **For DTC B2267** , HVAC module - DATC C228B-5, circuit CH211 (YE), harness side and temperature blend door actuator C2092-8, circuit CH211 (YE), harness side.	**Yes** INSPECT for binding or broken linkage. REPAIR as necessary. If no condition is found, INSTALL a new door actuator. If a new actuator is installed, CONNECT the actuator electrical connector before the HVAC module connector(s). This will allow the new actuator to be calibrated when the HVAC module is reconnected. TEST the system for normal operation. **No** REPAIR the circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 • **Are the resistances less than 5 ohms?**	
C9 CHECK THE ACTUATOR CONNECTION	
• Disconnect: **For DTC B2266** , LH Temperature Blend Door Actuator C2091. • Disconnect: **For DTC B2267** , RH Temperature Blend Door Actuator C2092. • Check for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat the actuator connector. • Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** CARRY OUT the Temperature Blend Door Actuator component test in this section. If a new actuator is installed, CONNECT the actuator electrical connector before the HVAC module connector(s). This will allow the new actuator to be calibrated when the HVAC module is reconnected. If the actuator tests OK, GO to C10 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. TEST the system for normal operation.
C10 MODULE ACTUATOR POSITION CALIBRATION	
NOTE: The purpose of the module actuator position calibration is to allow the HVAC module to reinitialize and calibrate the actuator stop points. To carry out the calibration, follow the steps below. • Ignition OFF. • Disconnect and inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Ignition ON. • Clear the DTCs. • Select any position except OFF. • **NOTE:** The HVAC module will now initialize and calibrate the actuators. Calibration of the actuators will take approximately 30 seconds.	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is now operating correctly at this time. The concern may have been caused by a foreign object in the HVAC case or temporary binding that restricted actuator door travel. CHECK any actuator external linkage. If condition recurs, INSPECT actuator linkage and door for binding and CHECK HVAC case for foreign objects.

• Operate the system. • Enter the following diagnostic mode on the scan tool: Self-Test - HVAC Module. • **Do the DTCs return?**	

Pinpoint Test D: DTC B1251 or B1253

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

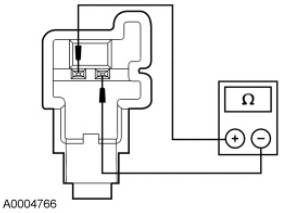
Normal Operation

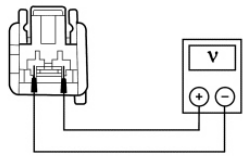
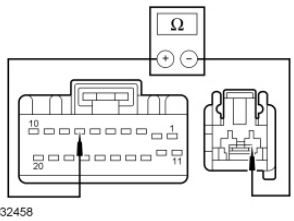
Under normal operation, the in-vehicle air temperature sensor receives a ground from the HVAC module. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls the resistance rises. The HVAC module measures this resistance to determine the temperature at the sensor.

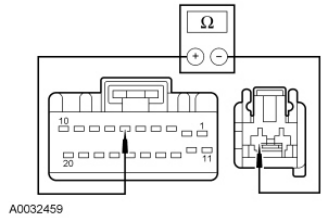
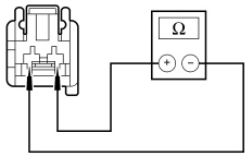
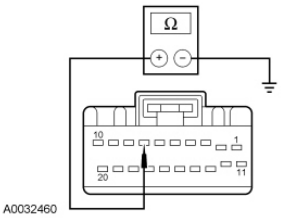
- DTC B1251 (Air Temperature Internal Sensor Circuit Open) - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B1253 (Air Temperature Internal Sensor Circuit Short to Ground) - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- In-vehicle air temperature sensor
- HVAC module - Dual Automatic Temperature Control (DATC)

PINPOINT TEST D: DTC B1251 OR B1253

Test Step	Result / Action to Take
D1 CHECK THE SENSOR RESISTANCE	
• Ignition OFF. • Disconnect: In-Vehicle Temperature Sensor C233. • Measure the resistance between the in-vehicle temperature sensor terminals.  A0004766 • **Is the resistance within the specified values for these temperature ranges: 10-20°C (50-68°F), 37,000-58,000 ohms; 20-30°C (68-86°F),**	**Yes** GO to D2 . **No** GO to D7 .

24,000-37,000 ohms; 30-40°C (86-104°F), 16,000-24,000 ohms?	
D2 CHECK THE HVAC MODULE SENSOR OUTPUT VOLTAGE	
• Ignition ON. • Press the AUTOMATIC button. • Measure the voltage between in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU), harness side and C233-2, circuit RH104 (BU/BN), harness side.  A0001977 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** INSTALL a new in-vehicle temperature sensor. TEST the vehicle for normal operation. If code returns, INSTALL a new HVAC module - DATC . REFER to Section 412-01 . TEST the system for normal operation. **No** **For DTC B1251** , GO to D3 . **For DTC B1253** , GO to D5 .
D3 CHECK CIRCUIT VH414 (GN/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Measure the resistance between HVAC module - DATC C228A-7, circuit VH414 (GN/BU), harness side and in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU), harness side.  A0032458 • **Is the resistance less than 5 ohms?**	**Yes** GO to D4 . **No** REPAIR circuit VH414 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D4 CHECK CIRCUIT RH104 (BU/BN) FOR AN OPEN	
• Measure the resistance between HVAC module - DATC C228A-6, circuit RH104 (BU/BN), harness side and in-vehicle temperature sensor C233-2, circuit RH104 (BU/BN), harness side.	**Yes** GO to D7 . **No** REPAIR circuit RH104 (BU/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 A0032459 • **Is the resistance less than 5 ohms?**	
D5 CHECK CIRCUITS VH414 (GN/BU) AND RH104 (BU/BN) FOR A SHORT TOGETHER	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Disconnect: HVAC Module - DATC C228B. • Measure the resistance between in-vehicle temperature sensor C233-1, circuit VH414 (GN/BU), harness side and C233-2, circuit RH104 (BU/BN), harness side.  A0052122 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D6 . **No** REPAIR circuits VH414 (GN/BU) and RH104 (BU/BN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D6 CHECK CIRCUIT VH414 (GN/BU) FOR A SHORT TO GROUND	
• Measure the resistance between ground and HVAC module - DATC C228A-7, circuit VH414 (GN/BU), harness side.  A0032460 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D7 . **No** REPAIR circuit VH414 (GN/BU) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D7 CHECK THE HVAC MODULE CONNECTION	
• Disconnect and inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals.	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time.

• Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system. • Enter the following diagnostic mode on the scan tool: Self-Test - HVAC Module. • **Do the DTCs return?**	The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: DTC B1255 or B1257

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

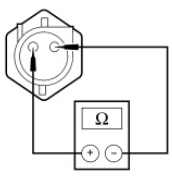
Normal Operation

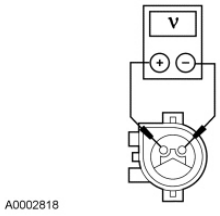
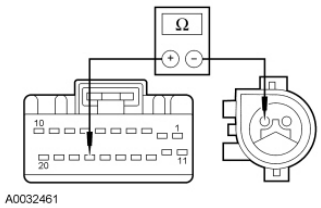
Under normal operation, the ambient air temperature sensor receives a ground from the HVAC module. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The HVAC module measures this resistance to determine the temperature at the sensor.

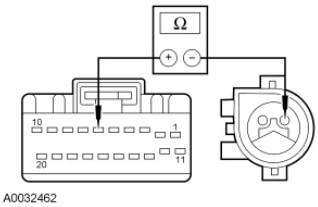
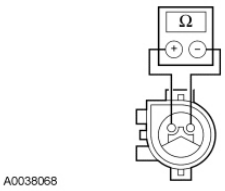
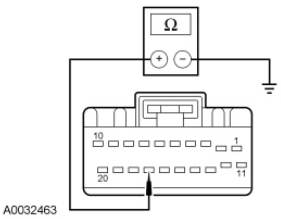
- DTC B1255 (Air Temperature External Sensor Circuit Open) - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B1257 (Air Temperature External Sensor Circuit Short to Ground) - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Ambient air temperature sensor
- HVAC module - Dual Automatic Temperature Control (DATC)

PINPOINT TEST E: DTC B1255 OR B1257

Test Step	Result / Action to Take
E1 CHECK THE AMBIENT TEMPERATURE SENSOR RESISTANCE	
• Ignition OFF. • Disconnect: Ambient Temperature Sensor C132. • Measure the resistance between the ambient temperature sensor terminals.  A0013640 • **Is the resistance within the specified values for**	**Yes** GO to E2 . **No** INSTALL a new ambient air temperature sensor. REFER to Section 412-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

these temperature ranges: 10-20°C (50-68°F), 37,000-58,000 ohms; 20-30°C (68-86°F), 24,000-37,000 ohms; 30-40°C (86-104°F), 16,000-24,000 ohms?	
E2 CHECK THE HVAC MODULE OUTPUT VOLTAGE	
• Ignition ON. • Press the AUTOMATIC button. • Measure the voltage between ambient temperature sensor C132-1, circuit VH407 (YE/GN), harness side and C132-2, circuit RMC32 (GN/BU), harness side.  A0002818 • **Is the voltage between 4.7 and 5.1 volts?**	**Yes** INSTALL a new ambient temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If code returns, GO to E7 . **No** **For DTC B1255** , GO to E3 . **For DTC B1257** , GO to E5 .
E3 CHECK CIRCUIT VH407 (YE/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Measure the resistance between HVAC module - DATC C228A-17, circuit VH407 (YE/GN), harness side and ambient temperature sensor C132-1, circuit VH407 (YE/GN), harness side.  A0032461 • **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** REPAIR circuit VH407 (YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E4 CHECK CIRCUIT RH104 (BU/BN)/RMC32 (GN/BU) FOR AN OPEN	
• Measure the resistance between HVAC module - DATC C228A-6, circuit RH104 (BU/BN), harness side and ambient temperature sensor C132-2, circuit RMC32 (GN/BU), harness side.	**Yes** GO to E7 . **No** REPAIR circuit RH104 (BU/BN)/RMC32 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 A0032462 • **Is the resistance less than 5 ohms?**	
E5 CHECK CIRCUITS VH407 (YE/GN) AND RH104 (BU/BN)/RMC32 (GN/BU) FOR A SHORT TOGETHER	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Disconnect: HVAC Module - DATC C228B. • Measure the resistance between ambient temperature sensor C132-1, circuit VH407 (YE/GN), harness side and C132-2, circuit RMC32 (GN/BU), harness side.  A0038068 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E6 . **No** REPAIR circuits VH407 (YE/GN) and RH104 (BU/BN)/RMC32 (GN/BU) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E6 CHECK CIRCUIT VH407 (YE/GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and HVAC module - DATC C228A-17, circuit VH407 (YE/GN), harness side.  A0032463 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E7 . **No** REPAIR circuit VH407 (YE/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E7 CHECK THE HVAC MODULE CONNECTION	
• Disconnect and inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals.	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation.

♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system. • Enter the following diagnostic mode on the scan tool: Self-Test - HVAC Module. • **Do the DTCs return?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: DTC B1259 or B1261

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

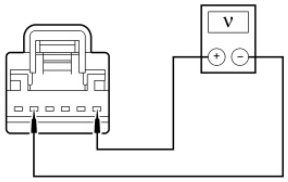
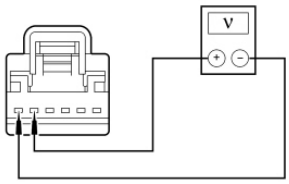
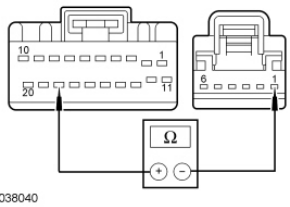
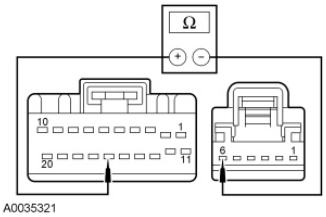
Under normal operation, the sunload sensor receives a ground from the HVAC module. As the light applied to the sensor changes, the PCM detects the change through the RH and LH feedback circuits.

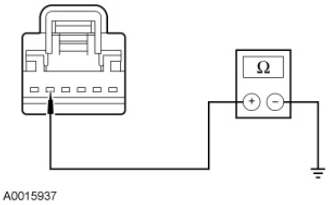
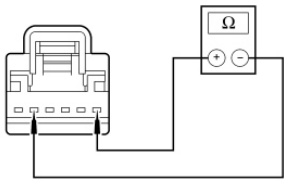
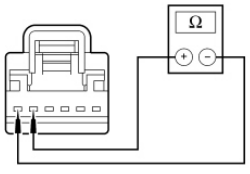
- DTC B1259 (Solar Radiation Sensor Circuit Open) - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B1261 (Solar Radiation Sensor Circuit Short To Ground) - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

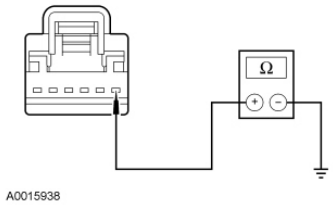
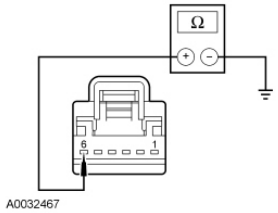
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Solar radiation sensor
- HVAC module - Dual Automatic Temperature Control (DATC)

PINPOINT TEST F: DTC B1259 OR B1261

Test Step	Result / Action to Take
F1 CHECK THE HVAC MODULE OUTPUT VOLTAGE	
• Ignition OFF. • Disconnect: Solar Radiation Sensor C286. • Ignition ON. • Press the AUTOMATIC button. • Measure the voltage between solar radiation sensor C286-1, circuit VH417 (YE/OG), harness side and C286-5, circuit GD145 (BK/BU), harness side.	**Yes** INSTALL a new solar radiation sensor. CLEAR the DTCs. REPEAT the self-test. If the code returns, GO to F6 . **No** **For DTC B1259** , GO to F2 . **For DTC B1261** , GO to F4 .

 A0015935 • Measure the voltage between solar radiation sensor C286-5, circuit GD145 (BK/BU), harness side and C286-6, circuit VH416 (VT/GY), harness side.  A0038234 • **Are the voltages between 4.7 and 5.1 volts?**	
F2 CHECK CIRCUITS VH416 (VT/GY) AND VH417 (YE/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Measure the resistance between HVAC module - DATC C228A-18, circuit VH417 (YE/OG), harness side and solar radiation sensor C286-1, circuit VH417 (YE/OG), harness side.  A0038040 • Measure the resistance between HVAC module - DATC C228A-16, circuit VH416 (VT/GY), harness side and solar radiation sensor C286-6, circuit VH416 (VT/GY), harness side.  A0035321 • **Are the resistances less than 5 ohms?**	**Yes** GO to F3 . **No** REPAIR circuit VH416 (VT/GY) or VH417 (YE/OG) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

F3 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Measure the resistance between ground and solar radiation sensor C286-5, circuit GD145 (BK/BU), harness side.  A0015937 • **Is the resistance less than 5 ohms?**	**Yes** GO to F6 . **No** REPAIR circuit GD145 (BK/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
F4 CHECK CIRCUITS VH416 (VT/GY) AND VH417 (YE/OG) FOR A SHORT TO CIRCUIT GD145 (BK/BU)	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Measure the resistance between solar radiation sensor C286-1, circuit VH417 (YE/OG), harness side and circuit C286-5, GD145 (BK/BU), harness side.  A0047078 • Measure the resistance between solar radiation sensor C286-6, circuit VH416 (VT/GY), harness side and circuit C286-5, GD145 (BK/BU), harness side.  A0047079 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to F5 . **No** REPAIR circuit VH416 (VT/GY) or VH417 (YE/OG) for a short to circuit GD145 (BK/BU). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
F5 CHECK CIRCUITS VH416 (VT/GY) AND VH417 (YE/OG) FOR A SHORT TO GROUND	

• Measure the resistance between ground and solar radiation sensor C286-1, circuit VH417 (YE/OG), harness side.  A0015938 • Measure the resistance between ground and solar radiation sensor C286-6, circuit VH416 (VT/GY), harness side.  A0032467 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to F6 . **No** REPAIR circuit VH416 (VT/GY) or VH417 (YE/OG) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
F6 CHECK THE HVAC MODULE CONNECTION	
• Disconnect and inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system. • Enter the following diagnostic mode on the scan tool: Self-Test - HVAC Module. • **Do the DTCs return?**	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: DTC B1676

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the HVAC module - Dual Automatic Temperature Control (DATC) receives a ground through circuit GD145 (BK/BU). The HVAC module - DATC is supplied constant battery voltage through circuit SBP28 (GN/RD) and ignition switched voltage through circuit CBP20 (YE/VT).

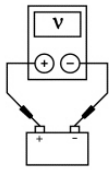
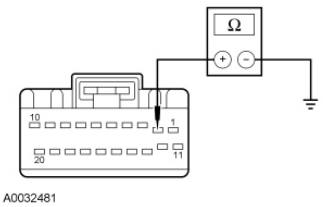
- DTC B1676 (Battery Pack Voltage Out Of Range) - The module senses when battery voltage is less than 9 volts or greater than 16 volts.

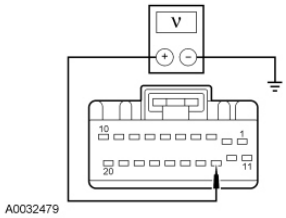
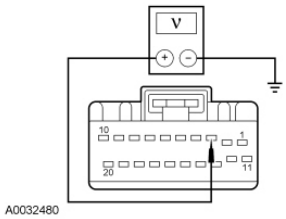
This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- HVAC module - DATC

PINPOINT TEST G: DTC B1676

Test Step	Result / Action to Take
G1 RETRIEVE ALL CMDTCs IN ALL MODULES	
• Enter the following diagnostic mode on the scan tool: Self Test - All CMDTCs . • **Is DTC B1317, B1318 or B1676 present in more than one module AND DTC P0563, P0620, P0625, P0626 or P065B present in the PCM?**	**Yes** REFER to Section 414-00 for diagnosis of the battery and charging system. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). TEST the system for normal operation. **No** GO to G2 .
G2 CHECK BATTERY CONDITION	
• Refer to Section 414-01 and carry out the Battery - Condition Test. • **Does the battery pass the condition test?**	**Yes** If the battery passed the condition test but required a recharge, REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation. If the battery passed the condition test and did not require a recharge, GO to G3 . **No** INSTALL a new battery. CLEAR all CMDTCs . TEST the system for normal operation.
G3 CHECK CHARGING SYSTEM VOLTAGE	
NOTE: Do not allow the engine speed to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine speed goes above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step. • Measure the voltage of the battery with and without a load on the charging system as follows: ♦ Turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes while measuring battery voltage. ♦ Turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2	**Yes** GO to G4 . **No** REFER to Section 414-00 to diagnose the charging system. CLEAR all CMDTCs . TEST the system for normal operation.

minutes while measuring battery voltage.  AJ0210-A • **Are the voltages between 13 and 15.2 volts?**	
G4 CHECK FOR VOLTAGE MONITORING THE MODULE SUPPLY VOLTAGE (VBAT_CC) HVAC PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: VBAT_CC HVAC PID. • Monitor the battery voltage VBAT_CC HVAC PID. • **Is the battery voltage less than 9 or greater than 15.5 volts?**	**Yes** If voltage is less than 9 volts, GO to G5 . If voltage is greater than 15.5 volts, INSTALL a new HVAC module. REFER to Section 412-01 . CLEAR all CMDTCs . REPEAT the self-test. **No** GO to G8 .
G5 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between ground and HVAC module - DATC C228A-2, circuit GD145 (BK/BU), harness side.  A0032481 • **Is the resistance less than 5 ohms?**	**Yes** GO to G6 . **No** REPAIR circuit GD145 (BK/BU) for an open. TEST the system for normal operation.
G6 CHECK CIRCUIT SBP28 (GN/RD) FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Measure the voltage between ground and HVAC module - DATC C228A-13, circuit SBP28 (GN/RD), harness side.	**Yes** GO to G7 . **No** VERIFY Smart Junction Box (SJB) fuse 28 (10A) is OK. If OK, REPAIR circuit SBP28 (GN/RD) for an open. TEST the system for normal operation.

 A0032479 • **Is the voltage greater than 10 volts?**	
G7 CHECK CIRCUIT CBP20 (YE/VT) FOR AN OPEN	
• Ignition ON. • Measure the voltage between ground and HVAC module - DATC C228A-3, circuit CBP20 (YE/VT), harness side.  A0032480 • **Is the voltage greater than 10 volts?**	**Yes** GO to G8 . **No** If DTC B1676 is present in multiple modules, refer to Section 414-00 . If DTC B1676 is present only in the HVAC module - Electronic Manual Temperature Control (EMTC) or HVAC module - DATC , VERIFY SJB fuse 20 (10A) is OK. If OK, REPAIR circuit SBP28 (GN/RD) for an open. TEST the system for normal operation.
G8 CHECK THE HVAC MODULE CONNECTION	
• Disconnect and inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system. • Enter the following diagnostic mode on the scan tool: Self-Test - HVAC Module. • **Do the DTCs return?**	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test H: Unable to Duplicate the Customer Concern and No DTCs Present

Normal Operation

The purpose of this pinpoint test is to test the functions of the HVAC system and to identify the correct pinpoint test symptom.

This pinpoint test is intended to diagnose the following:
- Incorrect functioning of the HVAC system

PINPOINT TEST H: UNABLE TO DUPLICATE THE CUSTOMER CONCERN AND NO DTCs PRESENT

NOTE: Before carrying out the following test, diagnose any HVAC, PCM or Instrument Cluster (IC) DTCs.

Test Step	Result / Action to Take
H1 CHECK THE BLOWER MOTOR OPERATION	
• Ignition ON. • Select PANEL mode. • Observe blower motor operation and select each blower motor speed. • **Does the blower motor operate in all selections and change speed in each?**	**Yes** GO to H2 . **No** (Manual climate control systems) If the blower motor does not operate in any setting, GO to Pinpoint Test P . (Dual Automatic Temperature Control (DATC) systems) If the blower motor does not operate in any setting, GO to Pinpoint Test R . (Manual climate control systems) If the blower motor does not properly change speeds or shut OFF, GO to Pinpoint Test Q . (DATC systems) If the blower motor does not properly change speeds or shut OFF, GO to Pinpoint Test S .
H2 CHECK AIRFLOW OPERATION	
• Select the highest blower motor setting. • **NOTE:** Refer to Description and Operation in this section for proper airflow descriptions. • While observing the airflow, select each of the airflow positions (PANEL, PANEL/FLOOR, FLOOR, FLOOR/DEFROST, DEFROST). • **Is the airflow directed to the proper outlets?**	**Yes** GO to H3 . **No** (Manual climate control systems) GO to Pinpoint Test I . (DATC systems) GO to Pinpoint Test J .
H3 VERIFY TEMPERATURE CONTROL OPERATION	
• Start the vehicle and allow it to reach normal operating temperature. • With the A/C OFF, select PANEL mode. • Change the temperature setting from the coldest to the warmest and back to the coldest. • **Does the temperature change between very warm to cool?**	**Yes** GO to H4 . **No** If the temperature does not get very warm, GO to Pinpoint Test K . (Manual climate control systems) If the temperature does not change at all, GO to Pinpoint Test O . (DATC systems) If the temperature does not change at all, GO to Pinpoint Test C .

H4 VERIFY THE A/C CLUTCH DOES NOT ENGAGE WITH A/C OFF	
• With the A/C OFF, select PANEL mode. • Select the coldest temperature setting. • **Is the outlet temperature close to ambient temperature?**	**Yes** GO to H5 . **No** (Manual climate control systems) If the temperature is warmer than ambient temperature, GO to Pinpoint Test O and diagnose for inoperative blend door. (DATC systems) If the temperature is warmer than ambient temperature, GO to Pinpoint Test C and diagnose for inoperative blend door. If the outlet temperature is significantly colder than ambient temperature and the A/C compressor clutch cycles normally, GO to Pinpoint Test N . If the outlet temperature is significantly colder than ambient temperature and the A/C compressor clutch is engaged and does not cycle, GO to Pinpoint Test M .
H5 VERIFY A/C CLUTCH ENGAGEMENT IN THE A/C MODE	
• Make sure the ambient air temperature is above 2°C (35°F). • Select PANEL mode. • Press the A/C button (indicator ON). • **Does the A/C clutch engage when the PANEL and A/C button (indicator ON) is pressed?**	**Yes** GO to H6 . **No** GO to Pinpoint Test L .
H6 CHECK THE RECIRC OPERATION	
• Press the RECIRC button (indicator OFF). • Select PANEL mode. • Select the highest blower motor setting. • Observe airflow noise. • Press the RECIRC button (indicator ON). • **Does the airflow noise increase when the RECIRC mode is selected (indicator ON)?**	**Yes** GO to H7 . **No** (Manual climate control systems) GO to Pinpoint Test I . (DATC systems) GO to Pinpoint Test J .
H7 CHECK THE AUXILIARY BLOWER MOTOR OPERATION	
• Using the front and rear auxiliary blower motor controls, observe blower motor operation and select each auxiliary blower motor speed.	**Yes** GO to H8 . **No**

• **Does the auxiliary blower motor operate in all selections and change speed in each?**	If the auxiliary blower motor does not operate in any setting, GO to Pinpoint Test T . If the auxiliary blower motor does not properly change speeds or shut OFF, GO to Pinpoint Test U .
H8 VERIFY AUXILIARY TEMPERATURE/MODE OPERATION	
• Select the highest auxiliary blower motor setting. • Using the front and rear auxiliary controls, change the temperature/mode setting from the coldest to the warmest/floor and back to the coldest/overhead. • **Does the temperature change between very warm to cool and auxiliary airflow to the floor when warm is selected and headliner when cool is selected?**	**Yes** The system is operating normally. **No** If the auxiliary temperature control is inoperative/does not operate correctly, GO to Pinpoint Test W . If the auxiliary panel/floor control is inoperative/does not operate correctly from the front/rear auxiliary controls, GO to Pinpoint Test V .

Pinpoint Test I: Incorrect/Erratic Direction of Airflow From Outlets - Manual Climate Control

Normal Operation

Under normal operation, the function selector switch is provided vacuum from the engine. When a position is selected, vacuum is applied to the desired vacuum control motor that is connected to the mode door to be controlled.

A leak or blockage of the vacuum source line to the HVAC system will result in the following default conditions:

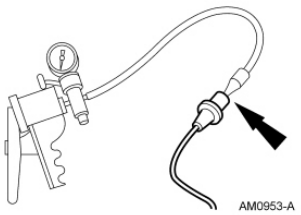
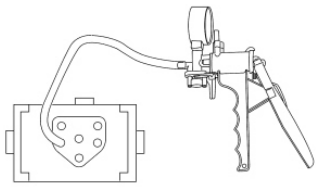
- Airflow will be from the defrost outlets only.
- The air inlet door will remain in the fresh air position only.
- The coolant control valve will allow coolant flow to the heater core at all times.

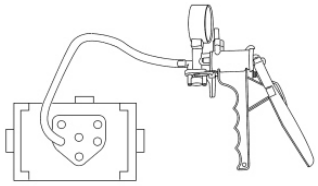
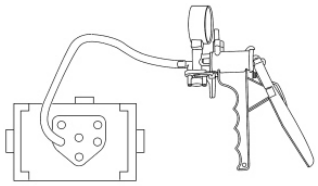
This pinpoint test is intended to diagnose the following:
- Function selector switch
- Heater control valve
- Vacuum control motor
- Stuck or bound linkage or door
- Leaking or plugged vacuum hose

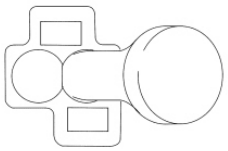
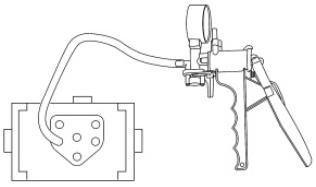
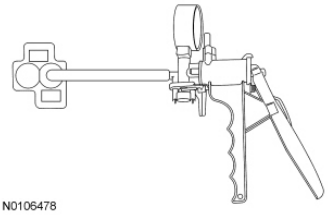
PINPOINT TEST I: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS - MANUAL CLIMATE CONTROL

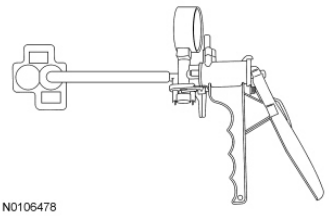
Test Step	Result / Action to Take
I1 CHECK THE SYSTEM AIRFLOW	
• Start the engine.	**Yes** GO to I2 .

• Set the blower motor speed to maximum. • Check for proper airflow in each function selector switch position at engine idle and under acceleration. • Road test the vehicle and recheck the airflow during the road test. • **Is the airflow correct in each function selector switch position?**	**No** If the airflow is from only the defrost outlet in all settings, GO to I3 . CARRY OUT the Function Selector Vacuum Switch component test. If the switch leaks or is blocked, INSTALL a new climate control assembly. TEST the system for normal operation. If the switch tests OK and: If there is no airflow from the panel outlets in PANEL mode, GO to I11 and diagnose the panel door vacuum control motor. If there is no airflow from the floor outlets in FLOOR mode, GO to I11 and diagnose the floor door vacuum control motor. If there is no airflow from the defrost outlets in DEFROST mode, GO to I11 and diagnose the defroster door vacuum control motor. If there is some airflow from the defrost outlets in PANEL and FLOOR modes, GO to I11 and diagnose the defroster door vacuum control motor. If there is some airflow from the panel outlets in DEFROST and FLOOR modes, GO to I11 and diagnose the panel door vacuum control motor. If there is some airflow from the floor outlets in DEFROST and PANEL modes, GO to I11 and diagnose the floor door vacuum control motor.
I2 CHECK THE AIR INLET DOOR OPERATION	
• Select PANEL mode. • Select the highest blower motor setting. • Observe airflow noise. • Select MAX A/C mode. • **During the road test, does the airflow noise increase when the MAX A/C mode is selected?**	**Yes** The system is operating normally. **No** CARRY OUT the Function Selector Vacuum Switch component test. If the switch leaks or is blocked, INSTALL a new climate control assembly. If the switch tests OK, GO to I11 and diagnose the air inlet door vacuum control motor.
I3 CHECK THE VACUUM CHECK VALVE	

• Ignition OFF. • Disconnect: Vacuum Check Valve. • **NOTE:** The vacuum check valve is located in the passenger side, rear area of the engine compartment, near the heater control valve. • Connect the vacuum pump to the each port on the vacuum check valve and attempt to pull a vacuum. • **Can a vacuum be pulled on only one side of the vacuum check valve and not the other?**	**Yes** GO to I4 . **No** INSTALL a new vacuum check valve. TEST the system for normal operation.
I4 CHECK FOR VACUUM AT THE CHECK VALVE	
• Connect the vacuum pump to the vacuum source line to the check valve from the engine intake manifold.  AM0953-A • Start the engine. • Check for manifold vacuum. • **Is manifold vacuum present at the check valve vacuum source line?**	**Yes** GO to I5 . **No** REPAIR or INSTALL a new check valve vacuum source line harness. TEST the system for normal operation.
I5 CHECK THE FUNCTION SELECTOR SWITCH VACUUM SOURCE LINE FOR BLOCKAGE	
• Ignition OFF. • Disconnect: Function Selector Switch Vacuum Connector. • With the vacuum check valve disconnected, connect the vacuum pump to the function selector switch vacuum source line (black) and attempt to pull a vacuum. (Pulling a vacuum here would indicate a restricted or blocked vacuum source line.)  A0033878 • **Does air flow freely through the vacuum source line (no vacuum)?**	**Yes** GO to I6 . **No** REPAIR or INSTALL a new function selector switch vacuum source line. TEST the system for normal operation.
I6 CHECK THE FUNCTION SELECTOR SWITCH VACUUM SOURCE LINE FOR LEAKS	

• Connect: Vacuum Check Valve. • Apply 51 kPa (15 in-Hg) of vacuum to the selector switch vacuum source line (black) using the vacuum pump.  A0033878 • **Does the function selector switch vacuum source line hold the vacuum?**	**Yes** INSTALL a new climate control assembly. TEST the system for normal operation. **No** GO to I7 .
I7 CHECK THE VACUUM RESERVOIR FOR LEAKS	
• Disconnect the vacuum reservoir line at the vacuum reservoir. • Plug the vacuum reservoir line at the vacuum reservoir connection. • Apply 51 kPa (15 in-Hg) of vacuum to the selector switch vacuum source line (black) using the vacuum pump.  A0033878 • **Does the function selector switch vacuum source line hold the vacuum?**	**Yes** INSTALL a new vacuum reservoir. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to I8 .
I8 CHECK THE HEATER CONTROL VALVE VACUUM SWITCH CIRCUIT	
• Disconnect: Heater Control Valve Vacuum Switch. • **NOTE:** The heater control valve vacuum switch is located on the RH side of the heater core and evaporator core housing, attached to the temperature blend door shaft. The control valve vacuum switch is accessible through the glove compartment opening. • Using a golf tee or equivalent, plug the vacuum source line (black) port of the heater control valve vacuum switch vacuum harness.	**Yes** GO to I9 . **No** REPAIR the vacuum line to the heater control valve vacuum switch or INSTALL a new vacuum source line harness. TEST the system for normal operation.

 A0033879 • Apply 51 kPa (15 in-Hg) of vacuum to the selector switch vacuum source line (black) using the vacuum pump.  A0033878 • **Does the function selector switch vacuum source line hold the vacuum?**	
I9 CHECK THE HEATER CONTROL VALVE VACUUM SWITCH	
• Apply 51 kPa (15 in-Hg) of vacuum to the heater control valve switch vacuum motor line (gray) using the vacuum pump.  N0106478 • **Does the heater control valve switch vacuum motor line hold the vacuum?**	**Yes** INSTALL a new heater control valve vacuum switch. TEST the system for normal operation. **No** GO to I10 .
I10 CHECK THE HEATER CONTROL VALVE VACUUM MOTOR CIRCUIT	
• Disconnect the vacuum line from the heater control valve and plug the vacuum line (gray) at the heater control valve. • Apply 51 kPa (15 in-Hg) of vacuum to the heater control valve vacuum motor line (gray) using the vacuum pump.	**Yes** INSTALL a new heater control valve. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR or INSTALL a new heater control valve vacuum line. TEST the system for normal operation.

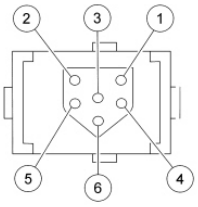

N0106478

- **Does the heater control valve vacuum motor line hold the vacuum?**

I11 CHECK THE VACUUM CONTROL MOTOR LINE FOR LEAKS

- Ignition OFF.
- Disconnect: Function Selector Switch Vacuum Connector.
- Disconnect: Vacuum Control Motor (noted in Step I1).
- Plug the vacuum control motor line at the vacuum control motor connection.
- Apply 51 kPa (15 in-Hg) of vacuum to the appropriate vacuum control motor line (noted in Step I1) at the function selector switch vacuum connector using the vacuum pump. using the following chart:

Function Selector Switch Vacuum Connector Port Number	Vacuum Control Motor Vacuum Line Color	Vacuum Control Motor
1	White	Air inlet door
2	Blue	Floor door
4	Red	Panel door
6	Yellow	Defrost door



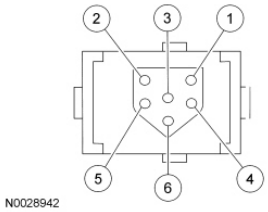
N0028942

- **Does the vacuum control motor line hold the vacuum?**

Yes
GO to I12 .

No
REPAIR or INSTALL a new vacuum harness. TEST the system for normal operation.

I12 CHECK THE VACUUM CONTROL MOTOR LINE FOR BLOCKAGE

<table>
<tr>
<td>
• Remove the plug from the vacuum control motor line.
• Connect the vacuum pump to the appropriate vacuum control motor line (noted in Step I1) at the function selector switch vacuum connector using the following chart and attempt to pull a vacuum.
<table>
<tr><th>Function Selector Switch Vacuum Connector Port Number</th><th>Vacuum Control Motor Vacuum Line Color</th><th>Vacuum Control Motor</th></tr>
<tr><td>1</td><td>White</td><td>Air inlet door</td></tr>
<tr><td>2</td><td>Blue</td><td>Floor door</td></tr>
<tr><td>4</td><td>Red</td><td>Panel door</td></tr>
<tr><td>6</td><td>Yellow</td><td>Defrost door</td></tr>
</table>


• Does air flow freely through the vacuum control motor line (no vacuum)?
</td>
<td>Yes
GO to I13 .

No
INSTALL a new vacuum harness. TEST the system for normal operation.</td>
</tr>
<tr>
<td>I13 CHECK THE MODE DOOR LINKAGE AND MOVEMENT</td>
<td></td>
</tr>
<tr>
<td>
• Inspect the mode door linkage and verify correct movement of the mode door.
• Is the mode door or mode door linkage broken, binding or otherwise obstructed?
</td>
<td>Yes
REPAIR the mode door or mode door linkage as necessary. TEST the system for normal operation.

No
INSTALL a new vacuum control motor. TEST the system for normal operation.</td>
</tr>
</table>

Pinpoint Test J: Incorrect/Erratic Direction of Airflow From Outlets - DATC

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the solenoid and manifold assembly receives a ground from the HVAC module - Dual Automatic Temperature Control (DATC). Depending on which solenoid is to be energized, the solenoid and manifold assembly receives voltage from the HVAC module - DATC through circuits:

- CH220 (GN/BN) for the air inlet door vacuum control motor.
- CH221 (GY/VT) for the defrost door vacuum control motor.
- CH222 (WH/VT) for the floor door vacuum control motor.
- CH223 (YE/BU) for the panel door vacuum control motor.
- CH224 (BU/OG) for the heater control valve.

Engine vacuum is supplied to the solenoid and manifold assembly. When one of the solenoids is energized, vacuum is applied to the control motor or valve and the desired door or valve is either opened or closed.

A leak or blockage of the vacuum source line to the HVAC system will result in the following default conditions:

- Airflow will be from the defrost outlets only.
- The air inlet door will remain in the fresh air position only.
- The coolant control valve will allow coolant flow to the heater core at all times.

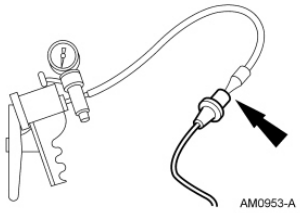
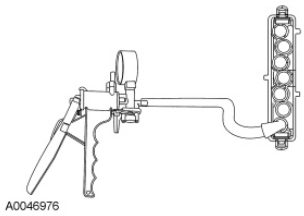
This pinpoint test is intended to diagnose the following:

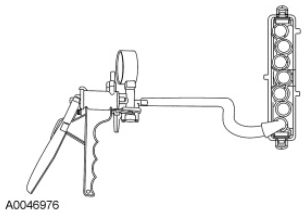
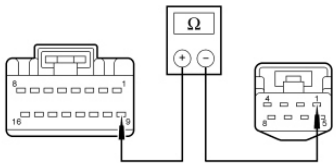
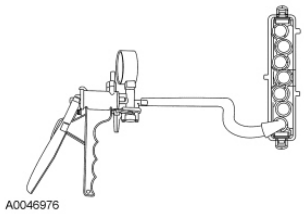
- Wiring, terminals or connectors
- Solenoid and manifold assembly
- HVAC module - DATC
- Heater control valve
- Vacuum control motor
- Stuck or bound linkage or door
- Leaking or plugged vacuum hose

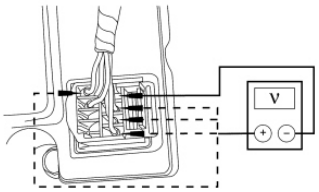
PINPOINT TEST J: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS - DATC

Test Step	Result / Action to Take
J1 CHECK THE AIRFLOW IN EACH SETTING	
• Start the engine. • Set the blower motor speed to maximum. • Check the airflow in each manual override setting on the HVAC module - DATC during engine idle and under acceleration. • Road test the vehicle and recheck the airflow during the road test. • **Is the airflow correct in each manual override setting?**	**Yes** GO to J2 . **No** If the airflow is from only the defrost outlet in all settings, GO to J3 . CARRY OUT the Solenoid and Manifold Assembly component test. If the solenoid and manifold assembly tests OK and: If there is no airflow from the panel outlets in PANEL mode, GO to J9 and diagnose the panel door vacuum control motor.

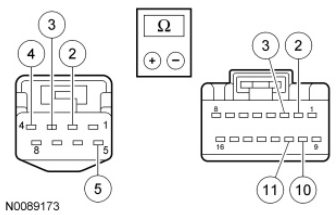
	If there is no airflow from the floor outlets in FLOOR mode, GO to J9 and diagnose the floor door vacuum control motor. If there is no airflow from the defrost outlets in DEFROST mode, GO to J9 and diagnose the defroster door vacuum control motor. If there is some airflow from the defrost outlets in PANEL and FLOOR modes, GO to J9 and diagnose the defroster door vacuum control motor. If there is some airflow from the panel outlets in DEFROST and FLOOR modes, GO to J9 and diagnose the panel door vacuum control motor. If there is some airflow from the floor outlets in DEFROST and PANEL modes, GO to J9 and diagnose the floor door vacuum control motor. For all other symptoms, GO to J15 .
J2 CHECK THE AIR INLET DOOR OPERATION	
• Press the RECIRC button (indicator OFF). • Select PANEL mode. • Select the highest blower motor setting. • Observe airflow noise. • Press the RECIRC button (indicator ON). • **During the road test, does the airflow noise increase when the RECIRC mode is selected (indicator ON)?**	**Yes** The system is operating normally. **No** CARRY OUT the Solenoid and Manifold Assembly component test. If the solenoid and manifold assembly tests OK, GO to J9 and diagnose the air inlet door vacuum control motor.
J3 CHECK THE VACUUM CHECK VALVE	
• Ignition OFF. • Disconnect: Vacuum Check Valve. • **NOTE:** The vacuum check valve is located in the passenger side, rear area of the engine compartment, near the heater control valve. • Connect the vacuum pump to the each port on the vacuum check valve and attempt to pull a vacuum.	**Yes** GO to J4 . **No** INSTALL a new vacuum check valve. TEST the system for normal operation.

• **Can a vacuum be pulled on only one side of the vacuum check valve and not the other?**	
J4 CHECK FOR VACUUM AT THE CHECK VALVE	
• Connect the vacuum pump to the vacuum source line to the check valve from the engine intake manifold.  AM0953-A • Start the engine. • Check for manifold vacuum. • **Is manifold vacuum present at the check valve vacuum source line?**	**Yes** GO to J5 . **No** REPAIR or INSTALL a new check valve vacuum source line harness. TEST the system for normal operation.
J5 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY VACUUM SOURCE LINE FOR BLOCKAGE	
• Ignition OFF. • Disconnect: Solenoid and Manifold Assembly Vacuum Connector. • With the vacuum check valve disconnected, connect the vacuum pump to the solenoid and manifold assembly vacuum source line (black) and attempt to pull a vacuum. (Pulling a vacuum here would indicate a restricted or blocked vacuum source line.)  A0046976 • **Does air flow freely through the vacuum source line (no vacuum)?**	**Yes** GO to J6 . **No** REPAIR or INSTALL a new solenoid and manifold assembly vacuum source line. TEST the system for normal operation.
J6 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY VACUUM SOURCE LINE FOR LEAKS	
• Connect: A/C Vacuum Check Valve. • Apply 51 kPa (15 in-Hg) of vacuum to the solenoid and manifold assembly vacuum source line (black) using the vacuum pump.	**Yes** GO to J7 . **No** GO to J8 .

 A0046976 • **Does the solenoid and manifold assembly vacuum source line hold the vacuum?**	
J7 CHECK CIRCUIT RH226 (WH/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228B. • Disconnect: Solenoid and Manifold Assembly C2093. • Measure the resistance between HVAC module - DATC C228B-9, circuit RH226 (WH/VT), harness side and solenoid and manifold assembly C2093-1, circuit RH226 (WH/VT), harness side.  A0033889 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new solenoid and manifold assembly. TEST the system for normal operation. If the condition returns, GO to J18 . **No** REPAIR circuit RH226 (WH/VT) for an open. TEST the system for normal operation.
J8 CHECK THE VACUUM RESERVOIR FOR LEAKS	
• Disconnect the vacuum reservoir line at the vacuum reservoir. • Plug the vacuum reservoir line at the vacuum reservoir connection. • Apply 51 kPa (15 in-Hg) of vacuum to the solenoid and manifold assembly vacuum source line (black) using the vacuum pump.  A0046976 • **Does the solenoid and manifold assembly vacuum source line hold the vacuum?**	**Yes** INSTALL a new vacuum reservoir. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR or INSTALL a new solenoid and manifold assembly vacuum source line. TEST the system for normal operation.
J9 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY	

• Press the PANEL/FLOOR button then the RECIRCULATION button on the HVAC module - DATC . • **NOTE:** The following measurements must be taken by back-probing the solenoid and manifold assembly C2093. • Measure the voltage between solenoid and manifold assembly C2093-1, circuit RH226 (WH/VT), harness side and solenoid and manifold assembly: ♦ C2093-2, circuit CH220 (GN/BN), harness side. ♦ C2093-3, circuit CH221 (GY/VT), harness side. ♦ C2093-4, circuit CH222 (WH/VT), harness side. ♦ C2093-5, circuit CH223 (YE/BU), harness side.  A0033888 • **Are all the voltages greater than 10 volts?**	**Yes** INSTALL a new solenoid and manifold assembly. TEST the system for normal operation. **No** GO to J10 .
J10 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228B. • Disconnect: Solenoid and Manifold Assembly C2093. • Measure the resistance between the HVAC module - DATC connector, harness side and solenoid and manifold assembly, harness side using the following chart.	**Yes** GO to J11 . **No** REPAIR the affected circuit for an open. TEST the system for normal operation.

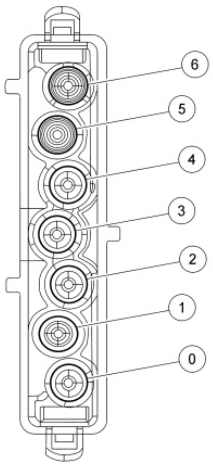
HVAC Module Connector	Circuit	Solenoid and Manifold Assembly Connector
C228B-3	CH220 (GN/BN)	C2093-2
C228B-2	CH221 (GY/VT)	C2093-3
C228B-10	CH222 (WH/VT)	C2093-4
C228B-11	CH223 (YE/BU)	C2093-5



N0089173

• **Are the resistances less than 5 ohms?**	
J11 CHECK THE VACUUM CONTROL MOTOR LINE FOR LEAKS	
• Ignition OFF. • Disconnect: Solenoid and Manifold Assembly Vacuum Connector. • Disconnect: Vacuum Control Motor (noted in Step J1). • Plug the vacuum control motor line at the vacuum control motor connection. • Apply 51 kPa (15 in-Hg) of vacuum to the appropriate vacuum control motor line (noted in Step J1) at the solenoid and manifold assembly vacuum connector using the vacuum pump. using the following chart:	**Yes** GO to J12 . **No** REPAIR or INSTALL a new vacuum harness. TEST the system for normal operation.

Solenoid and Manifold Assembly Vacuum Connector Port Number	Vacuum Control Motor Vacuum Line Color	Vacuum Control Motor
1	White	Air inlet door
2	Yellow	Defrost door
3	Blue	Floor door
4	Red	Panel door
5	Gray	Heater control valve

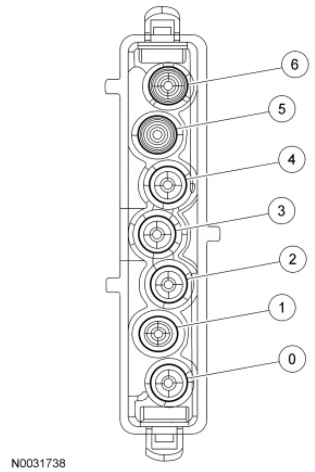


N0031738

• **Does the vacuum control motor line hold the vacuum?**	
J12 CHECK THE VACUUM CONTROL MOTOR LINE FOR BLOCKAGE	

<table>
<tr>
<td>
• Remove the plug the vacuum control motor line at the vacuum control motor connection.
• Connect the vacuum pump to the appropriate vacuum control motor line (noted in Step J1) at the solenoid and manifold assembly vacuum connector using the following chart rand attempt to pull a vacuum.

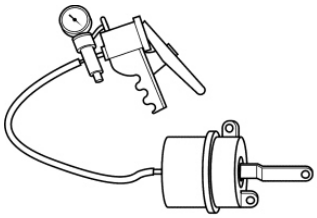
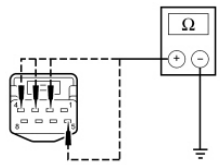
<table>
<tr><th>Solenoid and Manifold Assembly Vacuum Connector Port Number</th><th>Vacuum Control Motor Vacuum Line Color</th><th>Vacuum Control Motor</th></tr>
<tr><td>1</td><td>White</td><td>Air inlet door</td></tr>
<tr><td>2</td><td>Yellow</td><td>Defrost door</td></tr>
<tr><td>3</td><td>Blue</td><td>Floor door</td></tr>
<tr><td>4</td><td>Red</td><td>Panel door</td></tr>
<tr><td>5</td><td>Gray</td><td>Heater control valve</td></tr>
</table>

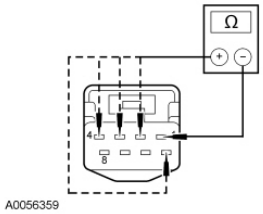


• Does air flow freely through the vacuum control motor line (no vacuum)?
</td>
<td>Yes
GO to J13 .

No
INSTALL a new vacuum harness. TEST the system for normal operation.</td>
</tr>
<tr><td>J13 CHECK THE MODE DOOR LINKAGE AND MOVEMENT</td><td></td></tr>
<tr>
<td>
• Inspect the mode door linkage and verify correct movement of the mode door.
• Is the mode door or mode door linkage broken, binding or otherwise obstructed?
</td>
<td>Yes
REPAIR the mode door or mode door linkage as necessary. TEST the system for normal operation.

No
GO to J14 .</td>
</tr>
<tr><td>J14 CHECK THE VACUUM CONTROL MOTOR FOR LEAKS AND CORRECT OPERATION</td><td></td></tr>
</table>

• Connect the vacuum pump to the appropriate vacuum control motor and pull a vacuum.  AL0136-A • **Does the vacuum control motor operate and hold vacuum?**	**Yes** GO to J18 . **No** INSTALL a new vacuum control motor. TEST the system for normal operation.
J15 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228B. • Disconnect: Solenoid and Manifold Assembly C2093. • Measure the resistance between ground and solenoid and manifold assembly: ♦ C2093-2, circuit CH220 (GN/BN), harness side. ♦ C2093-3, circuit CH221 (GY/VT), harness side. ♦ C2093-4, circuit CH222 (WH/VT), harness side. ♦ C2093-5, circuit CH223 (YE/BU), harness side.  A0040177 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to J16 . **No** REPAIR the affected circuit for a short to ground. TEST the system for normal operation.
J16 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY CIRCUITS FOR A SHORT TO CIRCUIT RH226 (WH/VT)	
• Measure the resistance between solenoid and manifold assembly C2093-1, circuit RH226 (WH/VT), harness side and solenoid and manifold assembly: ♦ C2093-2, circuit CH220 (GN/BN), harness side. ♦ C2093-3, circuit CH221 (GY/VT), harness side. ♦ C2093-4, circuit CH222 (WH/VT), harness side. ♦ C2093-5, circuit CH223 (YE/BU), harness side.	**Yes** GO to J17 . **No** REPAIR the affected circuit for a short to circuit RH226 (WH/VT). TEST the system for normal operation.

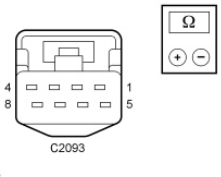


- **Are the resistances greater than 10,000 ohms?**

J17 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY CIRCUITS FOR A SHORT TOGETHER

- Measure the resistance between the solenoid and manifold assembly connector C2093, harness side using the following chart.

Solenoid and Manifold Assembly Connector	Circuit	Solenoid and Manifold Assembly Connector	Circuit
C2093-2	CH220 (GN/BN)	C2093-3	CH221 (GY/VT)
C2093-2	CH220 (GN/BN)	C2093-4	CH222 (WH/VT)
C2093-2	CH220 (GN/BN)	C2093-5	CH223 (YE/BU)
C2093-3	CH221 (GY/VT)	C2093-4	CH222 (WH/VT)
C2093-3	CH221 (GY/VT)	C2093-5	CH223 (YE/BU)
C2093-4	CH222 (WH/VT)	C2093-5	CH223 (YE/BU)



- **Are the resistances greater than 10,000 ohms?**

Yes
GO to J18 .

No
REPAIR the affected circuits for a short together. TEST the system for normal operation.

J18 CHECK THE HVAC MODULE CONNECTION

- Inspect the HVAC module connectors for:
  - ♦ corrosion.
  - ♦ pushed-out terminals.
  - ♦ damaged terminals.
- Connect and correctly seat all the HVAC module connectors.

Yes
INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation.

No
The system is operating correctly

• Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test K: Insufficient, Erratic or No Heat

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, for Dual Automatic Temperature Control (DATC) systems, the solenoid and manifold assembly receives a ground from the HVAC module - DATC . When the heater control valve vacuum solenoid is to be energized, the solenoid and manifold assembly receives voltage from the HVAC module - DATC .

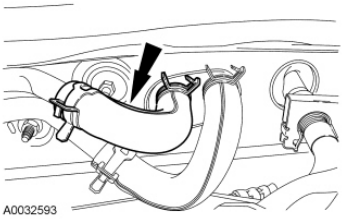
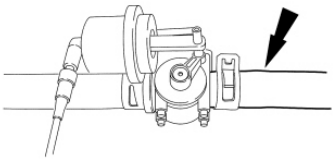
Under normal operation, for manual climate control systems, the function selector switch receives engine vacuum. When OFF or MAX A/C is selected, vacuum is applied to the recirculation vacuum control motor. When the temperature is in the full COOL position, the heater control valve vacuum switch applies vacuum to the heater control valve.

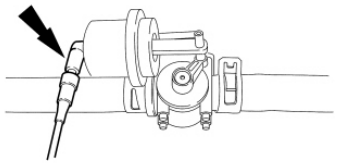
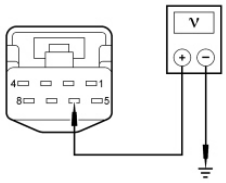
This pinpoint test is intended to diagnose the following:

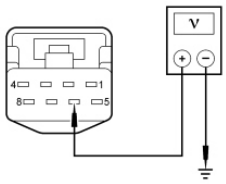
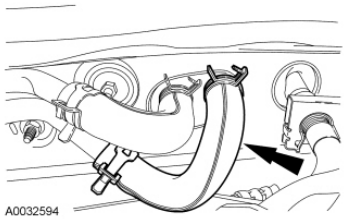
- Wiring, terminals or connectors
- Solenoid and manifold assembly (DATC systems only)
- HVAC module - DATC
- Function selector switch (manual climate control systems only)
- Heater control valve
- Heater control valve vacuum switch (if equipped)
- Stuck or bound linkage or door
- Leaking or plugged vacuum hose
- Temperature blend door actuator

PINPOINT TEST K: INSUFFICIENT, ERRATIC OR NO HEAT

Test Step	Result / Action to Take
K1 CHECK FOR PROPER ENGINE COOLANT LEVEL	
• Ignition OFF. • Check the engine coolant level when hot and cold. • **Is the engine coolant at the correct level (hot/cold) as indicated on the engine coolant recovery reservoir?**	**Yes** GO to K3 . **No** GO to K2 .
K2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS	
• Pressure test the cooling system for leaks. Refer to Section 303-03 . • **Does the engine cooling system leak?**	**Yes** REPAIR the engine coolant leak. TEST the system for normal operation.

	No FILL and BLEED the cooling system. REFER to Section 303-03 . After filling and bleeding the cooling system, GO to K3 .
K3 CHECK FOR COOLANT FLOW TO THE HEATER CORE	
• Run the engine until it reaches normal operation temperature. Select the FLOOR position on the control assembly. Set the temperature control to full warm and the blower to the lowest setting. • Using a suitable temperature measuring device, check the heater core inlet hose to see if it is hot.  A0032593 • **Is the heater core inlet hose hot?**	**Yes** GO to K9 . **No** GO to K4 .
K4 CHECK FOR COOLANT FLOW TO THE HEATER CONTROL VALVE	
• Using a suitable temperature measuring device, measure the heater control valve inlet hose to see if it is hot.  A0035188 • **Is the heater control valve inlet hose hot?**	**Yes** GO to K5 . **No** REFER to Section 303-03 .
K5 CHECK FOR VACUUM AT THE HEATER CONTROL VALVE	
• Disconnect the heater control valve vacuum connector and check for vacuum.	**Yes** GO to K6 . **No** INSTALL a new heater control valve. REFER to Section 412-01 . TEST the system for normal operation.

 A0035187 • **Is vacuum present at the heater control valve?**	
K6 CHECK FOR INCORRECT VACUUM LINE PLACEMENT	
• Ignition OFF. • Inspect the heater control valve and A/C vacuum lines for correct placement. • **Is the vacuum line placement correct?**	**Yes** For manual climate control systems, INSTALL a new heater control valve vacuum switch. For DATC systems, GO to K7 . **No** CORRECT the vacuum line placement. TEST the system for normal operation.
K7 CHECK THE CIRCUIT FOR VOLTAGE	
• Ignition OFF. • Disconnect: Solenoid and Manifold Assembly C2093. • Ignition ON. • Measure the voltage between ground and solenoid and manifold assembly C2093-6, circuit CH224 (BU/OG), harness side.  N0105581 • **Is any voltage present?**	**Yes** GO to K8 . **No** INSTALL a new solenoid and manifold assembly. TEST the system for normal operation.
K8 CHECK THE CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228A. • Ignition ON. • Measure the voltage between ground and solenoid and manifold assembly C2093-6, circuit CH224 (BU/OG), harness side.	**Yes** REPAIR circuit CH224 (BU/OG) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new HVAC module - DATC . TEST the system for normal operation.

 N0105581 • **Is any voltage present?**	
K9 CHECK FOR A PLUGGED OR RESTRICTED HEATER CORE	
• Using a suitable temperature measuring device, measure the heater core outlet hose temperature.  A0032594 • **Is the heater core outlet hose temperature similar to the inlet hose temperature (within approximately 6-17°C [10-30°F])?**	**Yes** For manual climate control systems, GO to Pinpoint Test O . For DATC systems, GO to Pinpoint Test C . **No** INSTALL a new heater core. REFER to Section 412-01 . TEST the system for normal operation.

Pinpoint Test L: The Air Conditioning (A/C) is Inoperative

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, for Dual Automatic Temperature Control (DATC) systems, when A/C is requested, the HVAC module - DATC sends an A/C request message over the Medium Speed Controller Area Network (MS-CAN) bus to the Instrument Cluster (IC), then from the IC through the High Speed Controller Area Network (HS-CAN) bus to the PCM.

Under normal operation, for manual climate control systems, when A/C is requested, a voltage is supplied to the PCM on the A/C request PCM input.

The PCM also receives a ground from the A/C cycling switch when pressures are sufficient to close the switch. Ground is provided to the A/C cycling switch.

Voltage is provided to the A/C clutch relay switch. When the PCM energizes the relay, voltage is supplied to the A/C clutch from the relay. Ground is supplied for the A/C clutch.

When an A/C request is received by the PCM, the A/C compressor clutch will only be engaged through the A/C clutch relay if all of the following conditions are met:

- The PCM does not detect excessively high refrigerant pressure from the A/C pressure transducer.

- The PCM does not detect excessively high engine coolant temperature.
- The PCM does not detect an ambient air temperature below -1°C (30°F).
- The PCM has not detected a Wide Open Throttle (WOT) condition.
- The PCM does not detect excessively low refrigerant pressure from the A/C cycling switch.

The A/C cycling switch is used for A/C compressor cycling. The A/C cycling switch is used by the PCM to turn off the A/C compressor when the refrigerant pressure is low enough to make the evaporator temperatures cold enough to freeze the condensation. The A/C pressure transducer is used to turn off the A/C compressor when the refrigerant pressure is to high. Excessively high refrigerant pressure can damage the A/C compressor.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- PCM
- HVAC module - DATC
- Function selector switch (manual climate control systems)
- A/C cycling switch
- A/C compressor clutch field coil
- A/C control relay
- A/C clutch air gap

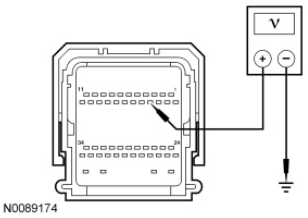
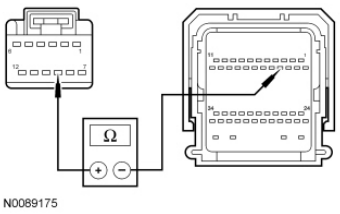
PINPOINT TEST L: THE AIR CONDITIONING (A/C) IS INOPERATIVE

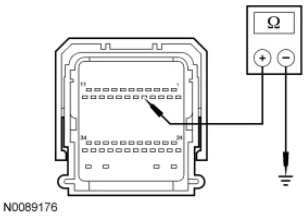
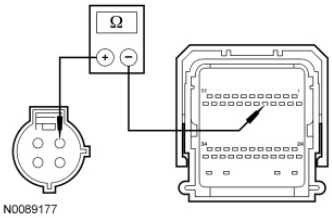
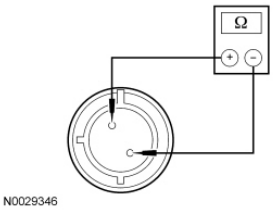
NOTE: Before carrying out the following test, diagnose any HVAC, PCM or IC DTCs.

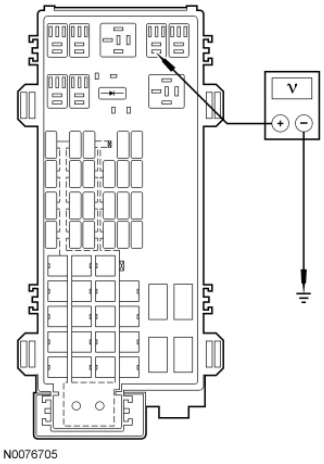
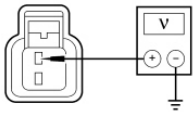
NOTE: Before carrying out the following test, check that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), refer to Fluorescent Dye Leak Detection in this section.

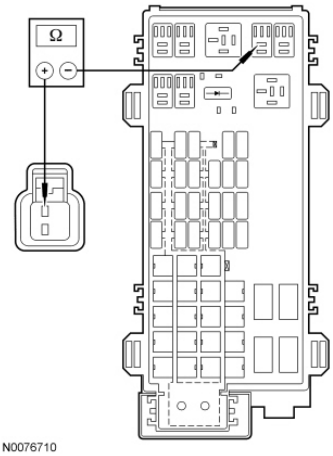
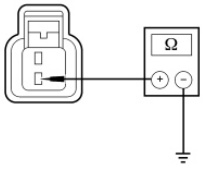
NOTE: The ambient temperature, as indicated by the DATC display, must be over 6°C (43°F). If the ambient temperature display is inaccurate, GO to Symptom Chart - Climate Control Systems .

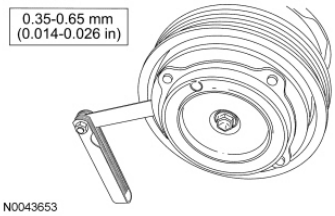
Test Step	Result / Action to Take
L1 CHECK THE AIR CONDITIONING COMPRESSOR CYCLING SWITCH (ACCS) PCM PID WITH THE A/C ON	
• Enter the following diagnostic mode on the scan tool: ACCS PCM PID. • Place the function selector switch in the MAX A/C position or press the PANEL and A/C manual override buttons on the HVAC module - DATC . • **Does the ACCS PCM PID read ON?**	**Yes** GO to L5 . **No** For manual climate control systems, GO to L2 . For DATC systems, GO to L4 .
L2 CHECK PCM FOR A/C SIGNAL VOLTAGE	
• Ignition OFF. • Disconnect: PCM C175B. • Ignition ON. • Measure the voltage between ground and PCM C175B-15, circuit CH443 (GN/OG), harness side.	**Yes** GO to L16 . **No** GO to L3 .

 • **Is the voltage greater than 10 volts?**	
L3 CHECK CIRCUIT CH443 (GN/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: Function Selector Switch C294C. • Measure the resistance between climate control assembly C294C-9, circuit CH443 (GN/OG), harness side and PCM C175B-15, circuit CH443 (GN/OG), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new function selector switch. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit CH443 (GN/OG) for an open. TEST the system for normal operation.
L4 CHECK THE AIR CONDITIONING SWITCH STATUS (AC_SEL_SW) HVAC PID WITH THE A/C ON	
• Enter the following diagnostic mode on the scan tool: AC_SEL_SW HVAC PID. • Press the PANEL and press and hold the A/C manual override buttons on the HVAC module - DATC . • **Does the AC_SEL_SW HVAC PID read A/C?**	**Yes** GO to L16 . **No** GO to L15 .
L5 CHECK THE AIR CONDITIONING COMPRESSOR DIAGNOSTIC SWITCH (ACDS1) PCM PID WITH THE A/C ON	
• Enter the following diagnostic mode on the scan tool: ACDS1 PCM PID. • Place the function selector switch in the MAX A/C position or press the PANEL and A/C manual override buttons on the HVAC module - DATC . • **Does the ACDS1 PCM PID read ENABLE?**	**Yes** GO to L9 . **No** GO to L6 .
L6 CHECK THE A/C CYCLING SWITCH INPUT	

• Ignition OFF. • Disconnect: PCM C175B. • Measure the resistance between ground and PCM C175B-16, circuit CH423 (YE), harness side.  N0089176 • **Is the resistance less than 5 ohms?**	**Yes** GO to L16 . **No** GO to L7 .
L7 CHECK CIRCUIT CH423 (YE) FOR AN OPEN	
• Disconnect: A/C Cycling Switch C130. • Measure the resistance between A/C cycling switch C130-1, circuit CH423 (YE), harness side and PCM C175B-16, circuit CH423 (YE), harness side.  N0089177 • **Is the resistance less than 5 ohms?**	**Yes** GO to L8 . **No** REPAIR circuit CH423 (YE) for an open. TEST the system for normal operation.
L8 CHECK THE A/C CYCLING SWITCH	
• Ignition OFF. • Measure the resistance between the A/C cycling switch terminals.  N0029346 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR circuit GD113 (BK/YE) for an open. TEST the system for normal operation. **No** INSTALL a new A/C cycling switch. TEST the system for normal operation.
L9 CHECK THE AIR CONDITIONING CLUTCH (WAC/ACCR) PCM PID WITH THE A/C ON	
• Enter the following diagnostic mode on the scan tool: WAC/ACCR PCM PID.	**Yes** GO to L10 . **No**

• Place the function selector switch in the MAX A/C position or press the PANEL and A/C manual override buttons on the HVAC module - DATC . • **With the engine running, does the WAC/ACCR PCM PID read ON?**	GO to L16 .
L10 CHECK CIRCUIT SBB35 (BU/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: A/C Control Relay. • Ignition ON. • Measure the voltage between ground and A/C control relay socket pin 3, circuit SBB35 (BU/RD).  N0076705 • **Is the voltage greater than 10 volts?**	**Yes** GO to L11 . **No** VERIFY the Battery Junction Box (BJB) fuse 35 (10A) is OK. If OK, REPAIR circuit SBB35 (BU/RD) for an open. TEST the system for normal operation.
L11 CHECK THE VOLTAGE AT THE A/C COMPRESSOR CLUTCH FIELD COIL	
• Ignition OFF. • Connect: A/C Control Relay. • Disconnect: A/C Compressor Clutch Field Coil C1110. • Ignition ON. • With the engine running, measure the voltage between ground and A/C compressor clutch field coil C1110-1, circuit CH401 (VT/WH) (4.0L) or CH401 (GY/WH) (4.6L), harness side.  A0048576 • **Is the voltage greater than 10 volts?**	**Yes** GO to L13 . **No** GO to L12 .

L12 CHECK CIRCUIT CH401 (VT/WH) OR CIRCUIT CH401 (GY/WH) FOR AN OPEN	
• Ignition OFF. • Connect: A/C Control Relay. • Measure the resistance between A/C control relay socket pin 5, circuit CH401 (VT/WH) (4.0L) or CH401 (GY/WH) (4.6L) and A/C compressor clutch field coil C1110-1, circuit CH401 (VT/WH) (4.0L) or CH401 (GY/WH) (4.6L), harness side.  N0076710 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new A/C control relay. TEST the system for normal operation. **No** REPAIR circuit CH401 (VT/WH) (4.0L) or CH401 (GY/WH) (4.6L) for an open. TEST the system for normal operation.
L13 CHECK THE GROUND AT THE A/C COMPRESSOR CLUTCH FIELD COIL	
• Ignition OFF. • Measure the resistance between ground and A/C compressor clutch field coil C1110-2, circuit GD120 (BK/GN) (4.0L) or GD120 (BK) (4.6L), harness side.  N0003086 • **Is the resistance less than 5 ohms?**	**Yes** GO to L14 . **No** REPAIR circuit GD120 (BK/GN) (4.0L) or GD120 (BK) (4.6L) for an open. TEST the system for normal operation.
L14 CHECK THE A/C COMPRESSOR CLUTCH AIR GAP	

• Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley.  N0043653 • **Is the A/C compressor clutch air gap average greater than 0.65 mm (0.026 in)?**	**Yes** ADJUST the A/C compressor clutch field coil. REFER to Air Conditioning (A/C) Clutch Air Gap Adjustment in this section. TEST the system for normal operation. **No** INSTALL a new A/C compressor clutch field coil. REFER to Section 412-01 . TEST the system for normal operation.
L15 CHECK THE HVAC MODULE CONNECTION	
• Inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
L16 CHECK THE PCM CONNECTION	
• Disconnect all the PCM connectors. • Inspect the module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the PCM connectors. • Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: The Air Conditioning (A/C) is Always On - A/C Compressor Does Not Cycle

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, for Dual Automatic Temperature Control (DATC) systems, when A/C is requested, the HVAC module - DATC sends an A/C request message over the Medium Speed Controller Area Network (MS-CAN) bus to the Instrument Cluster (IC), then from the IC through the High Speed Controller Area Network (HS-CAN) bus to the PCM.

Under normal operation, for manual climate control systems, when A/C is requested, a voltage is supplied to the PCM on the A/C request PCM input.

The PCM also receives a ground from the A/C cycling switch when pressures are sufficient to close the switch. Ground is provided to the A/C cycling switch.

Voltage is provided to the A/C clutch relay switch. When the PCM energizes the relay, voltage is supplied to the A/C clutch from the relay. Ground is supplied for the A/C clutch.

The A/C cycling switch is used for A/C compressor cycling. The A/C cycling switch is used by the PCM to turn off the A/C compressor when the refrigerant pressure is low enough to make the evaporator temperatures cold enough to freeze the condensation. The A/C pressure transducer is used to turn off the A/C compressor when the refrigerant pressure is to high. Excessively high refrigerant pressure can damage the A/C compressor.

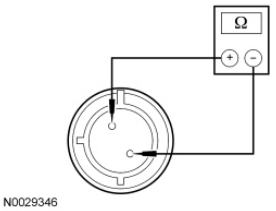
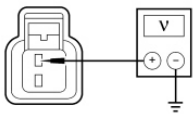
This pinpoint test is intended to diagnose the following:

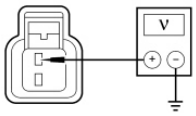
- Wiring, terminals or connectors
- PCM
- A/C compressor clutch field coil
- A/C control relay
- A/C clutch air gap

PINPOINT TEST M: THE AIR CONDITIONING (A/C) IS ALWAYS ON - A/C COMPRESSOR DOES NOT CYCLE

NOTE: Before carrying out the following test, diagnose any HVAC, PCM or IC DTCs.

Test Step	Result / Action to Take
M1 CHECK THE AIR CONDITIONING CLUTCH (WAC/ACCR) PCM PID WITH THE A/C ON	
• Ignition ON. • Place the function selector switch to the OFF position. • Enter the following diagnostic mode on the scan tool: WAC/ACCR PCM PID. • **Does the WAC/ACCR PCM PID read OFF?**	**Yes** GO to M2 . **No** GO to M6 .
M2 CHECK THE AIR CONDITIONING COMPRESSOR DIAGNOSTIC SWITCH (ACDS1) PCM PID	
• Ignition OFF. • Disconnect: A/C Cycling Switch C130. • Ignition ON. • Enter the following diagnostic mode on the scan tool: ACDS1 PCM PID. • Observe the ACDS1 PCM PID. • **Does the ACDS1 PCM PID read DISABLE?**	**Yes** GO to M3 . **No** REPAIR circuit CH423 (YE) for a short to ground. TEST the system for normal operation.
M3 CHECK THE A/C CYCLING SWITCH	

• Ignition OFF. • Remove the A/C cycling switch from the vehicle. • Measure the resistance between the A/C cycling switch terminals.  N0029346 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to M4 . **No** INSTALL a new A/C cycling switch. TEST the system for normal operation.
M4 CHECK FOR VOLTAGE TO THE A/C COMPRESSOR CLUTCH FIELD COIL	
• Ignition OFF. • Disconnect: A/C Compressor Clutch Field Coil C1110. • Ignition ON. • With the engine running, measure the voltage between ground and A/C compressor clutch field coil C1110-1, circuit CH401 (VT/WH) (4.0L) or CH401 (GY/WH) (4.6L), harness side.  A0048576 • **Is any voltage present?**	**Yes** GO to M5 . **No** ADJUST the A/C compressor clutch air gap. REFER to Air Conditioning (A/C) Clutch Air Gap Adjustment in this section. TEST the system for normal operation.
M5 CHECK THE A/C CONTROL RELAY	
• Ignition OFF. • Disconnect: A/C Control Relay. • Ignition ON. • With the engine running, measure the voltage between ground and A/C compressor clutch field coil C1110-1, circuit CH401 (VT/WH) (4.0L) or CH401 (GY/WH) (4.6L), harness side.	**Yes** REPAIR circuit CH401 (VT/WH) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new A/C control relay. TEST the A/C clutch diode. INSTALL a new diode, if necessary. TEST the system for normal operation.

 A0048576 • **Is any voltage present?**	
M6 CHECK THE PCM CONNECTION	
• Clear the DTCs. • Disconnect all the PCM connectors. • Check for: ♦ corrosion. ♦ pushed-out pins. ♦ incorrectly seated connector. • Connect and correctly seat all the PCM connectors. • Operate the system. • **Does the concern return?**	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Air Conditioning (A/C) is Always On - A/C Mode Always Commanded ON

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, for Dual Automatic Temperature Control (DATC) systems, when A/C is requested, the HVAC module - DATC sends an A/C request message over the Medium Speed Controller Area Network (MS-CAN) bus to the Instrument Cluster (IC), then from the IC through the High Speed Controller Area Network (HS-CAN) bus to the PCM.

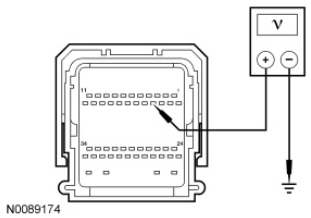
Under normal operation, for manual climate control systems, when A/C is requested, a voltage is supplied to the PCM on the A/C request PCM input.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- PCM
- HVAC module - DATC
- Function selector switch (manual climate control systems)

PINPOINT TEST N: THE AIR CONDITIONING (A/C) IS ALWAYS ON - A/C MODE ALWAYS COMMANDED ON

NOTE: Before carrying out the following test, diagnose any HVAC, PCM or IC DTCs.

Test Step	Result / Action to Take
N1 CHECK THE AIR CONDITIONING COMPRESSOR CYCLING SWITCH (ACCS) PCM PID WITH THE A/C OFF	

• Enter the following diagnostic mode on the scan tool: ACCS PCM PID. • Place the function selector switch to the OFF position or press the OFF manual override button on the HVAC module - DATC . • **Does the ACCS PCM PID read OFF?**	**Yes** GO to N6 . **No** GO to N4 . For manual climate control systems, GO to N2 .
N2 CHECK CIRCUIT CH443 (GN/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Climate Control Assembly C294B and C294C. • Disconnect: PCM C175B. • Ignition ON. • Measure the voltage between ground and PCM 175b-15, circuit CH443 (GN/OG), harness side.  • **Is any voltage present?**	**Yes** REPAIR circuit CH443 (GN/OG) for a short to voltage. TEST the system for normal operation. **No** GO to N3 .
N3 CHECK THE FUNCTION SELECTOR SWITCH	
• Ignition OFF. • Carry out the Function Selector Switch component test in this section. • **Does the function selector switch test good?**	**Yes** GO to N5 . **No** INSTALL a new function selector switch. REFER to Section 412-01 . TEST the system for normal operation.
N4 CHECK THE AIR CONDITIONING SWITCH STATUS (AC_SEL_SW) HVAC PID WITH THE A/C OFF	
• Enter the following diagnostic mode on the scan tool: AC_SEL_SW HVAC PID. • Select PANEL mode on the HVAC module and make sure the A/C button and indicator are OFF. • **Does the AC_SEL_SW HVAC PID read Not Pressed?**	**Yes** GO to N6 . **No** GO to N5 .
N5 CHECK THE HVAC MODULE CONNECTION	
• Inspect the HVAC module connectors for:	**Yes** INSTALL a new HVAC module. REFER to Section

♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
N6 CHECK THE PCM CONNECTION	
• Disconnect all the PCM connectors. • Inspect the module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the PCM connectors. • Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Temperature Control is Inoperative/Does Not Operate Correctly - Manual Climate Control

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

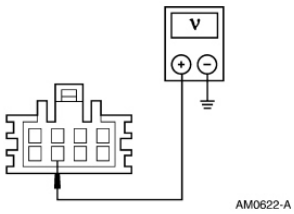
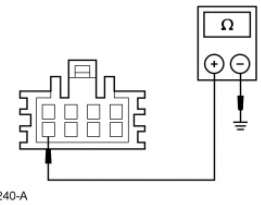
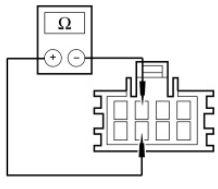
Under normal operation, the temperature blend door actuator receives voltage and ground. As the temperature selection changes it varies the voltage to the temperature blend door actuator from the temperature selector.

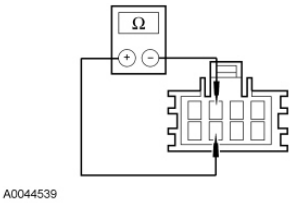
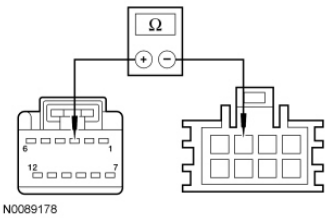
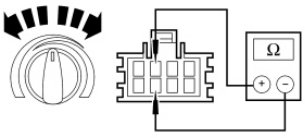
This pinpoint test is intended to diagnose the following:

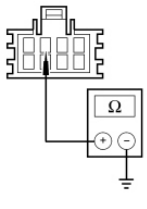
- Fuse
- Wiring, terminals or connectors
- Temperature control switch
- Temperature blend door actuator
- Stuck or bound linkage or door

PINPOINT TEST O: THE TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - MANUAL CLIMATE CONTROL

Test Step	Result / Action to Take
O1 CHECK THE VOLTAGE TO THE BLEND DOOR ACTUATOR	

• Ignition OFF. • Disconnect: Temperature Blend Door Actuator C2091. • Ignition ON. • Measure the voltage between ground and temperature blend door actuator C2091-7, circuit CBP20 (YE/VT), harness side.  AM0622-A • **Is the voltage greater than 10 volts?**	**Yes** GO to O2 . **No** VERIFY Battery Junction Box (BJB) fuse 20 (10A) is OK. If OK, REPAIR circuit CBP20 (YE/VT) for an open. TEST the system for normal operation.
O2 CHECK CIRCUIT GD140 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between ground and temperature blend door actuator C2091-8, circuit GD140 (BK/GN), harness side.  AM2240-A • **Is the resistance less than 5 ohms?**	**Yes** GO to O3 . **No** REPAIR circuit GD140 (BK/GN) for an open. TEST the system for normal operation.
O3 CHECK THE TEMPERATURE CONTROL POTENTIOMETER TOTAL RESISTANCE	
• Ignition OFF. • Measure the resistance between temperature blend door actuator C2091-7, circuit CBP20 (YE/VT), harness side and C2091-3, circuit VH439 (GY/VT), harness side.  A0044539 • **Is the resistance between 30 and 1,600 ohms?**	**Yes** GO to O6 . **No** If the resistance is less than 30 ohms, GO to O4 . If the resistance is greater than 1,600 ohms, GO to O5 .
O4 CHECK CIRCUITS CBP20 (YE/VT) AND VH439 (GY/VT) FOR A SHORT TOGETHER	

• Disconnect: Climate Control Assembly C294C. • Measure the resistance between temperature blend door actuator C2091-7, circuit CBP20 (YE/VT), harness side and C2091-3, circuit VH439 (GY/VT), harness side.  A0044539 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuits CBP20 (YE/VT) and VH439 (GY/VT) for a short together. TEST the system for normal operation.
O5 CHECK VH439 (GY/VT) FOR AN OPEN	
• Disconnect: Climate Control Assembly C294C. • Measure the resistance between blend door actuator control connector C2091-3, circuit VH439 (GY/VT), harness side and climate control assembly C294C-3, circuit VH439 (GY/VT), harness side.  N0089178 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit VH439 (GY/VT) for an open. TEST the system for normal operation.
O6 CHECK THE TEMPERATURE CONTROL POTENTIOMETER OPERATION	
• Measure the resistance between temperature blend door actuator C2091-7, circuit CBP20 (YE/VT), harness side and C2091-3, circuit CH439 (GY/VT), harness side while rotating the temperature control potentiometer from full WARM to full COOL.  A0044541 • **Does the resistance vary between 30 and 1,600 ohms?**	**Yes** GO to O7 . **No** INSTALL a new climate control assembly. REFER to Section 412-01 . TEST the system for normal operation.
O7 CHECK CIRCUIT VH439 (GY/VT) FOR A SHORT TO GROUND	

• Disconnect: Climate Control Assembly C294C. • Measure the resistance between ground and blend door actuator C2091-3, circuit VH439 (GY/VT), harness side.  A0044542 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to O8 . **No** REPAIR circuit VH439 (GY/VT) for a short to ground. TEST the system for normal operation.
O8 CHECK FOR A BINDING, STUCK OR BROKEN BLEND DOOR	
• Ignition OFF. • Remove the actuator. Refer to Section 412-01 . • Inspect for a binding, stuck or broken blend door or linkage. • **Is there a binding, stuck or broken blend door or linkage condition?**	**Yes** REPAIR the blend door/linkage. TEST the system for normal operation. **No** INSTALL a new temperature blend door actuator. REFER to Section 412-01 . TEST the system for normal operation.

Pinpoint Test P: The Blower Motor is Inoperative - Manual Climate Control

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

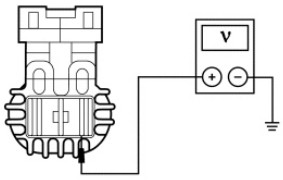
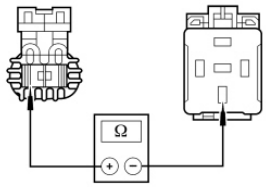
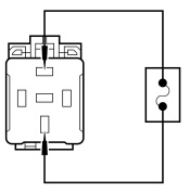
Under normal operation, the blower motor relay coil receives a ground. The coil receives voltage from the function selector switch when any position but OFF is selected. Voltage is supplied to the relay contacts. When the relay coil is energized, voltage is delivered to the blower motor and the high-speed blower motor relay. Ground is provided from the high-speed blower motor relay to the blower motor. Voltage is supplied for the function selector switch.

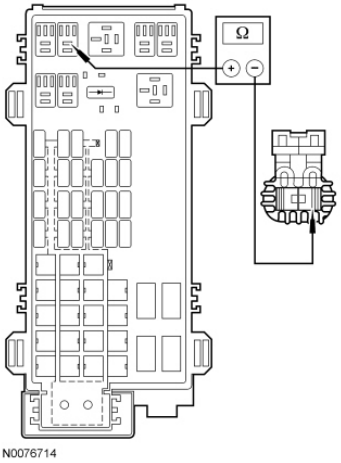
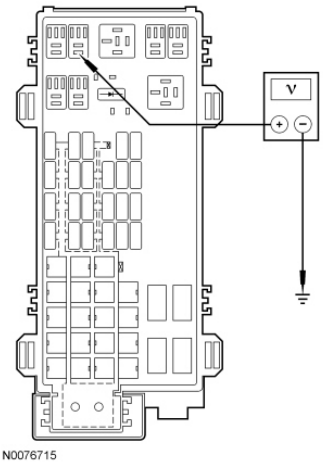
This pinpoint test is intended to diagnose the following:

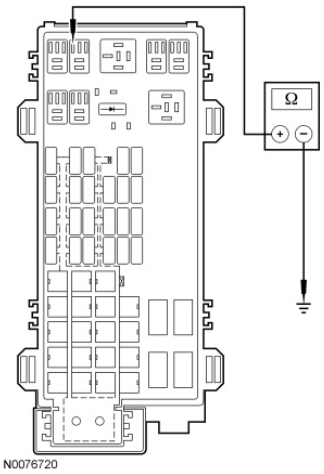
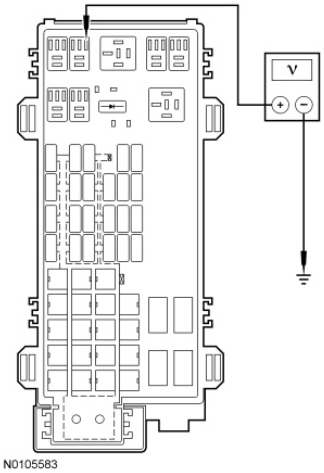
- Fuse(s)
- Wiring, terminals or connectors
- Blower motor
- High-speed blower motor relay
- Blower motor relay

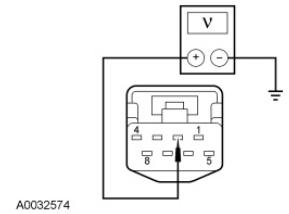
PINPOINT TEST P: THE BLOWER MOTOR IS INOPERATIVE - MANUAL CLIMATE CONTROL

Test Step	Result / Action to Take
P1 CHECK FOR VOLTAGE TO THE BLOWER MOTOR	

• Disconnect: Blower Motor C288. • Ignition ON. • Place the function selector switch in the FLOOR position. • Measure the voltage between ground and blower motor C288-1, circuit CH402 (YE/GN), harness side.  AM0416-A • **Is the voltage greater than 10 volts?**	**Yes** GO to P2 . **No** GO to P4 .
P2 CHECK CIRCUIT VH301 (YE/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: High-Speed Blower Motor Relay. • Measure the resistance between blower motor C288-2, circuit VH301 (YE/BU), harness side and high-speed blower motor relay socket pin 30, circuit VH301 (YE/BU).  N0105644 • **Is the resistance less than 5 ohms?**	**Yes** GO to P3 . **No** REPAIR circuit VH301 (YE/BU) for an open. TEST the system for normal operation.
P3 CHECK THE BLOWER MOTOR	
• Connect: Blower Motor C288. • Ignition ON. • Connect a fused jumper lead between high-speed blower motor relay socket pin 87, circuit GD140 (BK/GN) and pin 30, circuit VH301 (YE/BU).  N0105582 • **Does the blower motor operate?**	**Yes** INSTALL a new high-speed blower motor relay. TEST the system for normal operation. **No** INSTALL a new blower motor. REFER to Section 412-01 . TEST the system for normal operation.
P4 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN	

• Ignition OFF. • Disconnect: Blower Motor Relay. • Measure the resistance between blower motor relay socket pin 5, circuit CH402 (YE/GN) and blower motor C288-1, circuit CH402 (YE/GN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to P5 . **No** REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.
P5 CHECK FOR VOLTAGE TO THE BLOWER MOTOR RELAY, SWITCH SIDE	
• Measure the voltage between ground and blower motor relay socket pin 3, circuit SBB16 (VT/RD).  • **Is the voltage greater than 10 volts?**	**Yes** GO to P6 . **No** VERIFY Battery Junction Box (BJB) fuse 16 (40A) is OK. If OK, REPAIR circuit SBB16 (VT/RD) for an open. TEST the system for normal operation.
P6 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	

• Measure the resistance between ground and blower motor relay socket pin 2, circuit GD120 (BK/GN).  • **Is the resistance less than 5 ohms?**	**Yes** GO to P7 . **No** REPAIR circuit GD120 (BK/GN) for an open. TEST the system for normal operation.
P7 CHECK FOR VOLTAGE TO THE BLOWER MOTOR RELAY, COIL SIDE	
• Ignition ON. • Measure the voltage between ground and blower motor relay socket pin 1, circuit CH123 (VT/GN).  • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new blower motor relay. TEST the system for normal operation. **No** GO to P8 .
P8 CHECK CIRCUIT CBP20 (YE/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: Function Selector Switch C294B. • Ignition ON. • Measure the voltage between ground and function selector switch C294B-2, circuit CBP20 (YE/VT), harness side.	**Yes** GO to P9 . **No** VERIFY the Smart Junction Box (SJB) fuse 20 (10A) is OK. If OK, REPAIR circuit CBP20 (YE/VT) for an open. TEST the system for normal operation.

 • **Is the voltage greater than 10 volts?**	
P9 CHECK THE FUNCTION SELECTOR SWITCH	
• Ignition OFF. • Carry out the Function Selector Switch component test in this section. • **Does the function selector switch test good?**	**Yes** REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation. **No** INSTALL a new function selector switch. REFER to Section 412-01 . TEST the system for normal operation.

Pinpoint Test Q: The Blower Motor Does Not Operate Correctly - Manual Climate Control

Refer to Wiring Diagrams Cell 54 , Manual Climate Control System for schematic and connector information.

Normal Operation

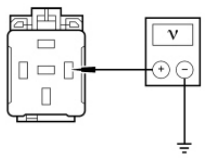
Under normal operation, when the high-speed blower relay is not energized, the blower motor is provided a ground from the resistor. The resistor is provided ground in the lowest blower setting. In MED-LO and MED-HI, the resistor gets a ground from the blower motor switch, depending on selected speed. The blower motor switch is grounded.

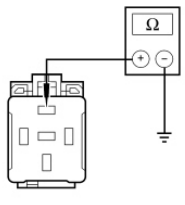
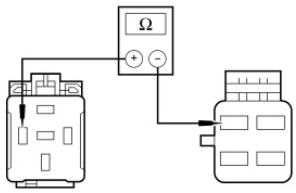
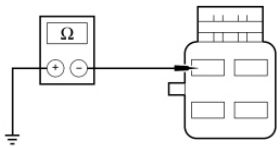
The high-speed blower motor relay coil receives voltage from the blower motor relay. The coil receives ground from the function selector switch when the highest blower speed is selected. Ground for high blower speed is provided to the high-speed blower relay when the relay is energized. The high-speed blower motor relay provides the blower motor ground.

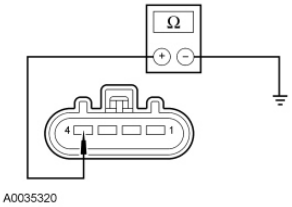
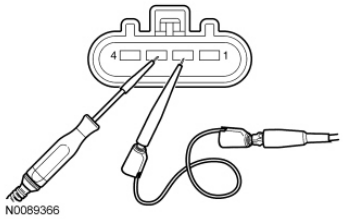
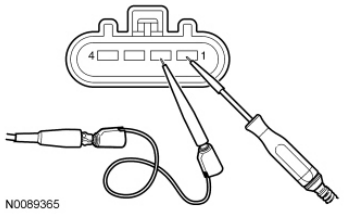
This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Blower motor resistor
- Blower motor switch
- High-speed blower motor relay

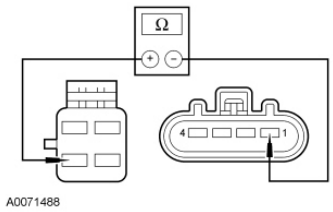
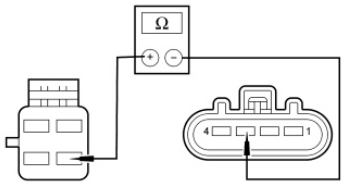
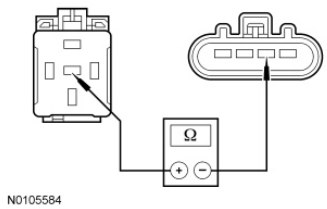
PINPOINT TEST Q: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY - MANUAL CLIMATE CONTROL

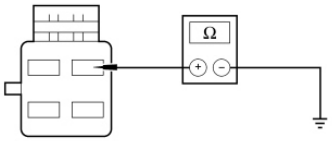
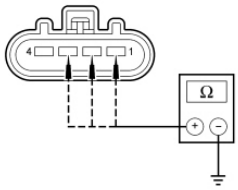
Test Step	Result / Action to Take
Q1 CHECK THE BLOWER MOTOR OPERATION	
• Ignition ON. • Turn the function selector switch to the FLOOR position. • Select all blower speed positions. • **Does the blower motor operate in any position?**	**Yes** If the blower motor does not operate in HI setting only, GO to Q2 .

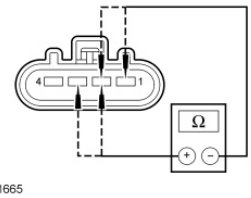
	If the blower motor does not operate in LO setting only, GO to Q6 . If the blower motor does not operate in MED-LO or MED-HI setting only, GO to Q7 . If the blower motor operates in HI setting only, GO to Q9 . If the blower motor operates in LO setting only, GO to Q10 . For all other symptoms, GO to Q11 . **No** GO to Pinpoint Test P .
Q2 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: High-Speed Blower Motor Relay. • Ignition ON. • Place the function selector switch in FLOOR and the blower motor switch in HI. • Measure the voltage between ground and high-speed blower motor relay pin 86, circuit CH402 (YE/GN).  N0046415 • **Is the voltage greater than 10 volts?**	**Yes** GO to Q3 . **No** REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.
Q3 CHECK THE HIGH-SPEED BLOWER MOTOR RELAY CIRCUIT GD140 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between ground and high-speed blower motor relay socket pin 87, circuit GD140 (BK/GN).	**Yes** GO to Q4 . **No** REPAIR circuit GD140 (BK/GN) for an open. TEST the system for normal operation.

 N0047168 • **Is the resistance less than 5 ohms?**	
Q4 CHECK CIRCUIT CH430 (VT/OG) FOR AN OPEN	
• Disconnect: Blower Motor Switch C294A. • Measure the resistance between high-speed blower motor relay socket pin 85, circuit CH430 (VT/OG) and the blower motor switch C294A-2, circuit CH430 (VT/OG), harness side.  N0047169 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q5 . **No** REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.
Q5 CHECK CIRCUIT CH430 (VT/OG) FOR A SHORT TO GROUND	
• Disconnect: Blower Motor Switch C294A. • Measure the resistance between ground and blower motor switch C294A-2, circuit CH430 (VT/OG), harness side.  A0013882 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new blower motor switch. TEST the system for normal operation. **No** REPAIR circuit CH430 (VT/OG) for a short to ground. TEST the system for normal operation.
Q6 CHECK BLOWER MOTOR RESISTOR GROUND CIRCUIT GD140 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Blower Motor Resistor C293. • Measure the resistance between ground and blower motor resistor C293-4, circuit GD140 (BK/GN), harness side.	**Yes** INSTALL a new blower motor resistor. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit GD140 (BK/GN) for an open. TEST the system for normal

 A0035320 • **Is the resistance less than 5 ohms?**	operation.
Q7 CHECK THE BLOWER MOTOR SWITCH	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** • Ignition OFF. • Disconnect: Blower Motor Resistor C293. • Ignition ON. **For MED-LO inoperative**  N0089366 • **For MED-LO inoperative** : With the blower motor switch in the MED-LO speed position, connect a 12-volt test light between blower motor resistor C293-2, circuit CH446 (BU/BN), harness side and blower motor resistor C293-3, circuit CH428 (GN/WH), harness side. **For MED-HI inoperative**  N0089365 • **For MED-HI inoperative** : With the blower motor switch in the MED-HI speed position, connect a 12-volt test light between blower motor resistor C293-2, circuit CH446 (BU/BN), harness side and blower motor resistor C293-1, circuit CH429 (GY/BN), harness side. • **Does the test light illuminate?**	**Yes** INSTALL a new blower motor resistor. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to Q8 .
Q8 CHECK CIRCUIT CH428 (GN/WH) OR CH429 (GY/BN) FOR AN OPEN	

• Ignition OFF. • Disconnect: Blower Motor Switch C294A. **For MED-LO inoperative**  A0071488 • **For MED-LO inoperative** : Measure the resistance between blower motor switch C294A-4, circuit CH428 (GN/WH), harness side and blower motor resistor C293-3, circuit CH428 (GN/WH), harness side. **For MED-HI inoperative**  A0071487 • **For MED-HI inoperative** : Measure the resistance between blower motor switch C294A-3, circuit CH429 (GY/BN), harness side and blower motor resistor C293-1, circuit CH429 (GY/BN), harness side. • **Is the resistance less than 5 ohms?**	**Yes** CARRY OUT the Blower Motor Resistor component test in this section. If the resistor tests OK, INSTALL a new blower motor switch. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit CH428 (GN/WH) or CH429 (GY/BN) for an open. TEST the system for normal operation.
Q9 CHECK BLOWER MOTOR RESISTOR CIRCUIT CH446 (BN/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: Blower Motor Resistor C293. • Disconnect: High-Speed Blower Motor Relay. • Measure the resistance between blower motor resistor C293-2, circuit CH446 (BN/BU), harness side and high-speed blower motor relay socket pin 87A, circuit CH446 (BN/BU).  N0105584 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new blower motor resistor. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.
Q10 CHECK THE BLOWER MOTOR SWITCH GROUND FOR AN OPEN	

• Ignition OFF. • Disconnect: Blower Motor Switch C294A. • Measure the resistance between ground and blower motor switch C294A-1, circuit GD138 (BK/WH), harness side.  A0020414 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new blower motor switch. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit GD138 (BK/WH) for an open. TEST the system for normal operation.
Q11 CHECK CIRCUITS CH446 (BU/BN), CH429 (GY/BN) AND CH428 (GN/WH) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Blower Motor Switch C294A. • Disconnect: Blower Motor C288. • Disconnect: Blower Motor Resistor C293. • Disconnect: High-Speed Blower Motor Relay. • Place the blower switch in the lowest setting. • Measure the resistance between ground and blower motor resistor: ♦ C293-1, circuit CH429 (GY/BN), harness side. ♦ C293-2, circuit CH446 (BU/BN), harness side. ♦ C293-3, circuit CH428 (GN/WH), harness side.  A0051664 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to Q12 . **No** REPAIR the affected circuit for a short to ground. TEST the system for normal operation.
Q12 CHECK THE BLOWER MOTOR CIRCUITS FOR SHORTS TOGETHER	
• Measure the resistance between blower motor resistor: ♦ C293-1, circuit CH429 (GY/BN), harness side and C293-2, circuit CH446 (BU/BN), harness side. ♦ C293-1, circuit CH429 (GY/BN), harness side and C293-3, circuit CH428 (GN/WH), harness side. ♦ C293-2, circuit CH446 (BU/BN), harness side and C293-3, circuit CH428 (GN/WH), harness side.	**Yes** INSTALL a new blower motor switch. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR the affected circuits for shorts. TEST the system for normal operation.

 • **Are the resistances greater than 10,000 ohms?**	

Pinpoint Test R: The Blower Motor is Inoperative - DATC System

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

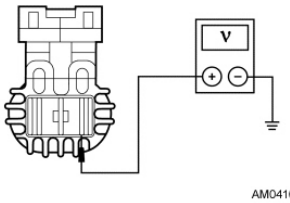
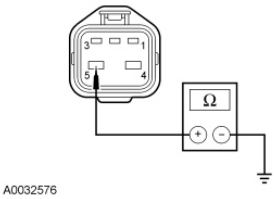
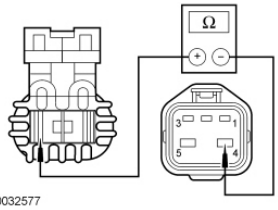
Under normal operation, the blower motor relay coil receives a ground. The coil receives voltage from the HVAC module - Dual Automatic Temperature Control (DATC) when the HVAC module - DATC is ON. Voltage is supplied to the relay contacts. When the relay coil is energized, voltage is delivered to the blower motor. Ground for the motor is provided from the blower control module. Ground is provided to the blower control module.

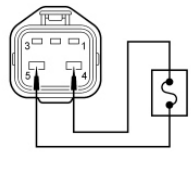
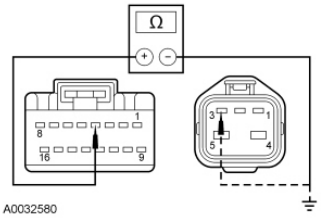
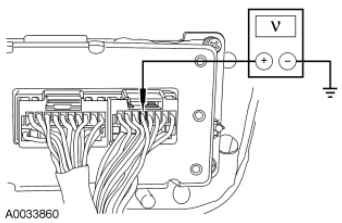
This pinpoint test is intended to diagnose the following:

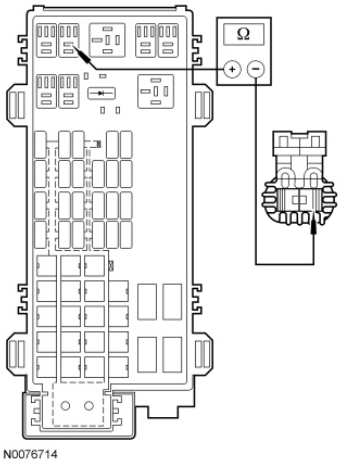
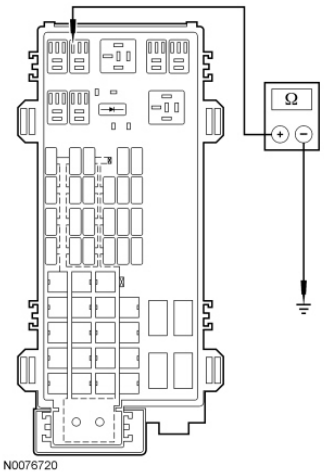
- Fuse(s)
- Wiring, terminals or connectors
- Blower motor control module
- HVAC module - DATC
- Blower motor relay
- Blower motor

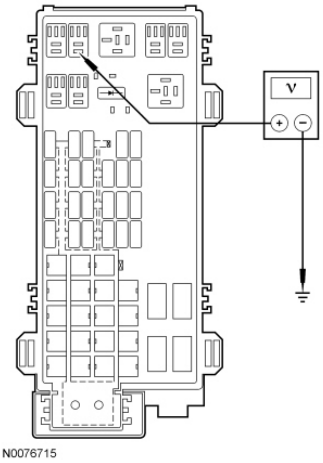
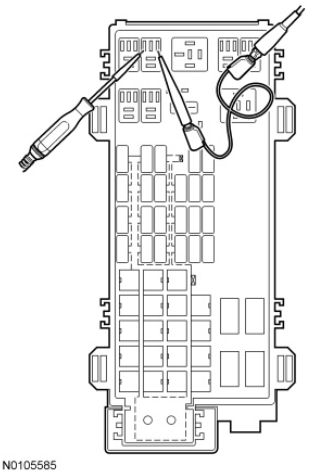
PINPOINT TEST R: THE BLOWER MOTOR IS INOPERATIVE - DATC SYSTEM

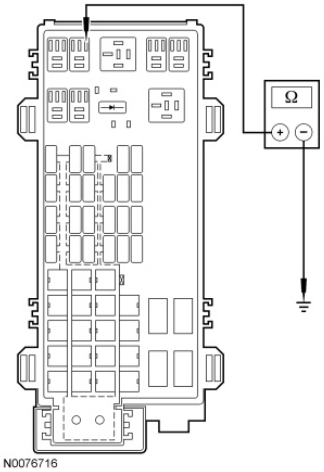
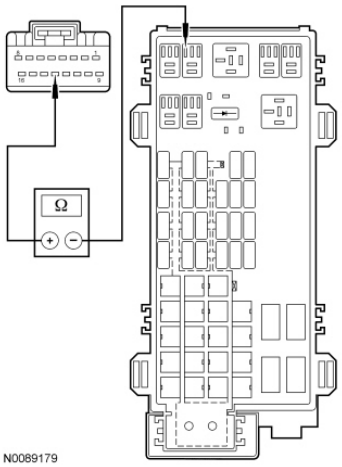
Test Step	Result / Action to Take
R1 VERIFY THE BLOWER MOTOR OPERATION	
• Ignition ON. • Press the PANEL button on the HVAC module - DATC . Adjust the blower motor setting to LO and then to HI. • **Is the blower motor inoperative in all settings?**	**Yes** GO to R2 . **No** GO to Pinpoint Test S .
R2 CHECK FOR VOLTAGE TO THE BLOWER MOTOR	
• Ignition OFF. • Disconnect: Blower Motor C288. • Ignition ON. • Measure the voltage between ground and blower motor C288-1, circuit CH402 (YE/GN), harness side.	**Yes** GO to R3 . **No** GO to R8 .

 AM0416-A • **Is the voltage greater than 10 volts?**	
R3 CHECK CIRCUIT GD140 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Blower Motor Speed Control C271. • Measure the resistance between ground and blower motor speed control C271-5, circuit GD140 (BK/GN), harness side.  A0032576 • **Is the resistance less than 5 ohms?**	**Yes** GO to R4 . **No** REPAIR circuit GD140 (BK/GN) for an open. TEST the system for normal operation.
R4 CHECK CIRCUIT VH301 (YE/BU) FOR AN OPEN	
• Measure the resistance between blower motor C288-2, circuit VH301 (YE/BU), harness side and blower motor speed control C271-4, circuit VH301 (YE/BU), harness side.  A0032577 • **Is the resistance less than 5 ohms?**	**Yes** GO to R5 . **No** REPAIR circuit VH301 (YE/BU) for an open. TEST the system for normal operation.
R5 CHECK THE BLOWER MOTOR	
• Connect: Blower Motor C288. • Connect a fused jumper lead between blower motor speed control C271-4, circuit VH301 (YE/BU), harness side and C271-5, circuit GD140 (BK/GN), harness side.	**Yes** GO to R6 . **No** INSTALL a new blower motor. REFER to Section 412-01 . TEST the system for normal operation.

 A0032579 • Ignition ON. • **Does the blower motor operate?**	
R6 CHECK CIRCUIT CH217 (BN) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Remove the fused jumper lead from blower motor speed control C271. • Disconnect: HVAC Module - DATC C228B. • Measure the resistance between: ♦ HVAC module - DATC C228B-4, circuit CH217 (BN), harness side and blower motor speed control C271-3, circuit CH217 (BN), harness side. ♦ ground and HVAC module - DATC C228B-4, circuit CH217 (BN), harness side.  A0032580 • **Is the resistance less than 5 ohms between the HVAC module - DATC and the blower motor speed control and greater than 10,000 ohms between the HVAC module - DATC and ground?**	**Yes** GO to R7 . **No** REPAIR circuit CH217 (BN) for an open or a short to ground. TEST the system for normal operation.
R7 CHECK THE HVAC MODULE OUTPUT	
• Connect: HVAC Module - DATC C228B. • Connect: Blower Motor Speed Control C271. • Ignition ON. • Adjust the blower motor speed to HI. • Measure the voltage between ground and HVAC module - DATC C228B-4, circuit CH217 (BN), harness side by back-probing the HVAC module - DATC C228B.  A0033860 • **Is the voltage within 2 volts of battery voltage?**	**Yes** INSTALL a new blower motor speed control. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to R14 .

R8 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Blower Motor Relay. • Measure the resistance between blower motor relay socket pin 5, circuit CH402 (YE/GN) and blower motor C288-1, circuit CH402 (YE/GN), harness side.  N0076714 • **Is the resistance less than 5 ohms?**	**Yes** GO to R9 . **No** REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.
R9 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Measure the resistance between ground and blower motor relay socket pin 2, circuit GD120 (BK/GN).  N0076720 • **Is the resistance less than 5 ohms?**	**Yes** GO to R10 . **No** REPAIR circuit GD120 (BK/GN) for an open. TEST the system for normal operation.
R10 CHECK CIRCUIT SBB16 (VT/RD) FOR VOLTAGE	

• Measure the voltage between ground and blower motor relay socket pin 3, circuit SBB16 (VT/RD).  N0076715 • **Is the voltage greater than 10 volts?**	**Yes** GO to R11 . **No** VERIFY Battery Junction Box (BJB) fuse 16 (40A) is OK. If OK, REPAIR circuit SBB16 (VT/RD) for an open. TEST the system for normal operation.
R11 CHECK THE HVAC MODULE OUTPUT	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** • Ignition ON. • Connect a 12-volt test light between blower motor relay socket pin 2, circuit GD120 (BK/GN) and socket pin 1, circuit CH123 (VT/GN).  N0105585 • **Does the test light illuminate?**	**Yes** INSTALL a new blower motor relay. TEST the system for normal operation. **No** GO to R12 .
R12 CHECK CIRCUIT CH123 (VT/GN) FOR SHORT TO GROUND	

• Ignition OFF. • Disconnect: HVAC Module - DATC C228B. • Measure the resistance between ground and blower motor relay socket pin 1, circuit CH123 (VT/GN).  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to R13 . **No** REPAIR circuit CH123 (VT/GN) for a short to ground. TEST the system for normal operation.
R13 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN	
• Measure the resistance between HVAC module - DATC C228B-13, circuit CH123 (VT/GN), harness side and blower motor relay socket pin 2, circuit CH123 (VT/GN).  • **Is the resistance less than 5 ohms?**	**Yes** GO to R14 . **No** REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.
R14 CHECK THE HVAC MODULE CONNECTION	
• Inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system and verify the concern is still present.	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may

• **Is the concern still present?**	have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test S: The Blower Motor Does Not Operate Correctly - DATC System

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

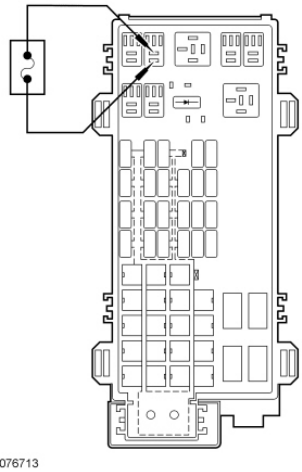
Under normal operation, the blower motor control module receives a 1-2 volt signal from the HVAC module - Dual Automatic Temperature Control (DATC) to determine the desired blower motor speed. The HVAC module - DATC receives a feedback voltage from the blower motor control module to determine actual blower motor speed. When the highest blower motor setting is selected, the HVAC module - DATC sends 12 volts to the blower control module.

This pinpoint test is intended to diagnose the following:

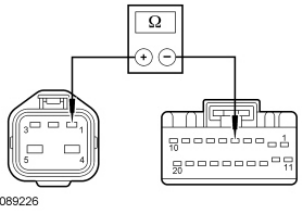
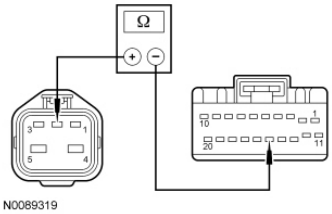
- Wiring, terminals or connectors
- Blower motor control module
- HVAC module - DATC

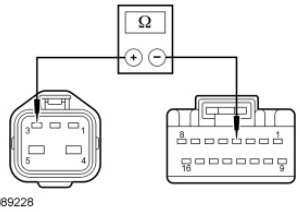
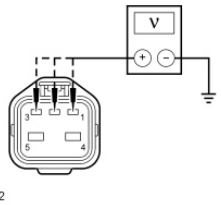
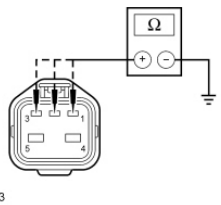
PINPOINT TEST S: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY - DATC SYSTEM

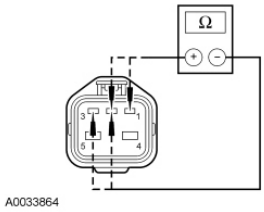
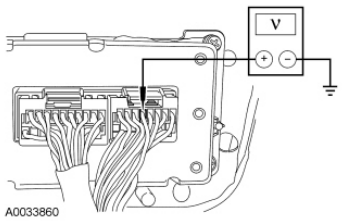
Test Step	Result / Action to Take
S1 CHECK CIRCUIT VH301 (YE/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Blower Motor Speed Control C271. • Ignition ON. • Press the PANEL button on the HVAC module - DATC . Adjust the blower motor setting to LO and then to HI. • **Does the blower motor operate?**	**Yes** REPAIR circuit VH301 (YE/BU) for a short to ground. TEST the system for normal operation. **No** GO to S2 .
S2 CHECK THE BLOWER MOTOR SPEED CONTROL	
• Ignition OFF. • Connect: Blower Motor Speed Control C271. • Disconnect: HVAC Module - DATC C228A. • Disconnect: HVAC Module - DATC C228B. • Disconnect: Blower Motor Relay. • Connect a fused jumper lead between blower motor relay socket pin 3, circuit SBB16 (VT/RD) and pin 5, circuit CH402 (YE/GN).	**Yes** INSTALL a new blower motor speed control module. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to S3 .

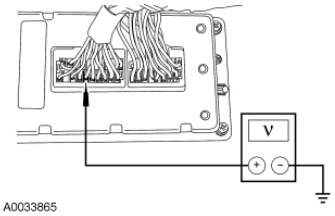

N0076713

- **Does the blower motor operate?**

S3 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR AN OPEN	
• Ignition OFF. • Connect: Blower Motor Relay. • Disconnect: Blower Motor Speed Control C271. • Measure the resistance between blower motor speed control C271-1, circuit VH219 (GY), harness side and HVAC module - DATC C228A-5, circuit VH219 (GY), harness side.  N0089226 • Measure the resistance between blower motor speed control C271-2, circuit CH218 (GN/VT), harness side and HVAC module - DATC C228A-15, circuit CH218 (GN/VT), harness side.  N0089319 • Measure the resistance between blower motor speed control C271-3, circuit CH217 (BN), harness side and HVAC module - DATC C228B-4, circuit CH217 (BN), harness side.	**Yes** GO to S4 . **No** REPAIR the affected circuit for an open. TEST the system for normal operation.

 N0089228 • **Are the resistances less than 5 ohms?**	
S4 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and blower motor speed control: ♦ C271-1, circuit VH219 (GY), harness side. ♦ C271-2, circuit CH218 (GN/VT), harness side. ♦ C271-3, circuit CH217 (BN), harness side.  A0033862 • **Are any voltages present?**	**Yes** REPAIR the affected circuit for a short to voltage. TEST the system for normal operation. **No** GO to S5 .
S5 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between ground and blower motor speed control: ♦ C271-1, circuit VH219 (GY), harness side. ♦ C271-2, circuit CH218 (GN/VT), harness side. ♦ C271-3, circuit CH217 (BN), harness side.  A0033863 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to S6 . **No** REPAIR the affected circuit for a short to ground. TEST the system for normal operation.
S6 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR SHORTS TOGETHER	

• Measure the resistance between blower motor speed control: ♦ C271-1, circuit VH219 (GY), harness side and C271-2, circuit CH218 (GN/VT), harness side. ♦ C271-1, circuit VH219 (GY), harness side and C271-3, circuit CH217 (BN), harness side. ♦ C271-2, circuit CH218 (GN/VT), harness side and C271-3, circuit CH217 (BN), harness side.  A0033864 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to S7 . **No** REPAIR the affected circuits for shorts. TEST the system for normal operation.
S7 CHECK THE HVAC MODULE HIGH BLOWER OUTPUT	
• Connect: HVAC Module - DATC C228B. • Connect: Blower Motor Speed Control C271. • Ignition ON. • Adjust the blower motor speed to HI. • Measure the voltage between ground and HVAC module - DATC C228B-4, circuit CH217 (BN), harness side by back-probing the HVAC module - DATC C228B.  A0033860 • **Is the voltage within 2 volts of battery voltage?**	**Yes** GO to S8 . **No** GO to S9 .
S8 CHECK THE HVAC MODULE BLOWER CONTROL OUTPUT	
• Adjust the blower motor speed to LO. • Measure the voltage between ground and HVAC module - DATC C228A-15, circuit CH218 (GN/VT), harness side by back-probing the HVAC module - DATC C228A.	**Yes** INSTALL a new blower motor speed control. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to S9 .

 • **Is the voltage greater than one volt?**	
S9 CHECK THE HVAC MODULE CONNECTION	
• Inspect the HVAC module connectors for: ♦ corrosion. ♦ pushed-out terminals. ♦ damaged terminals. • Connect and correctly seat all the HVAC module connectors. • Clear the DTCs. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test T: The Auxiliary Blower Motor is Inoperative

Refer to Wiring Diagrams Cell 52 , Auxilary Climate Control for schematic and connector information.

Normal Operation

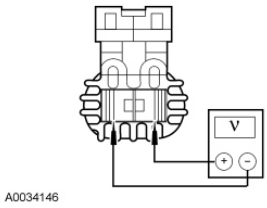
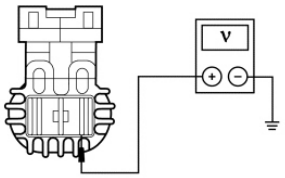
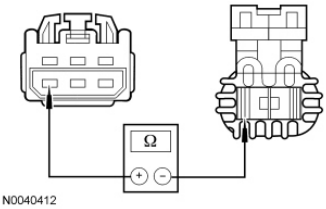
Under normal operation, the auxiliary blower motor relay coil receives a ground. The auxiliary blower motor relay coil receives voltage when the HVAC module - Dual Automatic Temperature Control (DATC) is ON or the function selector switch is in any position but OFF. Voltage is supplied to the auxiliary blower motor relay contacts. When the auxiliary blower motor relay coil is energized, voltage is delivered to the blower motor. Ground for the motor is provided from the blower motor resistor and blower motor switch. The blower motor resistor and blower motor switch are grounded.

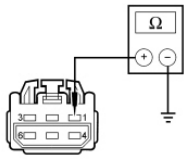
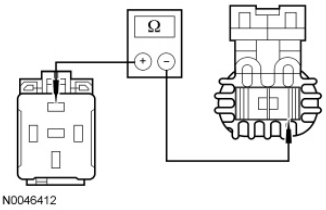
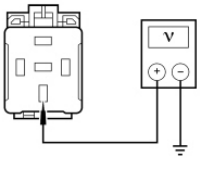
This pinpoint test is intended to diagnose the following:

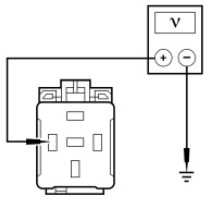
- Fuse
- Wiring, terminals or connectors
- Auxiliary blower motor
- Auxiliary blower motor relay
- Front auxiliary climate control assembly

PINPOINT TEST T: THE AUXILIARY BLOWER MOTOR IS INOPERATIVE

Test Step	Result / Action to Take
T1 CHECK FOR VOLTAGE AND GROUND TO THE AUXILIARY BLOWER MOTOR	

• Ignition OFF. • Disconnect: Auxiliary Blower Motor C3021. • Place the front auxiliary blower motor switch in its highest setting. • Ignition ON. • Measure the voltage between auxiliary blower motor C3021-1, circuit CHA02 (BN/GN), harness side and C3021-2, circuit CHA08 (GN/OG), harness side.  A0034146 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new auxiliary blower motor. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to T2 .
T2 CHECK FOR VOLTAGE TO THE AUXILIARY BLOWER MOTOR	
• Measure the voltage between ground and auxiliary blower motor C3021-1, circuit CHA02 (BN/GN), harness side.  AM0416-A • **Is the voltage greater than 10 volts?**	**Yes** GO to T3 . **No** GO to T5 .
T3 CHECK CIRCUIT CHA08 (GN/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: Front Auxiliary Climate Control Assembly C951A. • Measure the resistance between auxiliary blower motor switch C951A-6, circuit CHA08 (GN/OG), harness side and auxiliary blower motor C3021-2, circuit CHA08 (GN/OG), harness side.  N0040412 • **Is the resistance less than 5 ohms?**	**Yes** GO to T4 . **No** REPAIR circuit CHA08 (GN/OG) for an open. TEST the system for normal operation.

T4 CHECK CIRCUIT GD149 (BK/GY) FOR AN OPEN	
• Measure the resistance between ground and front auxiliary climate control assembly C951A-1, circuit GD149 (BK/GY), harness side.  A0034148 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new front auxiliary climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit GD149 (BK/GY) for an open. TEST the system for normal operation.
T5 CHECK CIRCUIT CHA02 (BN/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Auxiliary Blower Motor Relay. • Measure the resistance between auxiliary blower motor relay socket pin 87, circuit CHA02 (BN/GN) and auxiliary blower motor C3021-1, circuit CHA02 (BN/GN), harness side.  N0046412 • **Is the resistance less than 5 ohms?**	**Yes** GO to T6 . **No** REPAIR circuit CHA02 (BN/GN) for an open. TEST the system for normal operation.
T6 CHECK CIRCUIT SBB18 (YE/RD) FOR AN OPEN	
• Measure the voltage between ground and auxiliary blower motor relay socket pin 30, circuit SBB18 (YE/RD).  N0046413 • **Is the voltage greater than 10 volts?**	**Yes** CARRY OUT the auxiliary blower motor relay component test. Refer to Wiring Diagrams Cell 149 for component testing. If the relay tests OK, GO to T7 . **No** VERIFY Battery Junction Box (BJB) fuse 18 (30A) is OK. If OK, REPAIR circuit SBB18 (YE/RD) for an open. TEST the system for normal operation.
T7 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN	

• Ignition ON. • Press the DEFROST button on the HVAC module - DATC . • Measure the voltage between ground and auxiliary blower motor relay socket pin 85, circuit CH123 (VT/GN).  N0076723 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit GD140 (BK/GN) for an open. TEST the system for normal operation. **No** REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.

Pinpoint Test U: The Auxiliary Blower Motor Does Not Operate Correctly Using the Front Auxiliary Blower Motor Switch

Refer to Wiring Diagrams Cell 52 , Auxilary Climate Control for schematic and connector information.

Normal Operation

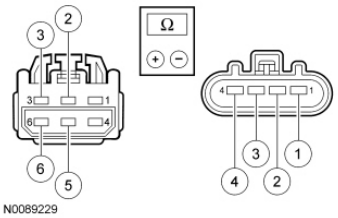
Under normal operation, the blower motor is provided a ground from the resistor. The resistor gets a ground from the front auxiliary blower switch, depending on selected speed.

This pinpoint test is intended to diagnose the following:
- Wiring, terminals or connectors
- Auxiliary blower motor resistor
- Front auxiliary climate control assembly

PINPOINT TEST U: THE AUXILIARY BLOWER MOTOR DOES NOT OPERATE CORRECTLY USING THE FRONT AUXILIARY BLOWER MOTOR SWITCH

Test Step	Result / Action to Take
U1 CHECK THE AUXILIARY BLOWER MOTOR RESISTOR CIRCUITS FOR AN OPEN	
• Disconnect: Auxiliary Blower Motor Resistor C3022. • Disconnect: Front Auxiliary Climate Control Assembly C951A. • Measure the resistance between the front auxiliary climate control assembly, harness side and auxiliary blower motor resistor, harness side using the following chart. **Front Auxiliary Climate Control Assembly** / **Circuit** / **Auxiliary Blower Motor Resistor**	**Yes** GO to U2 . **No** REPAIR the affected circuit(s) for an open. TEST the system for normal operation.

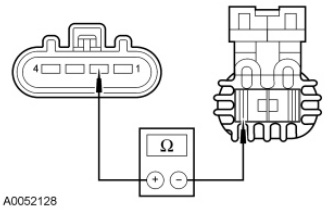
C951A-2	CHA06 (YE/VT)	C3022-4
C951A-3	CHA07 (BU/GY)	C3022-3
C951A-5	CHA16 (BU)	C3022-1
C951A-6	CHA08 (GN/OG)	C3022-2



- **Are the resistances less than 5 ohms?**

U2 CHECK CIRCUIT CHA08 (GN/OG) FOR AN OPEN

- Measure the resistance between auxiliary blower motor resistor C3022-2, circuit CHA08 (GN/OG), harness side and the auxiliary blower motor C3021-2, circuit CHA08 (GN/OG), harness side.



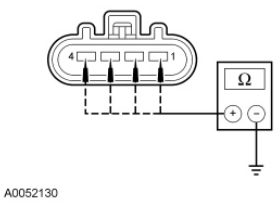
- **Is the resistance less than 5 ohms?**

Yes
GO to U3 .

No
REPAIR circuit CHA08 (GN/OG) for an open. TEST the system for normal operation.

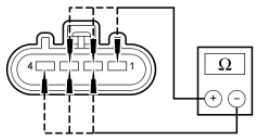
U3 CHECK THE AUXILIARY BLOWER MOTOR RESISTOR CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between ground and auxiliary blower motor resistor:
  - C3022-1, circuit CHA16 (BU), harness side.
  - C3022-2, circuit CHA08 (GN/OG), harness side.
  - C3022-3, circuit CHA07 (BU/GY), harness side.
  - C3022-4, circuit CHA06 (YE/VT), harness side.



Yes
GO to U4 .

No
REPAIR the affected circuit(s) for a short to ground. TEST the system for normal operation.

• **Are the resistances greater than 10,000 ohms?**	
U4 CHECK THE AUXILIARY BLOWER MOTOR RESISTOR CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between auxiliary blower motor resistor: ♦ C3022-1, circuit CHA16 (BU), harness side and C3022-2, circuit CHA08 (GN/OG), harness side. ♦ C3022-1, circuit CHA16 (BU), harness side and C3022-3, circuit CHA07 (BU/GY), harness side. ♦ C3022-1, circuit CHA16 (BU), harness side and C3022-4, circuit CHA06 (YE/VT), harness side. ♦ C3022-2, circuit CHA08 (GN/OG), harness side and C3022-3, circuit CHA07 (BU/GY), harness side. ♦ C3022-2, circuit CHA08 (GN/OG), harness side and C3022-4, circuit CHA06 (YE/VT), harness side. ♦ C3022-3, circuit CHA07 (BU/GY), harness side and C3022-4, circuit CHA06 (YE/VT), harness side.  A0052131 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to U5 . **No** REPAIR the affected circuit(s) for shorts. TEST the system for normal operation.
U5 CHECK THE AUXILIARY BLOWER MOTOR RESISTOR	
• Carry out the Auxiliary Blower Motor Resistor component test in this section. • **Does the auxiliary blower motor resistor test good?**	**Yes** INSTALL a new front auxiliary climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** INSTALL a new blower motor resistor. REFER to Section 412-01 . TEST the system for normal operation.

Pinpoint Test V: The Auxiliary Panel/Floor Control is Inoperative Using the Front Auxiliary Climate Controls

Refer to Wiring Diagrams Cell 52 , Auxilary Climate Control for schematic and connector information.

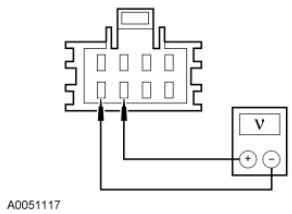
Normal Operation

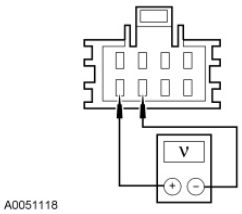
Under normal operation, the auxiliary mode door actuator motor is driven to the floor position by supplying voltage to the motor on circuit CHA11 (WH/OG) and ground to circuit CHA12 (GN/BU). The auxiliary mode door actuator motor is driven to the panel position by reversing the voltage and ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Front auxiliary climate control assembly
- Auxiliary mode door actuator motor
- Broken/binding auxiliary mode door

PINPOINT TEST V: THE AUXILIARY PANEL/FLOOR CONTROL IS INOPERATIVE USING THE FRONT AUXILIARY CLIMATE CONTROLS

Test Step	Result / Action to Take
V1 CHECK THE FLOOR MODE OUTPUT	
• Disconnect: Air Distribution Door Actuator C3004. • Ignition ON. • Place the front auxiliary blower motor switch in HI and set the front auxiliary climate control assembly to FLOOR. • Measure the voltage between air distribution door actuator C3004-8, circuit CHA11 (WH/OG), harness side and C3004-7, circuit CHA12 (GN/BU), harness side.  A0051117 • **Is the voltage greater than 10 volts?**	**Yes** GO to V2 . **No** GO to V3 .
V2 CHECK THE PANEL MODE OUTPUT	
• Set the front auxiliary climate control assembly to PANEL. • Measure the voltage between air distribution door actuator C3004-7, circuit CHA12 (GN/BU), harness side and C3004-8, circuit CHA11 (WH/OG), harness side.	**Yes** CHECK for a broken/binding auxiliary mode door. If OK, INSTALL a new air distribution door actuator. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to V3 .

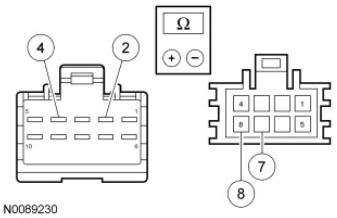


- **Is the voltage greater than 10 volts?**

V3 CHECK THE AIR DISTRIBUTION DOOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: Front Auxiliary Climate Control Assembly C951B.
- Measure the resistance between the front auxiliary climate control assembly, harness side and air distribution door actuator, harness side using the following chart.

Front Auxiliary Climate Control Assembly	Circuit	Air Distribution Door Actuator
C951B-2	CHA11 (WH/OG)	C3004-7
C951B-4	CHA12 (GN/BU)	C3004-8



- **Are the resistances less than 5 ohms?**

Yes
GO to V4 .

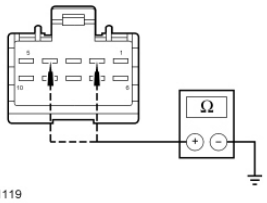
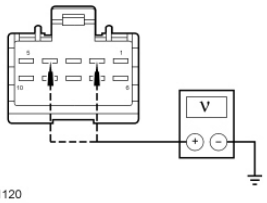
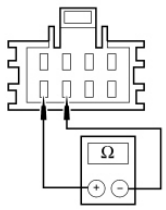
No
REPAIR the affected circuit for an open. TEST the system for normal operation.

V4 CHECK CIRCUITS CHA11 (WH/OG) AND CHA12 (GN/BU) FOR A SHORT TO GROUND

- Measure the resistance between ground and front auxiliary climate control assembly:
  - C951B-2, circuit CHA11 (WH/OG), harness side.
  - C951B-4, circuit CHA12 (GN/BU), harness side.

Yes
GO to V5 .

No
REPAIR the affected circuit for a short to ground. TEST the system for normal operation.

 A0051119 • **Are the resistances greater than 10,000 ohms?**	
V5 CHECK CIRCUITS CHA11 (WH/OG) AND CHA12 (GN/BU) FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between ground and front auxiliary climate control assembly: ♦ C951B-2, circuit CHA11 (WH/OG), harness side. ♦ C951B-4, circuit CHA12 (GN/BU), harness side.  A0051120 • **Are any voltages present?**	**Yes** REPAIR the affected circuit for a short to voltage. TEST the system for normal operation. **No** GO to V6 .
V6 CHECK CIRCUITS CHA12 (GN/BU) AND CHA11 (WH/OG) FOR A SHORT TOGETHER	
• Ignition OFF. • Measure the resistance between front auxiliary climate control assembly C3004-8, circuit CHA12 (GN/BU), harness side and C3004-7, circuit CHA11 (WH/OG), harness side.  A0051121 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new front auxiliary climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuits CHA12 (GN/BU) and CHA11 (WH/OG) for a short together. TEST the system for normal operation.

Pinpoint Test W: The Auxiliary Temperature Control is Inoperative Using the Front Auxiliary Climate Controls

Refer to Wiring Diagrams Cell 52 , Auxilary Climate Control for schematic and connector information.

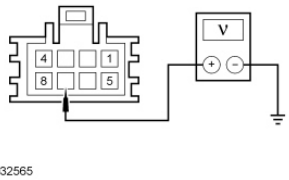
Normal Operation

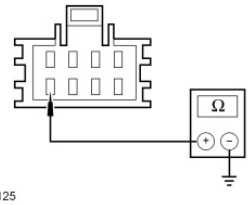
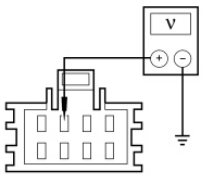
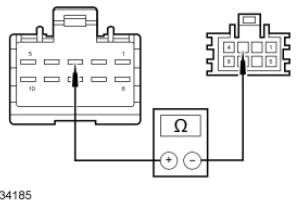
Under normal operation, the auxiliary temperature blend door actuator is supplied voltage and ground. A signal voltage is received by the auxiliary temperature blend door actuator from the front auxiliary temperature control to command the auxiliary temperature blend door actuator position.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Front auxiliary climate control assembly
- Auxiliary temperature blend door actuator
- Broken/binding auxiliary temperature blend door

PINPOINT TEST W: THE AUXILIARY TEMPERATURE CONTROL IS INOPERATIVE USING THE FRONT AUXILIARY CLIMATE CONTROLS

Test Step	Result / Action to Take
W1 CHECK VOLTAGE TO BLEND DOOR ACTUATOR	
• Disconnect: Auxiliary Temperature Blend Door Actuator C3004. • Ignition ON. • Measure the voltage between ground and auxiliary temperature blend door actuator C3004-7, circuit CBP18 (GY/OG), harness side.  A0032565 • **Is the voltage greater than 10 volts?**	**Yes** GO to W2 . **No** VERIFY the Smart Junction Box (SJB) fuse 18 (10A) is OK. If OK, REPAIR circuit CBP18 (GY/OG) for an open. TEST the system for normal operation.
W2 CHECK THE BLEND DOOR ACTUATOR GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Measure the resistance between ground and auxiliary temperature blend door actuator C3004-8, circuit GD149 (BK/GY), harness side.	**Yes** GO to W3 . **No** REPAIR circuit GD149 (BK/GY) for an open. TEST the system for normal operation.

 A0051125 • **Is the resistance less than 5 ohms?**	
W3 CHECK THE TEMPERATURE BLEND DOOR ACTUATOR SIGNAL	
• Ignition ON. • Place the front auxiliary blower motor switch in HI. • Measure the voltage between ground and auxiliary temperature blend door actuator C3004-3, circuit VHA09 (VT/BN), harness side.  A0051126 • Rotate the temperature control switch to full COOL then to full WARM. • **Does the voltage vary from greater than 10 volts (full COOL) to less than 1 volt (full WARM)?**	**Yes** Check for a broken/binding auxiliary temperature blend door. If OK, INSTALL a new auxiliary temperature blend door actuator. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to W4 .
W4 CHECK CIRCUIT VHA09 (VT/BN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Front Auxiliary Climate Control Assembly C951B. • Measure the resistance between front auxiliary climate control assembly C951B-3, circuit VHA09 (VT/BN), harness side and auxiliary temperature blend door actuator C3004-3, circuit VHA09 (VT/BN), harness side.  A0034185 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new front auxiliary climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit VHA09 (VT/BN) for an open. TEST the system for normal operation.

Pinpoint Test X: The Auxiliary Temperature and Panel/Floor Controls are Inoperative Using the Front Auxiliary Climate Controls

Refer to Wiring Diagrams Cell 52 , Auxilary Climate Control for schematic and connector information.

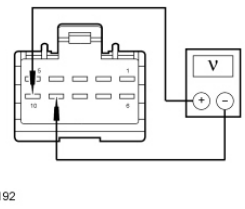
Normal Operation

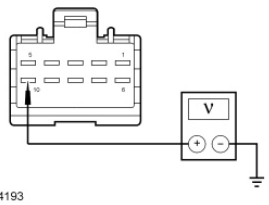
Under normal operation, the front auxiliary climate control assembly receives voltage and ground.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Front auxiliary climate control assembly

PINPOINT TEST X: THE AUXILIARY TEMPERATURE AND PANEL/FLOOR CONTROLS ARE INOPERATIVE USING THE FRONT AUXILIARY CLIMATE CONTROLS

Test Step	Result / Action to Take
X1 CHECK FOR VOLTAGE TO THE FRONT AUXILIARY CLIMATE CONTROL ASSEMBLY	
• Ignition OFF. • Disconnect: Front Auxiliary Climate Control Assembly C951B. • Ignition ON. • Measure the voltage between front auxiliary climate control assembly C951B-10, circuit CBP18 (GY/OG), harness side and C951B-9, circuit GD149 (BK/GY), harness side.  A0034192 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new front auxiliary climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to X2 .
X2 CHECK CIRCUIT CBP18 (GY/OG) FOR AN OPEN	
• Measure the voltage between ground and front auxiliary climate control assembly C951B-10, circuit CBP18 (GY/OG), harness side.	**Yes** REPAIR circuit GD149 (BK/GY) for an open. TEST the system for normal operation. **No** VERIFY Smart Junction Box (SJB) fuse 18 (10A) is OK. If OK, REPAIR circuit CBP18 (GY/OG) for an open. TEST the system for normal operation.

 • **Is the voltage greater than 10 volts?**	

Pinpoint Test Y: Insufficient Air Conditioning (A/C) Cooling

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

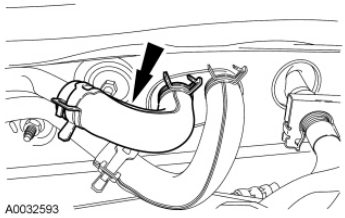
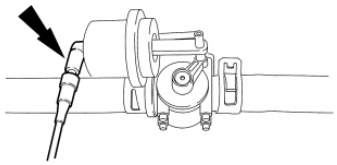
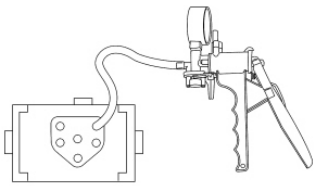
Under normal operation, the solenoid and manifold assembly receives a ground from the HVAC module - Dual Automatic Temperature Control (DATC). When the heater control valve vacuum solenoid is to be energized, the solenoid and manifold assembly receives voltage from the HVAC module - DATC .

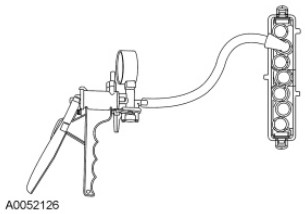
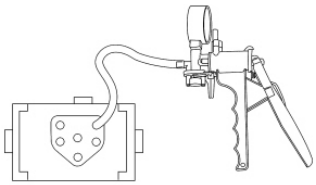
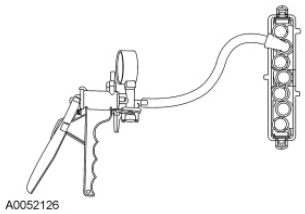
This pinpoint test is intended to diagnose the following:

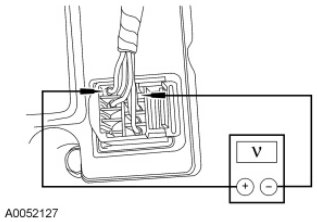
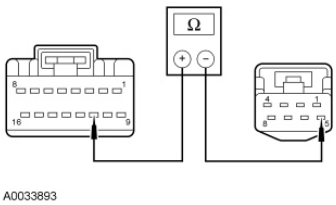
- Wiring, terminals or connectors
- Solenoid and manifold assembly
- HVAC module - DATC
- Manual climate control assembly
- Heater control valve
- Stuck or bound linkage or door
- Leaking or plugged vacuum hose

PINPOINT TEST Y: INSUFFICIENT AIR CONDITIONING (A/C) COOLING

Test Step	Result / Action to Take
Y1 CHECK FOR COOLANT FLOW TO THE HEATER CORE	
• Run the engine until it reaches normal operation temperature. • Press the PANEL, RECIRC and A/C buttons on the HVAC module - DATC or select MAX A/C on the function selector switch. Set the temperature control to full COOL. • Using a suitable temperature measuring device, check the heater core inlet hose to see if it is hot.	**Yes** GO to Y2 . **No** GO to Refrigerant System Tests in this section.

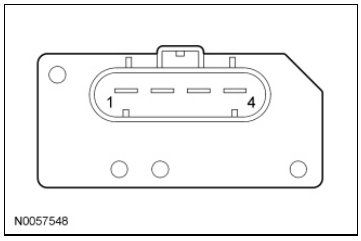
 A0032593 • **Is the heater core inlet hose hot?**	
Y2 CHECK FOR VACUUM AT THE HEATER CONTROL VALVE	
• Disconnect the heater control valve vacuum connector and check for vacuum.  A0035187 • **Is vacuum present at the heater control valve?**	**Yes** INSTALL a new heater control valve. REFER to Section 412-01 . TEST the system for normal operation. **No** GO to Y3 .
Y3 CHECK THE HEATER CONTROL VALVE VACUUM LINE FOR BLOCKAGE	
• Ignition OFF. • **NOTE:** Manual climate control systems only. • Disconnect the function selector switch vacuum connector. Connect the vacuum pump to the heater control valve vacuum line and attempt to pull a vacuum.  A0055376 • **NOTE:** DATC systems only. • Disconnect the solenoid and manifold assembly vacuum connector. Connect the vacuum pump to the heater control valve vacuum line and attempt to pull a vacuum.	**Yes** INSTALL a new vacuum harness. TEST the system for normal operation. **No** GO to Y4 .

 A0052126 • **Can a vacuum be pulled on the heater control valve vacuum line?**	
Y4 CHECK THE HEATER CONTROL VALVE VACUUM LINE FOR LEAKS	
• Plug the heater control valve vacuum line at the heater control valve connection. • **NOTE:** Manual climate control systems only. • Leak test the heater control valve vacuum line, using the vacuum pump.  A0055376 • **NOTE:** DATC systems only. • Leak test the heater control valve vacuum line, using the vacuum pump.  A0052126 • **Does the heater control valve vacuum line leak?**	**Yes** INSTALL a new vacuum harness. TEST the system for normal operation. **No** GO to Y5 .
Y5 CHECK FOR INCORRECT VACUUM LINE PLACEMENT	
• Ignition OFF. • Inspect the heater control valve and A/C vacuum lines for correct placement. • **Is the vacuum line placement correct?**	**Yes** Manual climate control systems, INSTALL a new climate control assembly. REFER to Section 412-01 . TEST the system for normal operation. DATC systems, GO to Y6 . **No** CORRECT the vacuum line placement. TEST the system for normal operation.

Y6 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY CIRCUIT VOLTAGE	
• Connect the vacuum harness connector to the solenoid and manifold assembly. • Ignition ON. • Press the PANEL, RECIRC and A/C buttons on the HVAC module - DATC . • **NOTE:** The following measurement must be taken by back-probing the solenoid and manifold assembly C2093. • Measure the voltage between solenoid and manifold assembly C2093-1, circuit RH226 (WH/VT), harness side and C2093-6, circuit CH224 (BU/OG), harness side.  A0052127 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new solenoid and manifold assembly. TEST the system for normal operation. **No** GO to Y7 .
Y7 CHECK THE SOLENOID AND MANIFOLD ASSEMBLY CIRCUIT CH224 (BU/OG) FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module - DATC C228B. • Disconnect: Solenoid and Manifold Assembly C2093. • Measure the resistance between HVAC module - DATC C228B-14, circuit CH224 (BU/OG), harness side and solenoid and manifold assembly C2093-6, circuit CH224 (BU/OG), harness side.  A0033893 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new HVAC module - DATC . REFER to Section 412-01 . TEST the system for normal operation. **No** REPAIR circuit CH224 (BU/OG) for an open. TEST the system for normal operation.

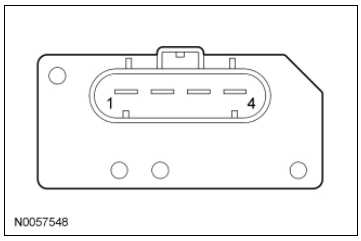
Component Tests

Blower Motor Resistor



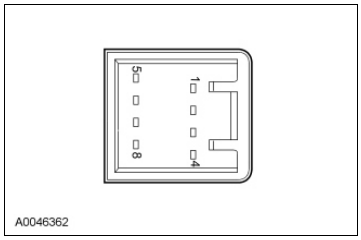
Blower Motor Resistor Pins	Resistance
1 and 4	1.5-2.1 ohms
1 and 3	0.4-0.8 ohm
1 and 2	0.15-0.3 ohm

Auxiliary Blower Motor Resistor



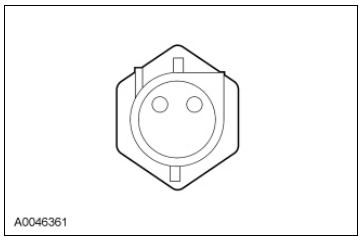
Blower Motor Resistor Pins	Resistance
1 and 4	2.3-2.9 ohms
1 and 3	0.8-1.1 ohms
1 and 2	0.2-0.4 ohm

Solenoid and Manifold Assembly



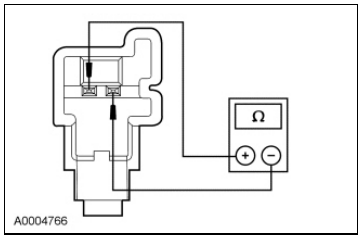
Solenoid and Manifold Assembly Pins	Resistance
1 and 2	44-54 ohms
1 and 3	44-54 ohms
1 and 4	44-54 ohms
1 and 5	44-54 ohms
1 and 6	44-54 ohms

Ambient Temperature Sensor



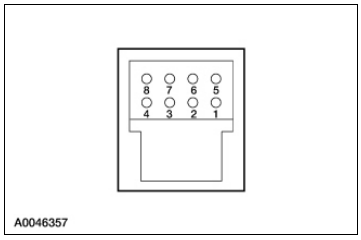
Ambient Temperature	Resistance
10-20°C (50-68°F)	37,000-58,000 ohms
20-30°C (68-86°F)	24,000-37,000 ohms
30-40°C (86-104°F)	16,000-24,000 ohms

In-Vehicle Temperature Sensor



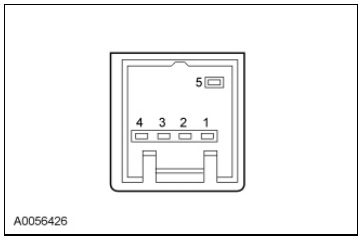
Temperature	Resistance
10-20°C (50-68°F)	37,000-58,000 ohms
20-30°C (68-86°F)	24,000-37,000 ohms
30-40°C (86-104°F)	16,000-24,000 ohms

(Dual Automatic Temperature Control (DATC) systems) Temperature Blend Door Actuator



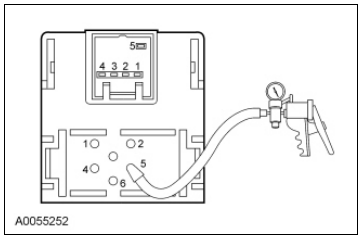
Resistance Between Pins	Resistance Range (approx.)
1 and 5	250-5,500 ohms
1 and 6	250-5,500 ohms

Function Selector Switch



Function Selection	Continuity Between Electrical Pins
MAX A/C	1, 2, 3 and 4
PANEL	1, 2 and 4
PANEL/FLOOR	1, 2 and 4
OFF	None
FLOOR	1, 2 and 4
FLOOR/DEFROST	1, 2 and 5
DEFROST	1, 2 and 5

Function Selector Vacuum Switch



Connect a vacuum pump to the function selector switch vacuum supply port and try to pull a vacuum in each function selector switch positions. Follow the chart below, to determine which positions should and should not hold vacuum. If the vacuum pump can pull and hold a vacuum when the chart indicates no vacuum (NV), the switch is plugged. If the vacuum pump does not pull and hold a vacuum when the chart indicates vacuum (V), the switch leaks.

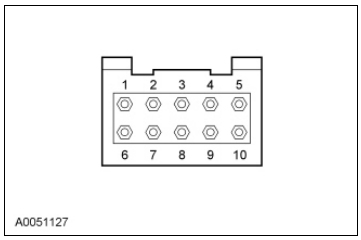
Vacuum Application Chart

Function Selector Switch Position						
MAX A/C	**PANEL**	**FLOOR/ PANEL**	**OFF**	**FLOOR**	**FLOOR/ DEF**	**DEF**
NV	V	V	NV	V	V	V
V	V	NV	V	NV	NV	V
NV	NV	NV	V	V	V	V
V	V	V	NV	NV	V	V

V = Vacuum

NV= No Vacuum

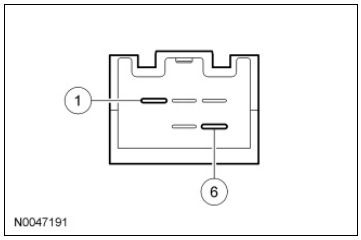
Front Auxiliary Climate Control Assembly



Airflow Mode	Continuity Between Pins
FLOOR	4 and 9, 2 and 10
PANEL	4 and 10, 2 and 9

Resistance Between Pins	Resistance Range (approx.)
3 and 9	50 ohms (WARM)-3,000 ohms (COOL)
3 and 10	50 ohms (COOL)-3,000 ohms (WARM)

Front Auxiliary Blower Motor Switch



Blower Switch Selection	Continuity Between Electrical Pins
Off	None
Low	1 and 2
Med-Low	1 and 3
Med-High	1 and 5
High	1 and 6

Heater Core

1. **NOTE:** If a heater core leak is suspected, the heater core must be tested by carrying out the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

   Inspect for evidence of coolant leakage at the heater water hose to heater core attachments. A coolant leak in the heater water hose could follow the heater core tube to the heater core and appear as a leak

in the heater core.

2. **NOTE:** Spring-type clamps are installed as original equipment. Installation and overtightening of non-specification clamps can cause leakage at the heater water hose connection and damage the heater core.

   Check the integrity of the heater water hose clamps.

Heater Core - Plugged

1. Check to see that the engine coolant is at the correct level.

2. Start the engine and turn on the heater.

3. When the engine coolant reaches operating temperature, using a suitable temperature measuring device, check the heater core inlet and outlet hose to see if they are hot.

If the inlet hose is not hot:

- the heater control valve may be stuck closed.
- the thermostat is not working correctly.

If the outlet hose is not hot:

- the heater core may have an air pocket.
- the heater core may be restricted or plugged.

Heater Core - Pressure Test

Use the Pressure Test Kit to perform the pressure test.

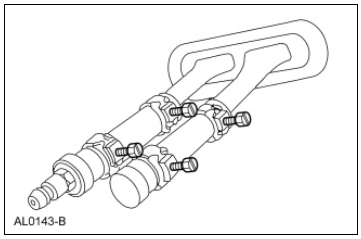
1. **NOTE:** Due to space limitations, a bench test may be necessary for pressure testing.

   Clamp off the heater hoses.

2. Disconnect the heater water hoses from the heater core.

3. Install a short piece of heater hose, approximately 101 mm (4 in) long on each heater core tube.

4. Fill the heater core and heater water hoses with water and install Plug BT-7422-B and Adapter BT-7422-A from the Pressure Test Kit in the heater water hose ends. Secure the heater water hoses, plug and adapter with hose clamps.



5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter.

6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core.

7. Observe the pressure gauge for a minimum of 3 minutes.

8. If the pressure drops, check the heater water hose connections to the core tubes for leaks. If the heater water hoses do not leak, remove the heater core from the vehicle and perform the bench test.

Heater Core - Bench Test

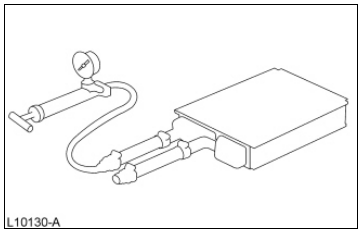
1. Remove the heater core from the vehicle. Refer to Section 412-01 .

2. Drain all of the coolant from the heater core.

3. Connect the 101 mm (4 in) test heater water hoses with plug and adapter to the core tubes. Then connect the radiator/heater core pressure tester from the Pressure Test Kit to the adapter.

4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water.

5. If a leak is observed, replace the heater core.



A/C Evaporator/Condenser Core - On Vehicle Leak Test

1. Recover the refrigerant. Refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Disconnect the suspect A/C evaporator core or A/C condenser core from the A/C system. Refer to Section 412-01 .

3. Clean the spring lock couplings. Refer to Spring Lock Coupling in this section.

4. Connect the appropriate test fittings from the A/C Flush Adapter Kit to the evaporator or condenser tube connections.

5. **NOTE:** The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter which will activate the valve. The test is not valid if the shut-off valve does not open.

   Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the A/C evaporator core or A/C condenser core. Connect the yellow hose to a known good vacuum pump.

6. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the low-pressure gauge of the gauge set indicates 101 kPa (30 in-Hg). The 45 minute evacuation is necessary to remove any refrigerant from oil left in the A/C evaporator

core or A/C condenser core. If the refrigerant is not completely removed from the oil, outgassing will degrade the vacuum and appear as a refrigerant leak.

7. If the low-pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum pump is operating, close the gauge set valves and observe the low-pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before replacing the A/C evaporator core or A/C condenser core.

8. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low-pressure gauge; it should remain at the 101 kPa (30 in-Hg) mark.
    - If the low-pressure gauge reading rises 34 kPa (10 in-Hg) or more of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.
    - If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.
    - If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the A/C evaporator core or A/C condenser core. Then recheck for loss of vacuum.
    - If a very small leak is suspected, allow the system to set overnight with vacuum applied and check for vacuum loss.

9. If the A/C evaporator core or A/C condenser core does leak, as verified by the above procedure, install a new A/C evaporator core or A/C condenser core. Refer to Section 412-01 .

A/C Compressor - External Leak Test

1. Install the appropriate adapter from the A/C Flush Adapter Kit on the rear head of the A/C compressor, using the existing peanut fitting nuts.

2. Connect the high and low pressure lines of a manifold gauge set or a refrigerant recovery/recycling station to the corresponding fittings on the adapter.

3. Attach the center hose of the manifold gauge set to a refrigerant container standing in an upright position.

4. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the A/C compressor.

5. Using the Refrigerant Leak Detector, check the entire A/C compressor for leaks.

6. If an external leak is found, install a new A/C compressor. Refer to Section 412-01 .

7. When the leak test is complete, recover the refrigerant from the compressor.

Spring Lock Coupling

Special Tool(s)

 ST2352-A	Remover, Refrigerant Coupling Spring 412-039 (T84L-19623-B)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Disconnect

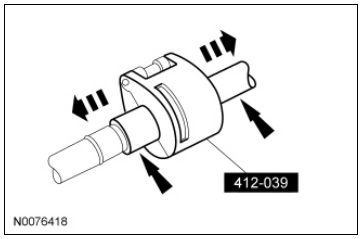
NOTE: If a leak has been found at a spring lock coupling, inspect the O-ring sealing surfaces on the male and female sides of the fitting for damage or scratches. Replace the affected component if damage is identified. If no damage is present, thoroughly clean both sides of the fitting using a suitable non-abrasive cloth, lubricate with PAG oil and install new O-ring seals. Due to subtle differences in O-ring sizes, it is critical for leak prevention that the correct O-ring seal be identified. Refer to the Ford Catalog AdvantageTM or equivalent for the specific vehicle and application. When repairs are complete, leak test the spring lock coupling to verify the repair.

1. Remove the spring lock coupling clip, if equipped.

2. ***NOTICE:*** **Do not use metal tools to remove the O-ring seals. They may cause axial scratches across the O-ring seal grooves, resulting in refrigerant leaks.**

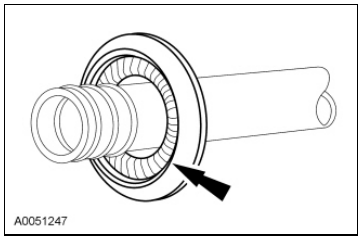
   Push the Refrigerant Coupling Spring Remover into the cage opening to release the female fitting from the spring lock coupling spring and pull the fitting apart.

   - Remove the O-ring seals using a non-metallic tool.



3. ***NOTICE:*** **Do not use a screwdriver or similar tool to remove the Air Conditioning (A/C) tube lock coupling spring; this may cause axial scratches across the O-ring seal grooves resulting in refrigerant leaks.**

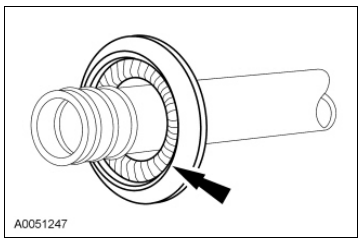
   Remove the spring lock coupling spring with a small hooked wire.



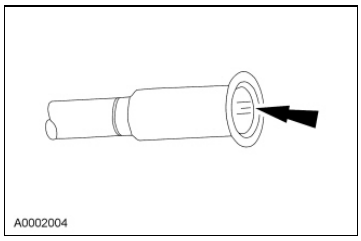
Connect

NOTICE: **It is imperative that the sealing surface of the spring lock coupling and O-ring seal be clean and completely free from debris. To prevent contamination, only new PAG oil should be used as an O-ring seal lubricant. Contamination from used PAG oil, residual PAG oil from inside the refrigerant system or a failure to thoroughly clean the fitting sealing surface will interrupt the O-ring seal-to-fitting sealing surface and cause refrigerant system leaks.**

1. Install the spring lock coupling spring.

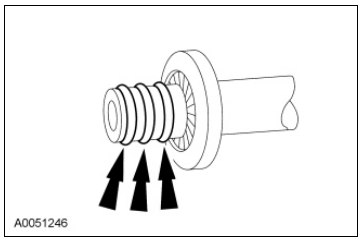


2. Lubricate the inside of the coupling with PAG oil.

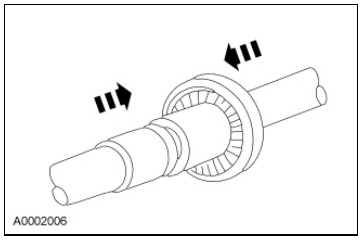


3. ***NOTICE:*** **Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Catalog AdvantageTM or equivalent may result in intermittent leakage during vehicle operation.**

   Install the O-ring seals.



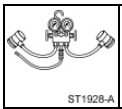
4. Connect the spring lock coupling fittings with a twisting motion until the spring lock coupling spring snaps over the flared end of the female fitting.



5. Install the spring lock coupling clip.

Refrigerant System Tests

Special Tool(s)

 ST1928-A	R-134a Manifold Gauge Set 023-00047 or equivalent
 ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 023-00181 or equivalent
 ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 199-00067 or equivalent
 ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 265-00012 or equivalent

Procedure 1 - Ambient Temperature At or Below 38°C (100°F)

NOTE: The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.

NOTE: The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow Procedure 1. If the ambient temperature is over 38°C (100°F), follow Procedure 2.

NOTE: If the A/C compressor cycles at any time during this test, refer to the diagnostic table.

1. Drive the vehicle or run the engine until it reaches normal operating temperature.

2. Connect a R-134 Manifold Gauge Set or R134a Refrigerant Management Machine with high-pressure and low-pressure gauges to the refrigerant system.

3. Set the climate controls.
   - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, HI Blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If equipped with Dual Automatic Temperature Control (DATC), set temperature to 15°C (60°F) (lowest possible temp setting) with the dual function disabled (if equipped). Manually set blower on HIGH. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If the vehicle is equipped with auxiliary climate control, set the auxiliary controls to full COOL in the PANEL mode at HI blower speed.

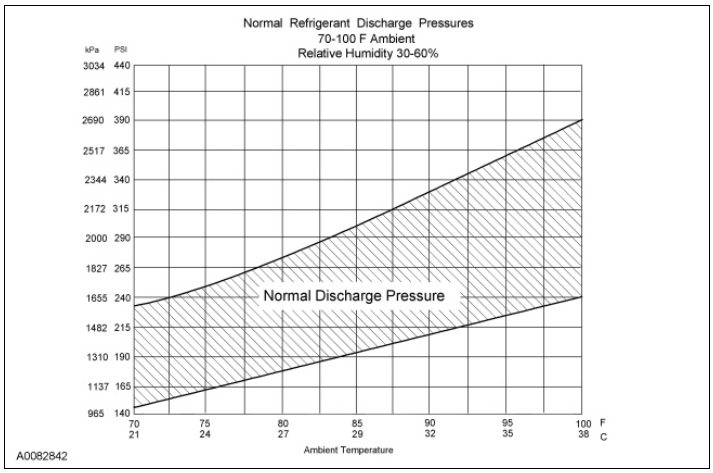
4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).

5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

6. Record the ambient (shop) temperature.

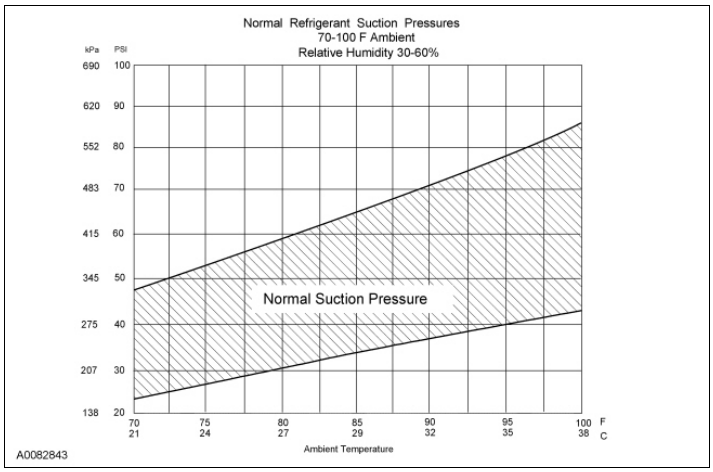
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant Discharge Pressures chart.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.

10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.



11. Proceed to the diagnostic table.

Procedure 2 - Ambient Temperature Above 38°C (100°F)

NOTE: The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.

NOTE: The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow Procedure 1. If the ambient temperature is over 38°C (100°F), follow Procedure 2.

1. Drive the vehicle or run the engine until it reaches normal operating temperature.

2. Connect a R-134a Manifold Gauge Set or R-134a Refrigerant Management Machine with high-pressure and low-pressure gauges to the refrigerant system.

3. Set the climate controls.
   - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, MED-LO blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If equipped with ATC, set temperature to 15°C (60°F) (lowest possible temp setting). Manually set blower to MED-LO (3 to 4 bars). If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If the vehicle is equipped with auxiliary climate control, set the auxiliary controls to full COOL in the PANEL mode at MED-LO blower speed.

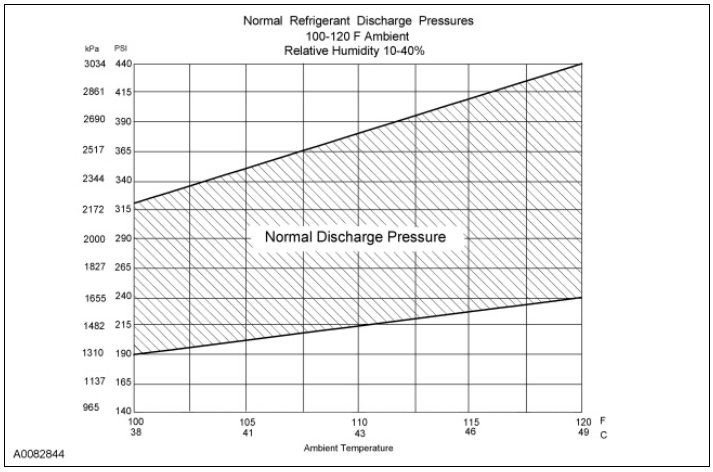
4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).

5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

6. Record the ambient (shop) temperature.

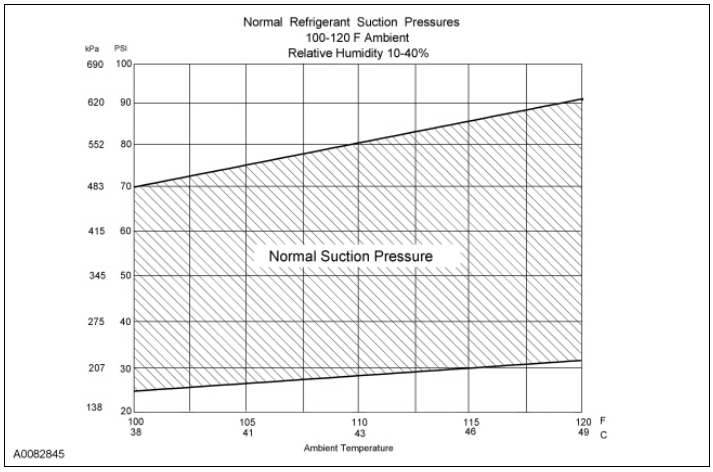
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant Discharge Pressures chart.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.

10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.



11. Refer to the chart below.

Diagnostic Table

1. **NOTE:** The following table is used to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.

   Proceed to the Diagnostic Table.

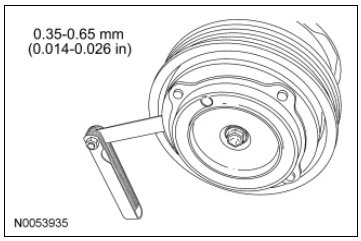
High (Discharge) Pressure	Low (Suction) Pressure	Component - Causes
High or clutch cycling	High	Condenser - inadequate airflow.
High	Normal to high	Engine - overheating.
Normal to high	Normal	Refrigerant overcharge - air in refrigerant.
Normal to low	High	Fixed orifice tube - missing O-rings leaking/missing.
Normal to low	Normal to high	A/C suction line - partially restricted or plugged. [a]
Normal to low	Low or clutch cycling	Low refrigerant charge, A/C suction line - partially restricted or plugged A/C cycling switch - sticking closed. [b]
Erratic operation or compressor not running		A/C cycling switch - poor connection at A/C clutch connector or clutch cycling switch connector. A/C electrical circuit erratic - see A/C Electrical Circuit Wiring Diagram.
Normal to low	High	Compressor - low performance.
Additional Possible Cause Components Associated With Inadequate Compressor Operation		
• Compressor drive belt - loose • Compressor clutch - slipping • Clutch coil open - shorted, or loose mounting • Control assembly switch - dirty contacts or sticking open • Clutch wiring circuit - high resistance, open or blown fuse • Compressor operation interrupted by engine computer		
Additional Possible Cause Components Associated With a Damaged Compressor		
• Incorrect clutch air-gap • Suction accumulator - refrigerant oil bleed hose plugged		

• Refrigerant leaks

[a] Low pressure reading will be normal to high if pressure is taken at accumulator and if restriction is downstream of service access valve.
[b] Low pressure reading will be low if pressure is taken near the compressor and restriction is upstream of service access valve.

Air Conditioning (A/C) Clutch Air Gap Adjustment

1. Check the A/C clutch air gap at 3 equally spaced places between the clutch plate and the A/C clutch pulley.



2. Remove the clutch plate. Add or remove spacers between the clutch plate hub and the compressor shaft until the clearance is within specification.

Electronic Leak Detection

Special Tool(s)

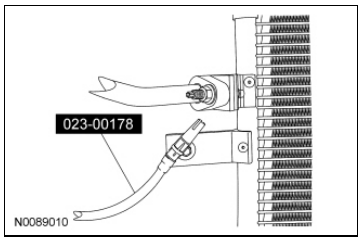
 ST3072-A	Heated Pentode Halogen Leak Detector 023-00178 or equivalent

NOTE: Good ventilation is necessary in the area where electronic A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the Heated Pentode Halogen Leak Detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner or other cleaning solvents can cause the same problem. Using a fan to ventilate the area to be tested before proceeding with the leak detection procedure is helpful in removing small traces of contamination from the air, but the fan should be turned off during actual testing.

NOTE: R-134a is heavier than air, and will tend to move downward from the source of the leak if present. It is possible that a leak may not be detected if the leak detector tip is held above the leaking fitting, line or component. Always be sure to thoroughly leak test below the fitting, line or component for the presence of R-134a as well as leak testing above and around.

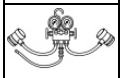
1. **NOTE:** The system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

   Leak test the refrigerant system using the Heated Pentode Halogen Leak Detector. Follow the instructions included with the Heated Pentode Halogen Leak Detector for handling and operation techniques.



Fluorescent Dye Leak Detection

Special Tool(s)

 ST3073-A	Cordless/Rechargeable True UV LED Light ES 023-00182 or equivalent
 ST3057-A	R-134a Loop/Add On Injector Kit-Set 219-00069 or equivalent
 ST1928-A	R-134a Manifold Gauge Set 300-R0B40134AE or equivalent
 ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 300-R0B34788-PROE or equivalent
 ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 199-00067 or equivalent
 ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 265-00012 or equivalent

Material

Item	Specification
Stay-Brite® R-134a Leak Detection Dye 164-R6060 (Rotunda)	-

Fluorescent Dye Injection Using a R-134a Refrigerant Management Machine and Dye Injector - Vehicles Requiring R-134a Addition

NOTE: This method of fluorescent dye injection requires the addition of R-134a from a R-134a Refrigerant Management Machine or R-134a Manifold Gauge Set hooked to an external tank to charge the dye into the refrigerant system. If adding fluorescent dye to a refrigerant system that is already fully charged, the R-134a Loop/Add On Injector Kit-Set method should be used.

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved UV blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators and receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator or receiver/drier is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant

capacity has been lost due to a fitting separation, hose rupture or other damage.

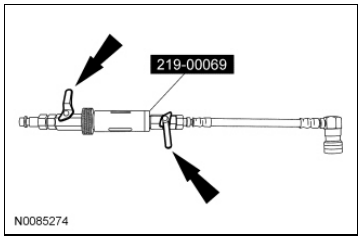
NOTE: Before using the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the manufacturer's instructions on evacuation of any non-condensable gases from the hoses.

NOTE: Only connect the dye/lubricant injector from the R-134a Loop/Add On Injector Kit-Set when fluorescent dye is to be injected. The dye/lubricant injector has a one-way check valve that will prevent refrigerant system recovery and evacuation.

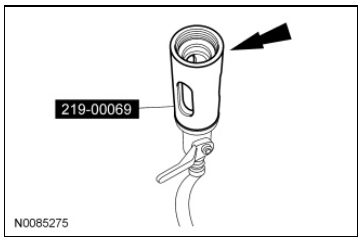
1. **NOTE:** If no R-134a pressure is present in the refrigerant system, the system should be evacuated before carrying out the injection procedure. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

   Connect a R-134a Refrigerant Management Machine or a R-134a Manifold Gauge Set to the refrigerant system service port valves.

2. Verify that the valves on the dye/lubricant injector from the R-134a Loop/Add On Injector Kit-Set are closed.



3. Fill the R-134a fluorescent dye injector reservoir with 7 ml (0.25 oz) of fluorescent dye.



4. Install the dye/lubricant injector between the low-pressure service gauge port valve and the R-134a Refrigerant Management Machine or R-134a Manifold Gauge Set.

5. **NOTE:** Following fluorescent dye injection, the refrigerant system should be fully charged to make sure of correct movement of the dye.

   Open all valves and inject the fluorescent dye into the refrigerant system by charging the refrigerant system with the required amount of R-134a.

6. When fluorescent dye injection is complete, close all valves.

7. Recover the refrigerant from the dye/lubricant injector.

8. Remove the dye/lubricant injector from the low-pressure service gauge port valve and the R-134a Refrigerant Management Machine or R-134a Manifold Gauge Set.

Fluorescent Dye Injection Using a R-134a Loop/Add On Injector Kit-Set - Vehicles Not Requiring

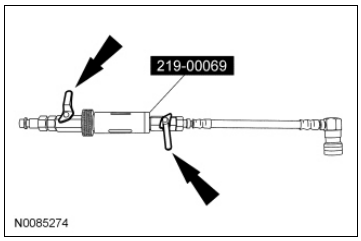
R-134a Addition

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved UV blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators and receiver/driers are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator or receiver/drier is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

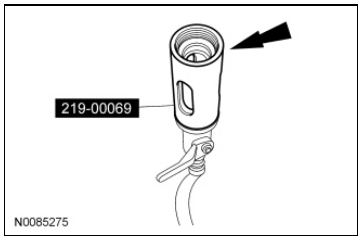
NOTE: Before using the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the equipment manufacturer's instructions on evacuation of non-condensable gases from the hoses.

NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off and cool.

1. Verify that the valves on the R-134a Loop/Add On Injector Kit-Set are closed.



2. Fill the R-134a Loop/Add On Injector Kit-Set reservoir with 7 ml (0.25 oz) of fluorescent dye.



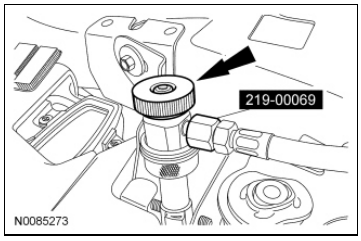
3. Install the R-134a Loop/Add On Injector Kit-Set between the high-pressure and low-pressure service gauge port valves.

4. ***NOTICE:*** **Make sure all tools and hoses are clear of the engine cooling fan and drive belt before starting the engine. Failure to keep tools and hoses clear from the engine cooling fan and drive belt will result in damage to the tools and/or vehicle.**

   With the A/C off, start the engine. Allow engine speed to stabilize below 1,000 rpm.

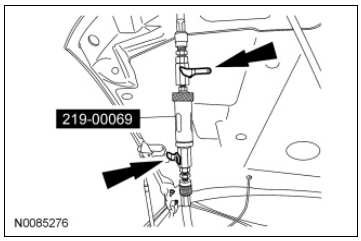
5. Set the A/C to the ON position.

6. Open the high-pressure service valve.

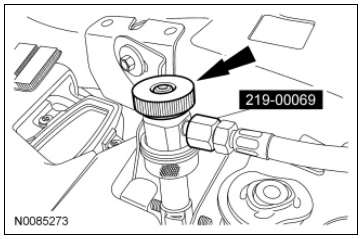


7. **NOTE:** To prevent pressure spike/liquid slug, crack the R-134a Loop/Add On Injector Kit-Set valves and slowly open to inject the fluorescent dye into the refrigerant system.

   Open the R-134a Loop/Add On Injector Kit-Set valves and inject the fluorescent dye into the refrigerant system.

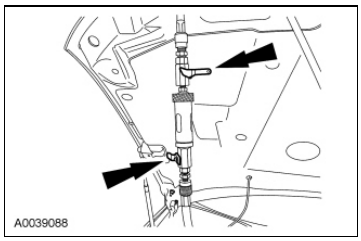


8. Close the high-pressure service valve to allow the pressure inside the R-134a Loop/Add On Injector Kit-Set to equalize with the suction side of the refrigerant system.



9. **NOTE:** Close the valves on the R-134a Loop/Add On Injector Kit-Set while the A/C compressor is operating.

   Close the valves on the R-134a Loop/Add On Injector Kit-Set.



10. **NOTE:** Leave all valves on the R-134a Loop/Add On Injector Kit-Set closed when not in use.

    Disconnect the high-pressure and low-pressure service valves and remove the R-134a Loop/Add On Injector Kit-Set from the vehicle.

Fluorescent Dye Detection

NOTE: Ford Motor Company vehicles are produced with R-134a fluorescent dye installed in the refrigerant system from the factory. The location of leaks can be pinpointed by the bright yellow-green glow of the

fluorescent dye under a UV lamp. Since more than one leak can exist, make sure to inspect each component, line and fitting in the refrigerant system for a leak.

NOTE: Use of dye-enhancing glasses or goggles greatly improves the detection of the dye under the UV lamp.

NOTE: Not all UV lamps will fluoresce the dye used in Ford vehicles. All Rotunda UV lamps are optimized to fluoresce the dye.

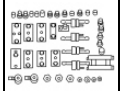
1. Check for leaks using a Rotunda-approved UV lamp and dye enhancing glasses.
    - Inspect all components, lines and fittings of the refrigerant system.

2. After the leak(s) is repaired, remove any traces of fluorescent dye with a general purpose oil solvent.

3. Verify the repair by running the vehicle for a short period of time and rechecking the area of the leak with a Rotunda-approved UV lamp.

Air Conditioning (A/C) System Flushing

Special Tool(s)

 ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
 ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 (part of 219-00023) or equivalent
 ST2466-A	A/C Flush and Purge Machine 219-00022 (part of 219-00023) or equivalent

Material

Item	Specification
A/C System Flushing Solvent YN-23	-
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTICE: **An Air Conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTICE: **Suction accumulator or receiver/drier, Thermostatic Expansion Valve (TXV) and/or evaporator core orifice, and hoses with mufflers, should be removed when flushing the Air Conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any residual-flushing agent. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material.**

NOTICE: **Only the listed A/C Flush and Purge Machine, A/C Flush and Purge Fitting Kit, A/C Flush Adapter Kit and A/C System Flushing Solvent are approved for use on Ford vehicles. No other flushing device or solvent is approved for flushing heat exchangers (Air Conditioning [A/C] condenser, A/C evaporator). Use of any other flusher or solvent may cause damage to the A/C system and the flushing unit.**

1. Recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Disconnect the refrigerant lines from the heat exchanger(s) to be flushed.

3. Using the correct adapters from the A/C Flush Adapter Kit or A/C Flush and Purge Fitting Kit, connect the A/C Flush and Purge Machine to the heat exchanger to be flushed. Do not flush through the evaporator core orifice (if equipped), Thermostatic Expansion Valve (TXV) (if equipped) or hoses with mufflers. Internal plumbing and material make-up of these components make it impossible to correctly remove foreign material or residual flushing solvent.

4. **NOTE:** Use 3.785L (1 gal) of A/C System Flushing Solvent to flush the heat exchanger for a minimum of 15 minutes. The flush solvent may be used for one or both heat exchangers in the A/C system. However, the flush solvent is intended for one vehicle only. The filter used on the flushing unit is also intended for use on one vehicle only.

   Flush the heat exchanger for a minimum of 15 minutes.

5. Apply 621-862 kPa (90-125 psi) pressurized air to the component for a minimum of 30 minutes. The 30-minute purge time is required to force and evaporate all residual solvent from the A/C system component. Failure to successfully remove all residual solvent within the component can result in system damage when reconnected and operated. Dispose of the used flush solvent and filter in accordance with local, state and federal regulations.

6. **NOTE:** A/C system filtering as described in this section is optional if system flushing is carried out. However, the filter kit use is recommended after flushing if the A/C system contamination is extensive.

   Install a new A/C evaporator core orifice (if equipped) and/or TXV (if equipped) in any vehicle being serviced for an internal A/C compressor or desiccant failure.

7. Install new refrigerant hoses with mufflers if clogged with foreign material.

8. Install a new suction accumulator (if equipped), receiver/drier (if equipped) or receiver/drier cartridge (if equipped) in any vehicle being serviced for an internal A/C compressor or desiccant failure.

9. Reconnect the heat exchanger being serviced.

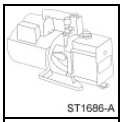
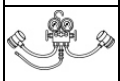
10. If a new A/C compressor is not to be installed, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

11. If a new A/C compressor is not to be installed, evacuate, leak test and charge the A/C system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

12. If a new A/C compressor is to be installed, refer to the A/C Compressor removal and installation procedure in Section 412-01 .

Air Conditioning (A/C) System Recovery, Evacuation and Charging

Special Tool(s)

 ST1686-A	6.0 CFM Vacuum Pump 300-R0B15600E or equivalent
 ST2742-A	Automatic Refrigerant Charging Meter 023-00155 or equivalent
 ST1928-A	R-134a Manifold Gauge Set 300-R0B40134AE or equivalent
 ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 300-R0B34788-PROE or equivalent
 ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 199-00067 or equivalent
 ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant) 265-00012 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant System Recovery

NOTICE: **An Air Conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTE: Ford Motor Company recommends the use of R-134a refrigerant management equipment that meets the requirements of the SAE J2788 standard.

1. Prior to recovering, the purity of the refrigerant must be verified. For additional information, refer to Refrigerant Identification Testing in this section.

2. Connect a R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.

3. Recover the refrigerant from the system following the operating instructions provided by the equipment manufacturer. Note the amount of oil removed during the refrigerant recovery (if any). Add that same amount back into the system once repairs are complete.

4. Once the R-134a Refrigerant Management Machine has recovered the refrigerant, switch OFF the power supply.

5. Allow the system to set for about 2 minutes, and observe the system vacuum reading. If the vacuum is not lost, disconnect the recovery equipment.

6. If the system does lose vacuum, repeat Steps 3 through 5 until the vacuum level remains stable for 2 minutes.

7. Carry out the required repairs.

Refrigerant System Evacuation Using a R-134a Refrigerant Management Machine

1. Connect a R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.

2. Evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.

3. Turn OFF the Vacuum Pump. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held.

Refrigerant System Evacuation Using a R-134a Manifold Gauge Set and Vacuum Pump

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect the R-134a Manifold Gauge Set to the low-side and high-side service gauge port valves.

2. Connect the center (yellow) hose from the R-134a Manifold Gauge Set to the suction port on the Vacuum Pump.

3. Open all valves on the R-134a Manifold Gauge Set and both service gauge port valves.

4. Turn on the Vacuum Pump and evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.

5. Close the high-side and low-side valves on the R-134a Manifold Gauge Set (not the service gauge port valves) and turn OFF the Vacuum Pump.

6. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Charging Using a R-134a Refrigerant Management Machine

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

2. Connect a R-134a Refrigerant Management Machine to the low-side and high-side service gauge port valves following the operating instructions provided by the equipment manufacturer.

3. Set the refrigerant charge amount, and charge the refrigerant system following the instructions provided by the equipment manufacturer.

Refrigerant System Charging Using a R-134a Manifold Gauge Set and Automatic Refrigerant Charging Meter

NOTE: Ford Motor Company recommends use of a R-134a Refrigerant Management Machine to carry out charging of the refrigerant system. If a R-134a Refrigerant Management Machine is not available, refrigerant system charging may be accomplished using a separate Automatic Refrigerant Charging Meter and R-134a Manifold Gauge Set.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

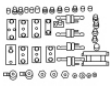
2. Assemble the R-134a Manifold Gauge Set, Automatic Refrigerant Charging Meter and R-134a supply tank following the Automatic Refrigerant Charging Meter operating instructions.

3. Charge the refrigerant system following the Automatic Refrigerant Charging Meter operating instructions.

4. If the refrigerant flow stops before the refrigerant charge is complete, start the engine, select MAX A/C operation and allow the refrigerant charge to complete.

Refrigerant System Filtering Following Air Conditioning (A/C) Compressor Installation

Special Tool(s)

 ST2985-A	A/C Flush Adapter Kit 219-00074 or equivalent
 ST2469-A	A/C Flush and Purge Fitting Kit 219-00024 or equivalent

Material

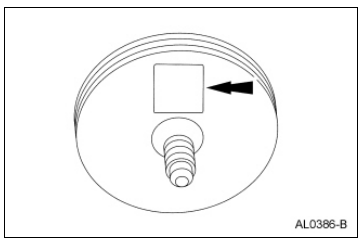
Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTICE: **An Air Conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer's procedures and instructions.**

NOTICE: **On vehicles being serviced for an internal compressor or desiccant failure, a new suction accumulator or receiver/drier, Thermostatic Expansion Valve (TXV) or evaporator core orifice and any hoses containing mufflers must be installed prior to filtering the Air Conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any foreign material. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The filter is intended for use on one vehicle only.**

1. **NOTE:** The filter inlet is marked with a label on one side of the filter body.

   Orient the filter inlet toward the A/C condenser core.



2. ***NOTICE:*** **The flexible extension adapters included in the A/C Flush Adapter Kit are designed for low-pressure flushing and are not designed for use with a charged refrigerant system. Do**

not make the condenser fitting connections using the flexible extension adapters or damage to the adapters and loss of refrigerant will occur.

NOTE: The F8VZ-19E773-AB pancake filter is not permanently installed and will be removed at the end of this procedure.

Disconnect the condenser outlet fitting and temporarily install the pancake filter between the 2 halves of the fitting.

- Use flexible R-134a service hoses of 17,238 kPa (2,500 psi) burst rating.
- Make the connections using the correct adapters from the A/C Flush Adapter Kit and/or A/C Flush and Purge Fitting Kit.

3. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Refrigerant Oil Adding in this section.

4. Evacuate and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

5. Check all refrigerant system hoses, lines and the position of the newly installed filters to be sure they do not interfere with other engine compartment components. If necessary, use tie straps to make adjustments.

6. Provide adequate airflow to the front of the vehicle (with a fan, if necessary). Select A/C operation and set the blower motor speed to maximum. Start the engine and let it idle briefly. Make sure the A/C system is operating correctly.

7. Using a scan tool, command the idle to gradually bring the engine up to 1,200 rpm by running it at lower rpms for short periods (first at 800 rpm, then at 1,000 rpm). Set the engine at 1,200 rpm and run it for one hour with the A/C system operating.

8. Stop the engine.

9. Recover the refrigerant. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

10. Remove the adapters, flexible hoses and pancake filter from between the condenser and the condenser to evaporator tube.

11. Discard the pancake filter. It can be used one time only.

12. Reconnect the condenser outlet fitting.

13. Evacuate, charge and leak-test the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Refrigerant Oil Adding

Special Tool(s)

 ST3057-A	R-134a Loop/Add On Injector Kit-Set 219-00069 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant Oil Adding

NOTE: During normal A/C operation, oil is circulated through the system with the refrigerant, and a small amount is retained in each component. If certain components of the system are removed, some of the PAG oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the new part.

1. Refer to the chart below for refrigerant oil adding amounts and methods of installation.

Component	PAG Oil Amount	Method of Adding
A/C Compressor	Refer to Adding Refrigerant Oil After A/C Compressor Replacement	Add or remove directly through A/C compressor low-side port before installation.
Suction Accumulator or Receiver/Drier	Refer to Adding Refrigerant Oil After New Suction Accumulator or Receiver/Drier Replacement	Add directly to suction accumulator inlet port or inject to low-side service port during system charging.
Evaporator Core	45 ml (1.5 fl oz) added to the amount collected during refrigerant recovery	Add directly to evaporator core inlet tube or inject to low-side service port during system charging.
Condenser Core	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Add directly to condenser core inlet or inject to low-side service port during system charging.
Evaporator Core Orifice or Thermostatic Expansion Valve (TXV)	The amount collected during refrigerant recovery	Inject to low-side service port during system charging.
A/C Pressure Relief Valve	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging.

Refrigerant Hose/Line	60 ml (2 fl oz) added to the amount collected during refrigerant recovery [a]	Inject to low-side service port during system charging.
O-ring Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery [b]	Inject to low-side service port during system charging.
Service Port Leak Repair	60 ml (2 fl oz) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging.

[a] If an excessive amount of PAG oil is lost due to a hose rupture/separation or other damage, the total system PAG oil capacity must be added.
[b] The amount specified may be used for one or multiple O-ring leak repairs. Do not multiply the PAG oil amount by the number of O-ring leaks being repaired.

Adding Refrigerant Oil After A/C Compressor Replacement

Service A/C compressors shipped without clutch and pulley

1. Rotate the old A/C compressor shaft 6 to 8 revolutions while collecting oil in a clean measuring device.
    - If the amount of oil drained from the old A/C compressor is between 85-142 ml (3-5 oz), pour the same amount plus 30 ml (1 oz) of clean PAG Refrigerant Compressor Oil (R-134a Systems) (YN-12-D) WSH M1C231-B or equivalent into the new A/C compressor.
    - If the amount of oil that was removed from the old A/C compressor is greater than 142 ml (5 oz), pour the same amount drained of clean PAG Refrigerant Compressor Oil (R-134a Systems) or equivalent into the new A/C compressor.
    - If the amount of oil that was removed from the old A/C compressor is less than 85 ml (3 oz), pour 85 ml (3 oz) of clean A/C Refrigerant Compressor Oil (R-134a Systems) or equivalent into the new A/C compressor.

Service A/C compressors shipped with clutch and pulley

2. Rotate the old A/C compressor shaft 6 to 8 revolutions while collecting oil in a clean measuring device.
    - If the amount of oil drained from the old A/C compressor is less than 89 ml (3 oz), remove 118 ml (4 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is 89 ml (3 oz), remove 89 ml (3 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is 118 ml (4 oz), remove 59 ml (2 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is 148 ml (5 oz), remove 29 ml (1 oz) from the new A/C compressor.
    - If the amount of oil drained from the old A/C compressor is greater than 148 ml (5 oz), remove 0 ml (0 oz) from the new A/C compressor.

Adding Refrigerant Oil After New Suction Accumulator or Receiver/Drier Replacement

NOTE: This refrigerant oil adding method is to be used when a new suction accumulator or receiver drier only has been installed. If a new A/C compressor and evaporator core orifice or Thermostatic Expansion Valve (TXV) have also been installed due to system contamination, refer to the appropriate heading.

1. Drill one 12.7 mm (1/2 in) hole in the old suction accumulator or receiver/drier cylinder and drain the oil into a clean measuring cup.

2. Add the same quantity of new PAG oil, plus the amount collected during refrigerant recovery and 60 ml (2 fl oz).

Adding Refrigerant Oil After Multiple Component Replacement After A/C System Contamination

NOTE: This refrigerant oil adding method is to be used when a new A/C compressor, suction accumulator or receiver drier and evaporator core orifice or TXV have been installed due to system contamination and the A/C system has been flushed.

1. If the new A/C compressor is shipped with a new clutch and pulley already installed, remove the shipping caps and rotate the new A/C compressor shaft 6 to 8 revolutions while collecting the oil in a clean measuring cup.

2. Add 60 ml (2 fl oz) directly to the new A/C compressor suction port.

3. Inject the total vehicle PAG oil capacity minus 60 ml (2 fl oz) to the low-side service port during system charging. For the total PAG oil capacity specification, refer to the Specifications table in this section.

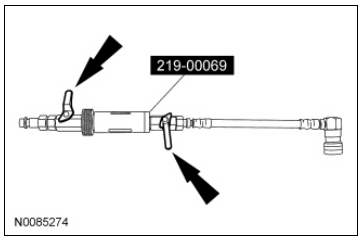
Oil Injection Using a Dye/Lubricant Injector

NOTE: If fluorescent leak detection dye is also to be added during A/C charging, the dye may be added to the dye/lubricant injector, from the R-134a Loop/Add On Injector Kit-Set, along with the PAG oil.

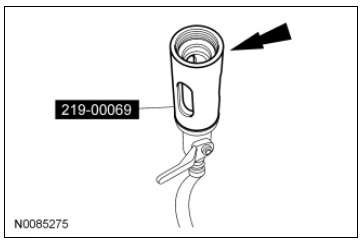
1. Evacuate the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

2. Assemble the dye/lubricant injector and the correct adapters from the R-134a Loop/Add On Injector Kit-Set to match the amount of refrigerant compressor oil to be injected.

3. Verify that all the valves on the dye/lubricant injector are closed.



4. Fill the dye/lubricant injector with the correct amount of clean, new PAG oil.



5. Install the dye/lubricant injector between the low-side service gauge port valve and the refrigerant service station or manifold gauge set.

6. Open all valves and charge the refrigerant system. For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging in this section.

Refrigerant Identification Testing

Special Tool(s)

 ST3090-A	Refrigerant Blend Identifier with Printer 198-00012 or equivalent

Refrigerant Identification

1. **NOTE:** A Refrigerant Blend Identifier with Printer must be used to identify gas samples taken directly from the refrigeration system or storage containers prior to recovering or charging the refrigerant system.

   Follow the instructions included with the Refrigerant Blend Identifier with Printer to obtain the sample for testing.

2. The Refrigerant Blend Identifier with Printer will display one of the following:
   - If the purity level of R-134a is 98% or greater by weight, the green PASS LED will light. The weight concentrations of R-134a, R-12, R-22, hydrocarbons and air will be displayed on the digital display.
   - If refrigerant R-134a does not meet the 98% purity level, the red FAIL LED will light and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will be displayed on the digital display.
   - If hydrocarbon concentrations are 2% or greater by weight, the red FAIL LED will light, "Hydrocarbon High" will be displayed on the digital display, and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will also be displayed on the digital display.

3. The percentage of air contained in the sample will be displayed if the R-134a content is 98% or greater. The Refrigerant Blend Identifier with Printer eliminates the effect of air when determining the refrigerant sample content because air is not considered a contaminant, although air can affect A/C system performance. When the Refrigerant Blend Identifier with Printer has determined that a refrigerant source is pure (R-134a is 98% or greater by weight) and air concentration levels are 2% or greater by weight, it will prompt the user if an air purge is desired.

4. If contaminated refrigerant is detected, repeat the refrigerant identification test to verify that the refrigerant is indeed contaminated.

Contaminated Refrigerant Handling

NOTICE: **If contaminated refrigerant is detected, DO NOT recover the refrigerant into R-134a recovery/recycling equipment. Recovery of contaminated refrigerant will contaminate the recovered refrigerant supply and may damage the recovery/recycling equipment.**

NOTE: A new suction accumulator or receiver/drier must be installed as directed by the A/C system flushing procedure.

1. Recover the contaminated refrigerant using suitable recovery-only equipment designed for capturing and storing contaminated refrigerant only.
    - If this equipment is not available, contact an A/C service facility in the area with the correct equipment to carry out this service.

2. Determine and correct the cause of the customer's initial concern.

3. Flush the A/C system.

4. Dispose of the contaminated refrigerant in accordance with all federal, state and local regulations.

Vacuum Hose Repair - Mini-Tube

Special Tool(s)

 ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent

1. Measure the length of the damaged area of the mini-tube vacuum hose.

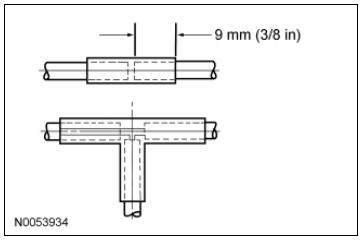
2. Cut a piece of standard 1/8-inch inner diameter vacuum hose approximately 25 mm (1 in) longer than the damaged area of the mini-tube vacuum hose.

3. Cut off the mini-tube vacuum hose on each side of the damaged area.

4. **⚠ WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

   Dip the mini-tube hose ends in commercially available paint thinner containing Methyl Ethyl Ketone (MEK). This solvent will seal the mini-tube in the vacuum hose.

5. Insert the ends of the mini-tube vacuum hose approximately 9 mm (3/8 in) into the ends of the standard 1/8-inch repair vacuum hose section.



6. Shake the repair joint after assembly to make sure the solvent is dispersed and the vacuum line is not plugged.

7. Test the system for a vacuum leak in the repair area.
   - Use the Vacuum Pump Kit or equivalent.

Air Conditioning (A/C) Odor Treatment

Special Tool(s)

 ST2940-A	Flexible Applicator Tool 258-00004

Material

Item	Specification
A/C Cooling Coil Coating YN-29	-

⚠ WARNING: Carry out this procedure in a well-ventilated area with all vehicle windows and doors opened. Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION, seek medical advice. On Ford/Motorcraft products in the USA or Canada call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS), if available. Failure to follow these instructions may result in serious personal injury.

NOTE: There are typically 4 types of objectionable odors found in a vehicle:

- Chemical odors
- Environmental odors
- Human and other interior-generated odors
- Microbiological odors

Before determining that A/C odor treatment is required, the source and the circumstances under which the odor occurs must be determined.

NOTE: Chemical odors are usually constant regardless of the climate control system setting although they may be enhanced by A/C operation. Most chemical odors are caused by fluid leaks or incorrectly cured adhesives. Chemical odors can be eliminated by repairing the leaking component and removing any residue.

NOTE: Environmental odors usually occur for a short time and diminish after the vehicle passes through the affected area. These odors are typically only detected when the vehicle windows are open, or when the climate control system is operating in a mode that allows for fresh air. Environmental odors cannot be eliminated because they are external in source, but they may be minimized by switching to a climate control setting that uses recirculated air.

NOTE: Human and other interior-generated odors occur while the source is present and may linger for a short time after. These odors may be more noticeable during A/C operation. Human odors may be eliminated by removing the source and cleaning the affected area.

NOTE: Microbiological odors, if in the A/C system, usually last for about 30 seconds after the system is turned on. They will be detected while the A/C is turned on and using either outside or recirculated air. Microbiological odors that occur in areas other than the A/C system (for example, water in doors or wet carpeting) may last indefinitely and will be more intense when recirculated air is used. Microbiological odors

will not be present at temperatures at or below 10°C (50°F).

Microbiological odors can be eliminated by removing the source and treating the affected area. Standing water must be allowed to drain and dry out. A/C systems may be treated by using A/C cooling coil coating as described in the service procedure below.

Microbiological odors result from microbial growth supported by warm temperatures and moisture. Microbiological odors are described as musty/mildew type smells and may occur on/in:

- foam seals.
- rubber seals.
- adhesives.
- standing water.
- water soaked carpet/trim.

1. Identify the type of odor present in the vehicle. Do not proceed with A/C odor treatment if the odor source is found to be outside of the A/C system. Refer to the following chart for examples.

Odor Source	Odor Description
Chemical Odors	
Coolant	Sweet smell
Fuel	Gasoline or diesel fuel smell
Oil	Oil type or burning smell
Power Steering Fluid	Oil type or burning smell
Transmission Fluid	Oil type or burning smell
Washer Fluid	Alcohol type smell
Gear Lube	Garlic/sulfur smell
Refrigerant Oil	Ether type smell
Carpet/trim Adhesives	Fishy, urine or sweet smell
Evaporator Core Coating	Wet cement type smell
Environmental Odors	
Exhaust	Exhaust, fuel or burning type smell
Industrial Pollutants	Various smells
Dust	Musty, mildew or wet cement type smell
Pollen	Sweet smell
Tobacco	Burning, tar smell
Human and Other Interior Generated Odors	
Body Secretions	Body odor
Perfuming Agents	Sweet or fragrance smell
Clothing	Musty, mildew or body odors
Food/Beverage	Sweet, musty, mildew or fishy smell
Microbiological Odors	
Microbiological Odors Occurring Inside of A/C System	Musty, mildew smell lasting about 30 seconds after A/C is turned on
Microbiological Odors Occurring Outside of A/C System	Musty, mildew smell lasting indefinitely and possibly more pronounced when using recirculated air

2. Identify the source of the odor.
    - Check the evaporator core drain tube for restriction.
    - Check the passenger and driver side carpet for moisture. If moisture is found, A/C odor treatment is not necessary. Diagnose for a water leak as needed.
    - Check the blower motor and blower motor cover (if equipped) for moisture resulting from water bypassing the cowl baffling system. If moisture is found, A/C odor treatment is not necessary. Diagnose for a water leak as needed.
    - Check the cowl top panel and air inlet screen for standing water or foreign material. If possible, remove any standing water and clean the air inlet screen using a wet/dry vacuum.

3. Open all vehicle windows and doors.

4. Make sure that the A/C is off.

5. Set the following.
    - Select PANEL mode (A/C off).
    - Adjust the temperature setting to full warm.
    - Adjust the blower motor speed to HI.

6. Run the engine for 25 minutes to dry out the A/C system.

7. Turn the ignition OFF.

8. Remove the blower motor.

9. **NOTE:** Blower motor speed controls that are mounted outside of the evaporator core housing and not exposed to the blower motor airflow do not need to be removed.

   Remove the blower motor resistor (if equipped) or blower motor speed control (if equipped and exposed to the inside of the evaporator core housing).

10. ***NOTICE:*** **To avoid damage to the vehicle interior, do not spill or spray this product on any interior surface.**

    Add one full bottle of A/C cooling coil coating to the Flexible Applicator Tool.

11. Insert the nozzle into the evaporator housing and direct the spray toward the evaporator core face. Spray the entire evaporator core face until empty.

12. Install the blower motor and blower motor resistor (if equipped) or blower motor speed control (if equipped).

13. Repeat Steps 4 through 6 to cure the evaporator core coating.

Material

Item	Specification	Fill Capacity
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	266 ml (9 fl oz) (without auxiliary climate control)
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	473 ml (16 fl oz) (with auxiliary climate control)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	0.77 kg (27 oz) (vehicles without auxiliary systems)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	1.25 kg (44 oz) (vehicles with auxiliary climate control)
RTV Silicone Sealant TA-31	-	-

General Specifications

Item	Specification
Magnetic Clutch	
Air gap clearance	0.35-0.65 mm (0.014-0.026 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
A/C charging valve cap	0.8	-	7
A/C clutch disc and hub bolt	14	-	124
A/C compressor bolt	25	18	-
A/C compressor fitting nuts	15	-	133
A/C compressor nuts	25	18	-
A/C compressor pressure relief valve	10	-	89
A/C compressor studs (4.0L)	4	-	35
A/C compressor studs (4.6L)	14	-	124
A/C line bracket nut at dash panel	6	-	53

Compressor-to-condenser discharge line bracket nut (4.0L)	7	-	62
Compressor-to-condenser discharge line bracket nut (4.6L)	9	-	80
Condenser bolts	12	-	106
Condenser fitting nuts	8	-	71
Condenser-to-evaporator line bracket nut	7	-	62
Coolant bottle bolts	9	-	80
Coolant expansion tank bolts	7	-	62
Cooling module bolts	12	-	106
Dash panel A/C line bracket nut	11	-	97
Evaporator core orifice access fitting	18	-	159
Heater core and evaporator core housing nuts	9	-	80
High-pressure Schrader-type valve	2.5	-	22
High-pressure service gauge port valve cap	0.8	-	7
Low-pressure Schrader-type valve	1.8	-	16
Low-pressure service gauge port valve cap	0.8	-	7
Low-side service port stem bracket bolt	11	-	97
Suction accumulator bolt	11	-	97
Suction accumulator fitting nuts	8	-	71
Suction accumulator stud	11	-	97
Suction accumulator-to- compressor line bracket bolt	11	-	97
Suction accumulator-to- compressor line bracket nut	7	-	62
Suction accumulator-to- compressor line middle fitting nut	8	-	71

Air Conditioning

The A/C system is a clutch cycling orifice tube type. The system components include the following:

- A/C compressor
- A/C condenser core
- A/C evaporator core
- Suction accumulator
- Connecting refrigerant lines

The A/C system operation is controlled by the following:

- Evaporator core orifice tube
- A/C cycling switch
- A/C compressor pressure relief valve
- A/C pressure transducer

The A/C system incorporates an A/C compressor controlled by the PCM through an A/C clutch relay.

The A/C cycling switch senses evaporator core pressure to control A/C compressor operation.

An evaporator core orifice tube is installed in the condenser-to-evaporator line to meter the liquid refrigerant into the evaporator core.

The A/C compressor clutch will only be engaged by the PCM if all of the following conditions are met:

- The climate control assembly or HVAC module is set to a mode which provides an A/C request to the PCM.
- The A/C cycling switch is reading an acceptable evaporator core pressure.
- The A/C pressure transducer is reading an acceptable pressure in the high side of the refrigerant system.
- The engine coolant temperature is not excessively high.
- The PCM has not detected a Wide Open Throttle (WOT) condition.

An A/C compressor pressure relief valve is installed in the compressor to protect the refrigerant system against excessively high refrigerant pressures.

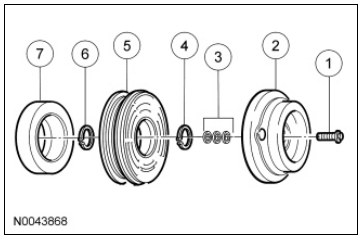
A/C Compressor and Clutch Assembly

NOTE: Internal FS18/FS20 A/C compressor components are not serviced separately. The A/C compressor is serviced only as an assembly. The clutch disc and hub, A/C compressor pulley and bearing, and clutch field coil are serviceable.

The FS18/FS20 A/C compressor has the following characteristics:

- A non-serviceable shaft seal
- A pressure relief valve is installed in the rear of the compressor to protect the refrigerant system against excessively high refrigerant pressures

- The A/C compressor uses PAG oil or equivalent. This oil contains special additives required for the A/C compressor
- The A/C compressor oil may have some slightly dark-colored streaks while maintaining normal lubricant properties. This is normal for this A/C compressor because of break-in wear that can discolor the oil
- Use standard oil matching procedures when installing new compressors



Item	Part Number	Description
1	W711877	A/C clutch bolt
2	19D786	A/C clutch disc and hub
3	19D648	A/C clutch disc and hub spacers
4	N805338	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W711883	A/C clutch field coil snap ring (FS20 only)
7	19D798	A/C clutch field coil

When battery voltage is applied to the A/C clutch field coil, the clutch disc and hub assembly is drawn toward the A/C compressor pulley. The magnetic force locks the clutch disc and hub assembly and the A/C compressor pulley together as one unit, causing the compressor shaft to rotate. When battery voltage is removed from the A/C clutch field coil, an annular ring in the clutch disc and hub assembly moves the clutch disc away from the A/C compressor pulley.

A/C Pressure Relief Valve

NOTE: If the A/C compressor is operating within limits and the A/C pressure relief valve is venting, or if the A/C pressure relief valve is leaking around the threads, replace the A/C pressure relief valve and O-ring. If the A/C pressure relief valve still vents after it is replaced, diagnose the refrigerant system for a restriction.

An A/C compressor pressure relief valve is installed in the compressor to relieve unusually high refrigerant system discharge pressure buildups. The compressor pressure relief valve will avoid total refrigerant loss by closing after the excessive pressure has been relieved.

The A/C pressure relief valve is a separate component and can be replaced separately from the A/C compressor. It is necessary to recover the refrigerant before removing the A/C pressure relief valve.

Condenser Core

The condenser is an aluminum fin and tube design heat exchanger, located in front of the vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

Evaporator Core

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle.

The evaporator core is an aluminum plate/fin type and is located in the heater core and evaporator core housing. A mixture of refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube and continues out of the evaporator core through the evaporator core outlet tube. Air from the blower motor is cooled and dehumidified as it flows through the evaporator core fins.

Evaporator Core Orifice

NOTE: A new evaporator core orifice should be installed whenever a new A/C compressor is installed.

The evaporator core orifice is located in the condenser-to-evaporator line, and can be removed through an access fitting. The evaporator core orifice provides a restriction to the flow of refrigerant from the high-pressure side of the refrigerant system and separates the low-pressure and high-pressure sides of the refrigerant system.

Suction Accumulator

NOTE: Installation of a new suction accumulator is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator. Damage to the suction accumulator includes leaks in the suction accumulator, physical damage to the suction accumulator shell or desiccant, or moisture contamination. Moisture contamination results only from a complete loss of refrigerant, and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than 1 hour. If even a slight amount of positive refrigerant pressure is present in the refrigerant system before repairs are carried out, the suction accumulator should not be replaced.

The suction accumulator is located at the RH rear of the engine compartment. The suction accumulator is used to prevent residual liquid refrigerant from reaching the A/C compressor after leaving the evaporator core. The suction accumulator allows the accumulated heavier liquid refrigerant and oil mixture to re-enter the compressor suction line at a controlled rate. A desiccant bag is mounted inside the canister to absorb any moisture in the refrigerant system.

A/C Cycling Switch

The A/C cycling switch is used to prevent icing of the evaporator core by cycling OFF the A/C compressor clutch when the suction pressure in the low-pressure side of the refrigerant system drops below acceptable levels. When the A/C cycling switch circuit is open, the PCM will disengage the A/C compressor clutch.

The A/C cycling switch is installed on a Schrader-type valve core fitting on the suction accumulator. It is not necessary to recover the refrigerant before removing the A/C cycling switch.

A/C Pressure Transducer

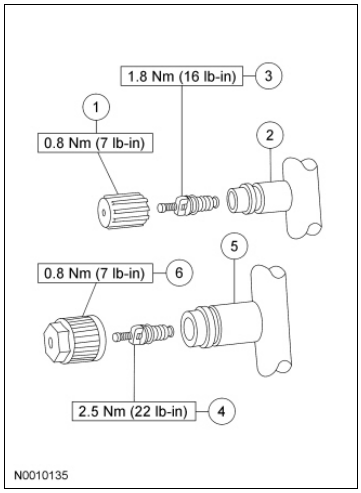
The A/C pressure transducer is used by the PCM to monitor the discharge pressure in the high-pressure side of the refrigerant system. When the A/C pressure transducer is reading a discharge pressure above acceptable levels, the PCM will disengage the A/C compressor clutch.

The A/C pressure transducer is installed on a Schrader-type valve core fitting on the compressor-to-condenser discharge line. It is not necessary to recover the refrigerant before removing the A/C pressure transducer.

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the compressor-to-condenser discharge line.

The low-pressure service gauge port valve is located on the suction accumulator.



Item	Part Number	Description
1	19D702	A/C charging valve cap
2	-	Low-pressure service gauge port valve
3	19D701	Low-pressure Schrader-type valve
4	19D701	High-pressure Schrader-type valve
5	-	High-pressure service gauge port valve
6	19D702	A/C charging valve cap

The fitting is an integral part of the A/C line or component.

- Special couplings are required for both the high-side and low-side service gauge ports.
- A very small amount of leakage will always be detectable around the Schrader-type valve with the service gauge port valve cap removed, and is considered normal. A new Schrader-type valve core can be installed if the seal leaks excessively.
- The service gauge port valve caps are used as primary seals in the refrigerant system to prevent leakage through the Schrader-type valves from reaching the atmosphere. Always install and tighten the A/C service gauge port valve caps to the correct torque after they are removed.

Refrigerant System Dye

Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved UV blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Replacement suction accumulators are shipped with a fluorescent dye "wafer" included in the desiccant bag which will dissolve after approximately 30 minutes of continued A/C operation. It is not necessary to add dye after flushing or filtering the refrigerant system because a new suction accumulator is installed as part of the flushing or filtering procedure. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

Air Distribution and Filtering

Air Distribution

NOTE: The air distribution system of this vehicle cannot be equipped with a cabin air filter.

There are 2 sources of air available to the air distribution system:

- Outside air
- Recirculated air

Recirculated air is used in OFF and is available in all modes except DEFROST and FLOOR/DEFROST.

Air distribution on vehicles equipped with dual-zone Electronic Automatic Temperature Control (EATC) is determined by the HVAC module in the AUTOMATIC mode but can be overridden by the driver if desired.

There are 4 independently actuated airflow mode doors used to direct airflow within the heater core and evaporator core housing and the plenum chamber. Vacuum control motors are used to position these airflow mode doors.

Vehicles with dual-zone EATC use a partitioned heater core and evaporator core housing assembly with 2 separate temperature blend doors. This allows individual temperature settings to be selected for the RH and LH air outlets. The airflow mode doors are not partitioned. Therefore, the airflow mode for the RH and LH outlets will remain similar in all modes, regardless of the temperature settings.

The air distribution system is designed to provide airflow from the defroster duct when no vacuum is applied to any of the vacuum control motors. This is done to prevent a situation where defrost cannot be obtained due to a system vacuum leak.

Air enters the passenger compartment from the:

- instrument panel A/C registers.
- floor ducts.
- windshield defroster duct.
- side window demisters.
- center flow-through console.

Passenger compartment air is exhausted from the vehicle through open windows or body air vents located at the rear lamp assemblies.

Control Components

Manual Climate Control

The manual climate control components are used to select:

- air inlet source (outside or recirculated).
- blower motor speed.
- discharge air temperature (temperature blend).
- discharge air location (defrost, panel, floor).
- A/C compressor operation.

Control System Inputs

The climate control assembly has 3 system control inputs.

Climate Control Assembly

The climate control assembly integrates the temperature control switch, A/C request button and rear defog switch into a single unit.

The temperature control switch setting determines air temperature. Temperature selection is accomplished with a potentiometer (temperature control switch) connected to the temperature blend door actuator. Movement of the temperature control switch from COOL (blue) to WARM (red) causes a corresponding movement of the temperature blend door and determines the air discharge temperature that the air distribution system will maintain. The temperature control switch is an integral part of the manual climate control assembly and a new one cannot be separately installed.

The A/C request switch determines A/C compressor operation, except when the function selector switch is in the OFF, MAX, DEFROST or FLOOR/DEFROST positions. The A/C request switch is an integral part of the manual climate control assembly and a new one cannot be separately installed.

The rear defog button signals activation of the heated backlight and heated mirrors. The rear defog button is an integral part of the manual climate control assembly and a new one cannot be separately installed.

Function Selector Switch

The function selector switch combines a vacuum selector valve that determines air distribution and an electrical switch to supply battery voltage to the A/C compressor circuit and the blower motor circuit. When the function selector switch is in the MAX A/C, DEFROST or FLOOR/DEFROST positions, the A/C compressor will be operational regardless of the A/C request switch status.

Blower Motor Switch

The blower motor switch controls blower motor speed by adding or bypassing resistors in the blower motor switch resistor in all function selector switch positions except OFF.

Control System Outputs

The climate control system has 5 system outputs.

Blower Motor Resistor

The blower motor resistor has 3 resistor elements mounted on the resistor board to provide 4 blower motor speeds. Depending on the blower motor switch position, series resistance is added or bypassed in the blower motor circuit to decrease or increase blower motor speed. The blower motor resistor has an overheating device (thermal limiter) that opens the resistor coil when the temperature reaches approximately 184°C (363°F), interrupting the blower motor operation in all speeds except HIGH. The thermal limiter cannot be reset and is not serviceable.

Temperature Blend Door Actuator

The temperature blend door actuator moves the temperature blend door on command from the temperature control switch using a reversible electric motor. The temperature blend door actuator contains an internal controller that will recognize the temperature control switch signal and drive the temperature blend door to the desired position.

The temperature blend door actuator is located on the LH side of the heater core and evaporator core housing.

Vacuum Control Motors

The 4 vacuum control motors move the airflow mode doors to direct system airflow to the vehicle interior as determined by the function selector switch. Vacuum control motors are used to control the:

- air inlet mode door.
- defrost mode door.
- panel mode door.
- floor mode door.

Heater Control Valve Vacuum Switch

The heater control valve vacuum switch applies vacuum to the heater control valve when the temperature blend door is in the full COOL position. The temperature blend door actuates the heater control valve vacuum switch with an arm attached to the RH side of the temperature blend door pivot shaft.

The heater control valve vacuum switch is mounted on the RH side of the heater core and evaporator core housing just below the defrost door vacuum control motor.

Dual-Zone Electronic Automatic Temperature Control (EATC)

The HVAC module analyzes input from the following major sources:

- Temperature, airflow direction and blower selection (made by the vehicle occupants)
- In-vehicle temperature
- Ambient temperature
- Sunload
- Vehicle speed
- Engine coolant temperature

Using these inputs, the HVAC module determines the correct conditions for the following outputs:

- A/C compressor operation
- Blower speed

- LH side temperature blend door position
- RH side temperature blend door position
- Air inlet mode door position
- Defrost mode door position
- Panel mode door position
- Floor mode door position

Control System Inputs

The dual-zone EATC system has 5 control system inputs.

NOTE: If installing a new HVAC module, the new module must be configured for the vehicle. Refer to Section 418-01 .

HVAC Module

The HVAC module has a vacuum fluorescent display for displaying set temperature, airflow direction, blower speed and DTCs. The HVAC module utilizes an On-Board Diagnostic (OBD) feature to supply the technician with DTCs. These DTCs help direct the technician to the inoperative component.

Steering Wheel Audio/Climate Control Switch

The steering wheel audio/climate control switch is located on the right side of the steering wheel. The steering wheel audio/climate control switch allows the driver to adjust the passenger compartment temperature setting and manually override the blower motor speed setting.

Ambient Temperature Sensor

The ambient temperature sensor signal is received by the HVAC module and indicates the outside air temperature. The ambient temperature sensor is located in front of the radiator on the LH side of the radiator support.

The ambient temperature sensor signal is not the sole factor considered by the HVAC module for the outside air temperature display. Therefore, the ambient temperature PID monitored with a scan tool may not exactly match the HVAC module display. For information regarding the HVAC module outside air temperature display, refer to Section 412-00 .

In-Vehicle Temperature Sensor

The in-vehicle temperature sensor contains a thermistor which measures the in-vehicle air temperature and sends that reading to the HVAC module. A hose and elbow is connected between the heater core and evaporator core housing and the in-vehicle temperature sensor. The automatic temperature control sensor hose and elbow takes air from the heater core and evaporator core housing air stream to create a suction in the in-vehicle temperature sensor. The suction draws in-vehicle air into the in-vehicle temperature sensor and across the thermistor.

Solar Radiation Sensor (Sunload Sensor)

The solar radiation sensor supplies information to the HVAC module indicating LH side and RH side sunload.

Control System Outputs

The dual-zone EATC system has 4 control system outputs.

Automatic Temperature Control Solenoid and Manifold

The automatic temperature control solenoid and manifold uses 5 internal solenoid-type valves to distribute vacuum to the vacuum control motors and heater control valve based on the HVAC module settings. Manifold vacuum is always available at the automatic temperature control solenoid and manifold from the vacuum reservoir when the engine is running. The 4 vacuum control motors and the heater control valve vacuum lines are each connected to a separate internal solenoid. The HVAC module will apply voltage to the desired solenoids to open the solenoid to the manifold vacuum supply and complete the vacuum circuit to the desired component.

Blower Motor Speed Control

The blower speed control converts low power signals from the HVAC module to a high current, variable ground feed for the blower motor. A delay function is used to provide a gradual increase or decrease in blower motor speed under all conditions.

Temperature Blend Door Actuators

The dual-zone EATC system uses 2 temperature blend door actuators to control 2 separate temperature blend doors. The temperature blend doors independently vary the LH side and RH side temperature settings, as desired. The temperature blend door actuators each contain a reversible electric motor and a potentiometer. The HVAC module applies a 5-volt signal to one end of the potentiometer and ground to the other. The potentiometer wiper is connected to the actuator output shaft and moves with the output shaft. The voltage available at the wiper indicates the position of the temperature blend door. The actuator wiper voltage is sent to the HVAC module which drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected HVAC module wiper voltage value.

Vacuum Control Motors

The 4 vacuum control motors move the airflow mode doors to direct system airflow to the vehicle interior as determined by the function selector switch. Vacuum control motors are used to control the:

- air inlet door.
- defrost mode door.
- panel mode door.
- floor mode door.

Heating and Ventilation

The heating and ventilation system has the following features:

- Controls the temperature and, during A/C operation, reduces the relative humidity of the air inside the vehicle.
- Delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.
- Cooling or heating can be adjusted to maintain the desired temperature.
- On vehicles with dual-zone Electronic Automatic Temperature Control (EATC), the temperature can be adjusted individually by the driver and passenger.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer it to air passing through the heater core.

Blower Motor

The blower motor pulls air from the air inlet and forces it into the heater core and evaporator core housing and the plenum chamber where it is mixed and distributed.

Heater Control Valve

The heater control valve is actuated by the heater control valve vacuum switch (manual climate control) or the heater control valve vacuum control circuit (Electronic Automatic Temperature Control (EATC)). When the heater control valve is closed (full vacuum), coolant flow through the heater core is shut OFF and A/C cooling efficiency is increased.

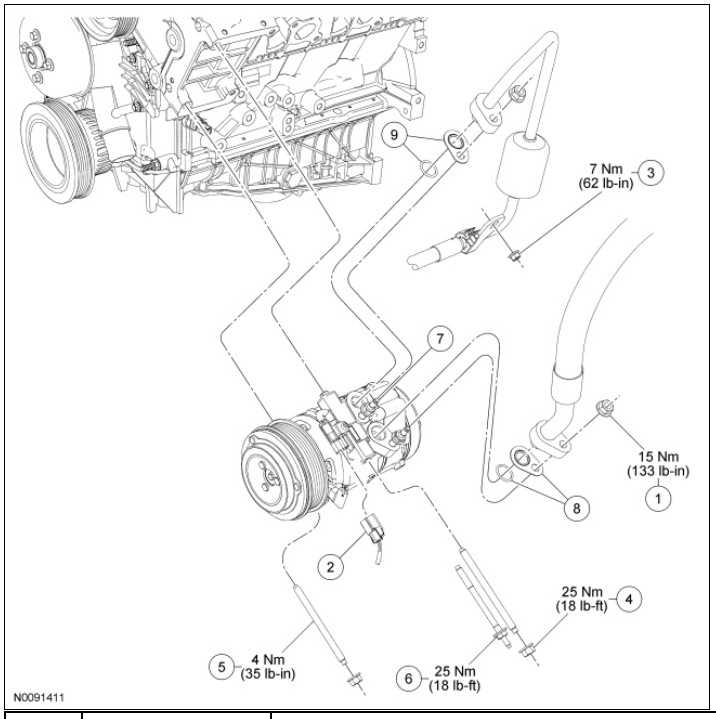
Heater Core and Evaporator Core Housing

The heater core and evaporator core housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is then directed through or around the heater core by the temperature blend door(s). Vehicles equipped with dual-zone Electronic Automatic Temperature Control (EATC) use a partitioned heater core and evaporator core housing with 2 electric actuator-positioned temperature blend doors. This allows for separate temperatures to be selected for the driver and passenger sides of the passenger compartment. Manual systems use a single electric actuator-positioned temperature blend door to direct airflow through or around the heater core.

Air Conditioning (A/C) Compressor - 4.0L SOHC

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	A/C compressor fitting nut (2 required)
2	-	Field coil electrical connector (part of 14A280)
3	W520111	Compressor-to-condenser discharge line bracket nut
4	N621939	A/C compressor nut (2 required)
5	W704795	A/C compressor stud (2 required)
6	W707821	A/C compressor bolt
7	19703	A/C compressor
8	19B596	O-ring seal and gasket seal kit
9	19B596	O-ring seal and gasket seal kit

Removal and Installation

NOTICE: **If installing a new Air Conditioning (AC) compressor due to an internal failure of the old unit, the following procedures must be carried out to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance**

and/or damage to the new A/C compressor and other components.

- If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor. For additional information, refer to Section 412-00 .
- If A/C flushing equipment is not available, carry out filtering of the A/C system after a new A/C compressor has been installed. For additional information, refer to Section 412-00 .
- Install a new evaporator core orifice and auxiliary Thermostatic Expansion Valve (TXV) (if equipped), as directed by the A/C flushing or filtering procedure.
- Install a new suction accumulator as directed by the A/C flushing or filtering procedure.

NOTE: A new A/C compressor may come equipped with an A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil already installed. If these components are not pre-installed, it will be necessary to transfer these parts from the old A/C compressor to the new compressor prior to installation of the A/C compressor if suitable for reuse.

NOTE: Installation of a new suction accumulator is not required when repairing the A/C system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

1. If flushing of the A/C system has not been carried out, recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the drive belt from the A/C compressor pulley.

3. Remove the 2 A/C compressor fitting nuts.
   - Discard the O-ring seals and gasket seals.
   - To install, tighten to 15 Nm (133 lb-in).

4. Disconnect the field coil electrical connector and detach the harness from the A/C compressor stud.

5. Remove the compressor-to-condenser discharge line bracket nut and detach the bracket.
   - To install, tighten to 7 Nm (62 lb-in).

6. Remove the 2 A/C compressor nuts.
   - To install, tighten to 25 Nm (18 lb-ft).

7. Remove the 2 A/C compressor studs.
   - To install, tighten to 4 Nm (35 lb-in).

8. Remove the A/C compressor bolt.
   - To install, tighten to 25 Nm (18 lb-ft).

9. Remove the A/C compressor.

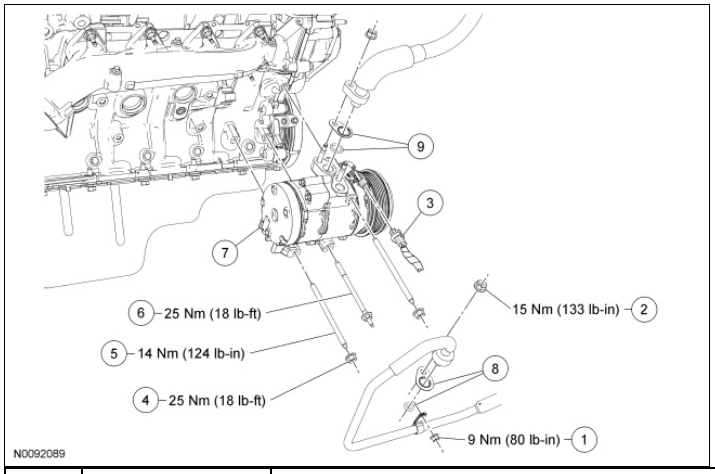
10. To install, reverse the removal procedure.
    - If a new A/C compressor is to be installed, the clutch assembly may need to be transferred from the old unit to the new unit. For additional information, refer to Clutch and Clutch Field Coil in this section.
    - Install new O-ring seals and gasket seals.
    - If filtering of the A/C system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

11. If filtering of the A/C system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Air Conditioning (A/C) Compressor - 4.6L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520111	Compressor-to-condenser discharge line bracket nut
2	W520413	A/C compressor fitting nut (2 required)
3	-	Field coil electrical connector (part of 14A280)
4	N621939	A/C compressor nut (2 required)
5	W704795	A/C compressor stud (2 required)
6	W707821	A/C compressor bolt
7	19703	A/C compressor
8	19B596	O-ring seal and gasket seal kit
9	19B596	O-ring seal and gasket seal kit

Removal and Installation

NOTICE: **If installing a new Air Conditioning (A/C) compressor due to an internal failure of the old unit, the following procedures must be carried out to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance and/or damage to the new A/C compressor and other components.**

- If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor. For additional information, refer to Section 412-00 .
- If A/C flushing equipment is not available, carry out filtering of the A/C system after a new A/C compressor has been installed. For additional information, refer to Section 412-00 .

- Install a new evaporator core orifice and auxiliary Thermostatic Expansion Valve (TXV) (if equipped), as directed by the A/C flushing or filtering procedure.
- Install a new suction accumulator as directed by the A/C flushing or filtering procedure.

NOTE: A new A/C compressor may come equipped with an A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil already installed. If these components are not pre-installed, it will be necessary to transfer these parts from the old A/C compressor to the new compressor prior to installation of the A/C compressor if suitable for reuse.

NOTE: Installation of a new suction accumulator is not required when repairing the A/C system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. If flushing of the A/C system has not been carried out, recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the drive belt from the A/C compressor pulley.

4. Remove the RH front wheel and tire. For additional information, refer to Section 204-04 .

5. Remove the front portion of the RH fender splash shield.

6. Remove the 2 A/C compressor fitting nuts and disconnect the compressor suction fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (133 lb-in).

7. Disconnect the field coil electrical connector and detach the wire harness from the A/C compressor stud.

8. Remove the compressor-to-condenser discharge line bracket nut and detach the bracket.
   - To install, tighten to 9 Nm (80 lb-in).

9. Remove the A/C compressor bolt.
   - To install, tighten to 25 Nm (18 lb-ft).

10. Remove the lower rear A/C compressor nut.
    - To install, tighten to 25 Nm (18 lb-ft).

11. Remove the lower rear A/C compressor stud.
    - To install, tighten to 14 Nm (124 lb-in).

12. Remove the upper A/C compressor nut.
    - To install, tighten to 25 Nm (18 lb-ft).

13. Remove the upper A/C compressor stud.
    - To install, tighten to 14 Nm (124 lb-in).

14. **NOTE:** The A/C compressor can be removed through the opening at the RH wheel well.

    Disconnect the A/C compressor discharge fitting and remove the A/C compressor.

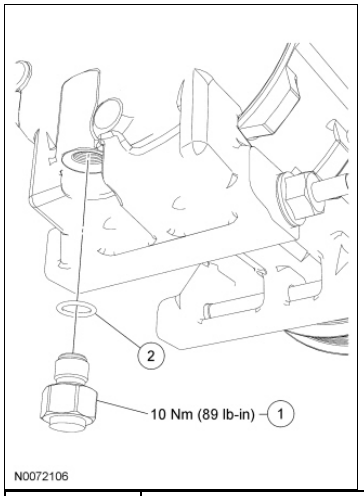
- Discard the O-ring seal and gasket seal.

15. To install, reverse the removal procedure.
    - If a new A/C compressor is to be installed, the clutch assembly may need to be transferred from the old unit to the new unit. For additional information, refer to Clutch and Clutch Field Coil in this section.
    - Install new O-ring seals and gasket seals.
    - If filtering of the A/C system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .
16. If filtering of the A/C system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Air Conditioning (A/C) Pressure Relief Valve

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	19D644	A/C compressor pressure relief valve
2	-	O-ring seal (part of 19D644)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the A/C compressor pressure relief valve and O-ring seal.
   - To install, tighten to 10 Nm (89 lb-in).

4. **NOTE:** A new O-ring seal will already be installed on the new A/C pressure relief valve service part.

   To install, reverse the removal procedure.

   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

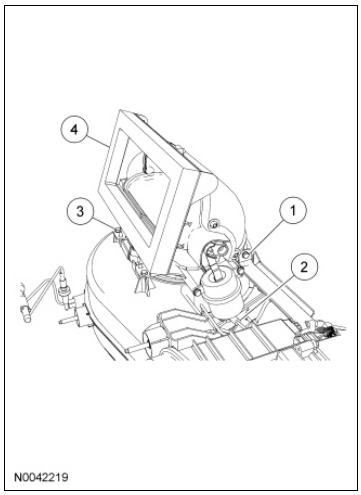
5. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Air Inlet Duct

Removal and Installation

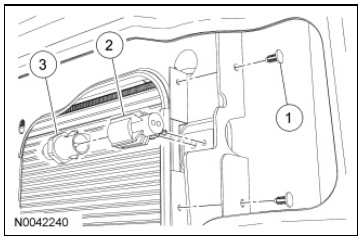
1. Remove the heater core and evaporator core housing. For additional information, refer to Section 412-02 .

2. Remove the air inlet duct.
    1. Remove the support bracket screw.
    2. Disconnect the air inlet door vacuum control motor vacuum connector.
    3. Remove the 3 air inlet duct screws.
    4. Remove the air inlet duct.



3. To install, reverse the removal procedure.

Ambient Air Temperature Sensor



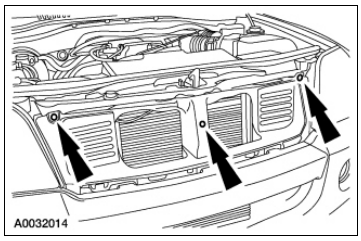
Item	Part Number	Description
1	N806799	Air deflector pin-type retainer (2 required)
2	-	Ambient air temperature sensor electrical connector (part of 14398)
3	12A647	Ambient air temperature sensor

Removal and Installation

Mountaineer

1. Remove the radiator grille. For additional information, refer to Section 501-08 .

2. Remove the pin-type retainers and position the air deflector forward.



3. Remove the 2 air deflector pin-type retainers and detach the air deflector from the 2 locator pins on the radiator support.

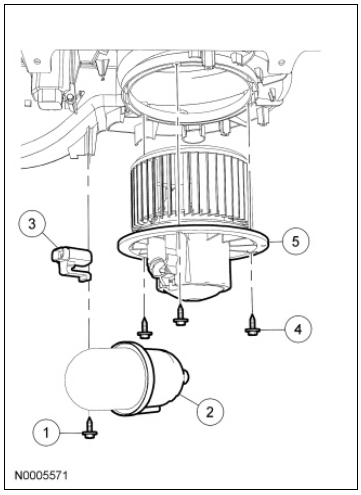
All vehicles

4. Detach the ambient air temperature sensor electrical connector.

5. Remove the ambient air temperature sensor.

6. To install, reverse the removal procedure.

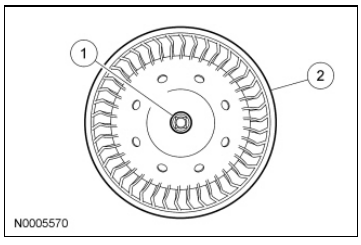
Blower Motor



Item	Part Number	Description
1	W701696	Vacuum reservoir screw
2	19A566	Vacuum reservoir
3	-	Blower motor electrical connector (part of 14401)
4	W701696	Blower motor screw (3 required)
5	19805	Blower motor

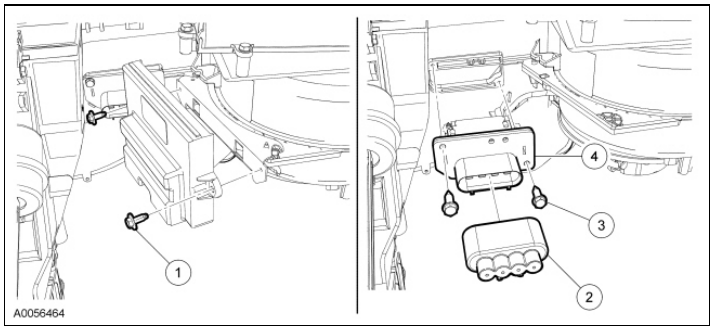
Removal and Installation

1. Remove the vacuum reservoir screw.
2. Position the vacuum reservoir aside.
3. Disconnect the blower motor electrical connector.
4. Remove the 3 blower motor screws.
5. Remove the blower motor.
6. Remove the blower motor wheel from the blower motor.
    1. Remove the push clip.
    2. Remove the blower motor wheel.



7. To install, reverse the removal procedure.

Blower Motor Resistor

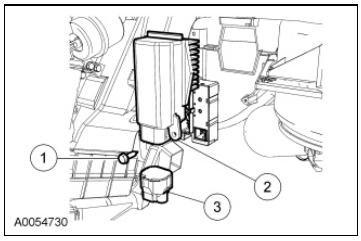


Item	Part Number	Description
1	W705314	4X4 control module screw (2 required)
2	-	Blower motor resistor electrical connector (part of 19C603)
3	W701696	Blower motor resistor screw (2 required)
4	19A706	Blower motor resistor

Removal and Installation

1. Remove the two 4X4 control module screws.
2. Disconnect the blower motor resistor electrical connector.
3. Remove the 2 blower motor resistor screws.
4. Remove the blower motor resistor.
5. To install, reverse the removal procedure.

Blower Motor Speed Control

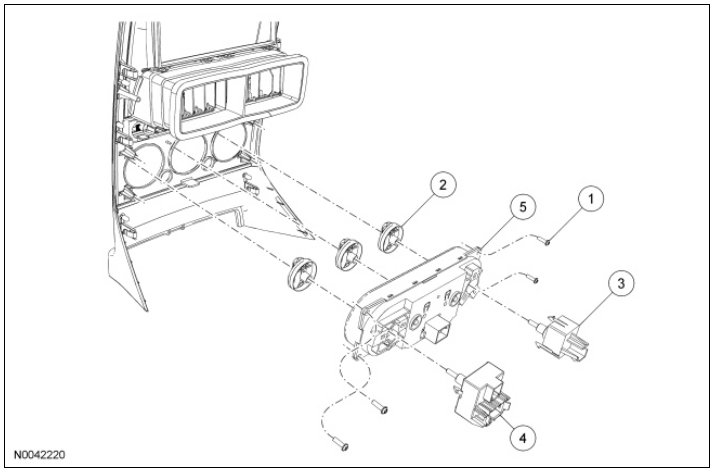


Item	Part Number	Description
1	W701696	Blower motor speed control screw
2	19E624	Blower motor speed control
3	-	Blower motor speed control electrical connector (part of 19C603)

Removal and Installation

1. Remove the blower motor speed control screw.
2. Remove the blower motor speed control.
3. Disconnect the blower motor speed control electrical connector.
4. To install, reverse the removal procedure.

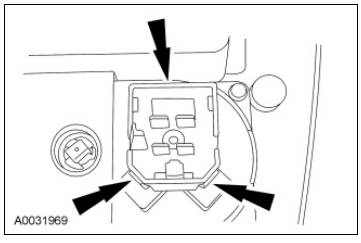
Climate Control Assembly



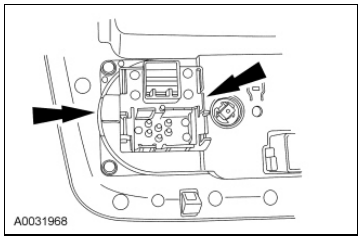
Item	Part Number	Description
1	W701679	Climate control assembly screw (4 required)
2	18519	Climate control knob (3 required)
3	19986	Blower motor switch
4	19B888	Function selector switch
5	19980	Climate control assembly

Removal and Installation

1. Remove the center instrument panel finish panel. For additional information, refer to Section 501-12 .
2. Remove the 4 climate control assembly screws.
3. Remove the climate control assembly.
4. Remove the 3 climate control knobs.
5. Depress the tabs and remove the blower motor switch.



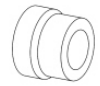
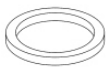
6. Depress the tabs and remove the function selector switch.

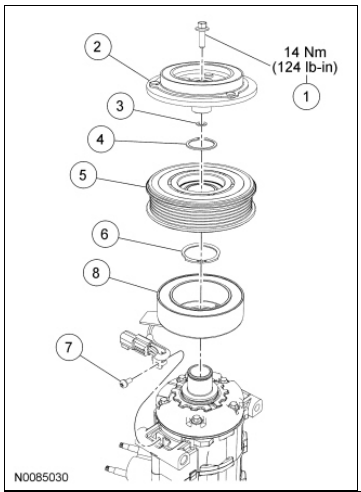


7. To install, reverse the removal procedure.

Clutch and Clutch Field Coil

Special Tool(s)

 ST1232-A	Coil Replacer (FS18 only) 412-065 (T89P-19623-EH)
 ST1233-A	Field Coil Remover (FS18 only) 412-067 (T89P-19623-FH)
 ST1234-A	Field Coil Replacer (FS18 only) 412-078 (T91L-19623-CH)
 ST2946-A	Holding Fixture, Compressor Clutch Disc and Hub 412-134
 ST2382-A	Remover, Compressor Pulley 412-001 (T71P-19703-B)



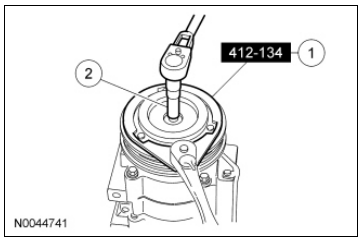
Item	Part Number	Description
1	W711887	A/C clutch disc and hub bolt
2	19D786	A/C clutch disc and hub
3	19D648	A/C clutch disc and hub spacers
4	N805338	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W711883	A/C clutch field coil snap ring (FS20 only)
7	W710797	A/C clutch field coil electrical connector screw (FS20 only)
8	19D798	A/C clutch field coil

Removal

All vehicles

1. Remove the A/C compressor. For additional information, refer to Air Conditioning (A/C) Compressor - 4.0L SOHC or Air Conditioning (A/C) Compressor - 4.6L in this section.

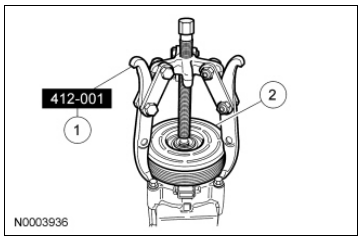
2. Remove the A/C clutch disc and hub bolt.
    1. Hold the A/C clutch disc and hub with the Compressor Clutch Disc and Hub Holding Fixture.
    2. Remove the A/C clutch disc and hub bolt.



3. Remove the A/C clutch disc and hub.

4. Remove the A/C compressor pulley snap ring.

5. Remove the A/C compressor pulley.
    1. Install the Compressor Pulley Remover
    2. Remove the A/C compressor pulley.

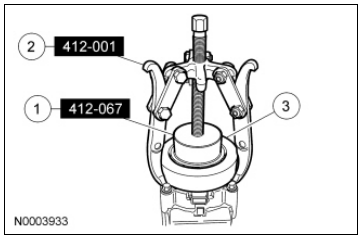


FS18 compressors only

6. ***NOTICE:*** **Do not use air tools. The Air Conditioning (A/C) clutch field coil can be easily damaged.**

   Remove the A/C clutch field coil.

    1. Install the Field Coil Remover.
    2. Install the Compressor Pulley Remover.
    3. Remove the A/C clutch field coil.



FS20 compressors only

7. Remove the A/C clutch field coil snap ring.

8. Remove the A/C clutch field coil electrical connector screw.

9. Remove the A/C clutch field coil.

Installation

NOTE: If installing a new A/C compressor, the A/C clutch components should be reused unless obvious signs of damage are found. If excessive grooving is found, a new A/C clutch disc and hub and A/C compressor pulley must be installed together. Otherwise, each component can be installed individually where needed.

All vehicles

1. Visually inspect the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil for damage.
    - Inspect for physical damage, including cracked or melted components or discoloration due to excessive heat.
    - Inspect for excessive wear, including grooving in the A/C clutch disc and hub or A/C compressor pulley that is more than fingernail depth.
    - Inspect for roughness in the A/C compressor pulley bearing.

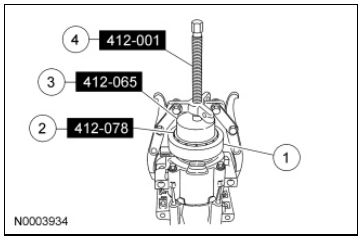
2. Clean the A/C clutch field coil and pulley mounting surfaces.

FS18 compressors only

3. ***NOTICE:*** **Do not use air tools. The Air Conditioning (A/C) clutch field coil can be easily damaged.**

   Install the A/C clutch field coil.

    1. Place the A/C clutch field coil on the A/C compressor with the A/C clutch field coil electrical connector correctly positioned.
    2. Place the Field Coil Replacer on the A/C clutch field coil.
    3. Place the Coil Replacer 412-065 on the Field Coil Replacer 412-078.
    4. Use the Compressor Pulley Remover to install the A/C clutch field coil.



FS20 compressors only

4. Install the A/C clutch field coil.

5. Install the A/C clutch field coil electrical connector screw.

6. Install the A/C clutch field coil snap ring.

All vehicles

7. **NOTE:** The A/C clutch pulley is a tight fit on the A/C compressor head. It must be correctly aligned during installation.

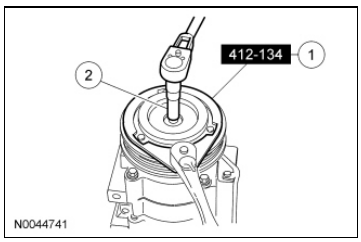
   Install the A/C clutch pulley.

8. Install the A/C clutch pulley snap ring with the bevel side out.

9. Place one nominal thickness A/C clutch disc and hub spacer inside the clutch hub spline opening.

10. Install the A/C clutch disc and hub assembly.

11. Install the A/C clutch disc and hub bolt.
    1. Hold the A/C clutch disc and hub with the Compressor Clutch Disc and Hub Holding Fixture.
    2. Install the A/C clutch disc and hub bolt.
    - Tighten to 14 Nm (124 lb-in).



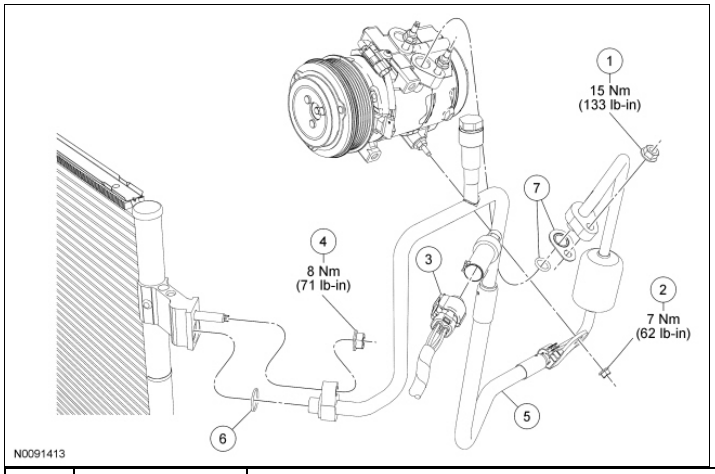
12. Measure and adjust the clutch air gap by removing or adding A/C clutch hub spacers.

13. Install the A/C compressor. For additional information, refer to Air Conditioning (A/C) Compressor - 4.0L SOHC or Air Conditioning (A/C) Compressor - 4.6L in this section.

Compressor to Condenser Discharge Line - 4.0L SOHC

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Compressor discharge fitting nut
2	W520111	Compressor-to-condenser discharge line bracket nut
3	-	A/C pressure transducer electrical connector (part of 14398)
4	W520413	Condenser inlet fitting nut
5	19972	Compressor-to-condenser discharge line
6	19E889	O-ring seal (2 required)
7	19B596	O-ring seal and gasket seal kit

Removal and Installation

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the compressor-to-condenser discharge line bracket nut and detach the bracket.
   - To install, tighten to 7 Nm (62 lb-in).

3. Remove the compressor discharge fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (133 lb-in).

4. Disconnect the A/C pressure transducer electrical connector.

5. Remove the condenser inlet fitting nut and disconnect the fitting.
    - Discard the O-ring seal.
    - To install, tighten to 8 Nm (71 lb-in).

6. Remove the compressor-to-condenser discharge line.

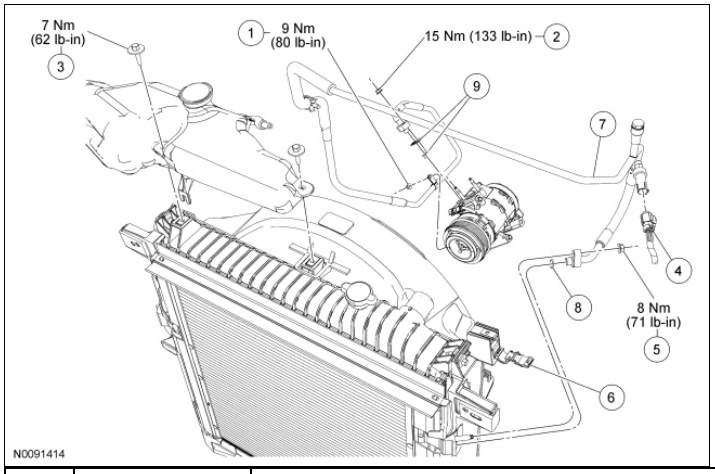
7. To install, reverse the removal procedure.
    - Install a new gasket seal and O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

8. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Compressor to Condenser Discharge Line - 4.6L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520111	Compressor-to-condenser discharge line bracket nut
2	W520413	A/C compressor discharge fitting nut
3	W709027	Coolant expansion tank bolt (2 required)
4	-	Pressure transducer electrical connector (part of 14398)
5	W520413	Condenser inlet fitting nut
6	19N704	Compressor-to-condenser discharge line clip (2 required)
7	19972	Compressor-to-condenser discharge line
8	19E889	O-ring seal and gasket seal kit
9	19B596	O-ring seal and gasket seal kit

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Recover the refrigerant. For additional information, refer to Section 412-00 .
3. Remove the Air Cleaner (ACL) and ACL outlet tube. For additional information, refer to Section 303-12 .
4. Remove the compressor-to-condenser discharge line bracket nut and detach the bracket.

- To install, tighten to 9 Nm (80 lb-in).

5. Remove the compressor outlet fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (133 lb-in).

6. Remove the 2 coolant expansion tank bolts and position the coolant expansion tank aside.
   - To install, tighten to 7 Nm (62 lb-in).

7. Disconnect the A/C pressure transducer electrical connector.

8. Remove the condenser inlet fitting nut and disconnect the fitting.
   - Discard the O-ring seal.
   - To install, tighten to 8 Nm (71 lb-in).

9. **NOTE:** The LH clip should be disconnected from the line. The RH clip should be disconnected from the cooling module.

   Detach the 2 compressor-to-condenser discharge line clips at the cooling module.

10. Remove the compressor-to-condenser discharge line.

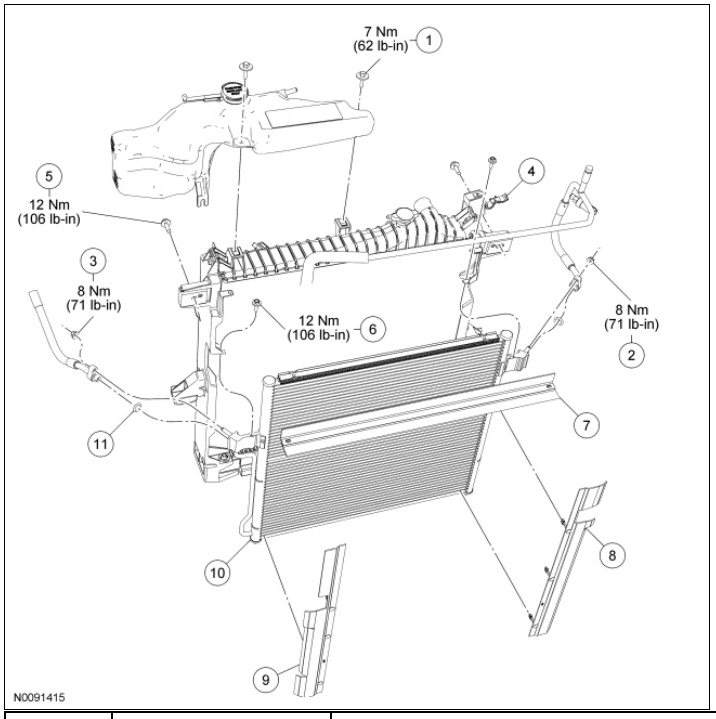
11. To install, reverse the removal procedure.
    - Install a new gasket seal and O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

12. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Condenser Core

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W709027	Coolant expansion tank bolt (2 required)
2	W520413	Condenser inlet fitting nut
3	W520413	Condenser outlet fitting nut
4	19N704	Compressor-to-condenser discharge line clip
5	W709390	Cooling module bolt (2 required)
6	W711343	Condenser bolt (2 required)
7	19E572	Upper radiator air deflector
8	19E572	LH condenser air deflector
9	19E572	RH condenser air deflector
10	19712	Condenser core
11	19E889	O-ring seal (2 required)

Removal and Installation

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the Air Cleaner (ACL). For additional information, refer to Section 303-12 .

3. Remove the 2 coolant expansion tank bolts and position the coolant expansion tank aside.
   - To install, tighten to 7 Nm (62 lb-in).

4. Disconnect the A/C pressure transducer electrical connector.

5. Remove the condenser inlet fitting nut and disconnect the fitting.
   - Discard the O-ring seal.
   - To install, tighten to 8 Nm (71 lb-in).

6. Remove the condenser outlet fitting nut and disconnect the fitting.
   - Discard the O-ring seal.
   - To install, tighten to 8 Nm (71 lb-in).

7. Detach the 2 compressor-to-condenser discharge line clips.

8. Remove the 2 cooling module bolts and position the cooling module rearward.
   - To install, tighten to 12 Nm (106 lb-in).

9. Remove the upper radiator air deflector.

10. Remove the 2 condenser core bolts.
    - To install, tighten to 12 Nm (106 lb-in).

11. Remove the condenser core.

12. Remove the 2 condenser air deflectors.

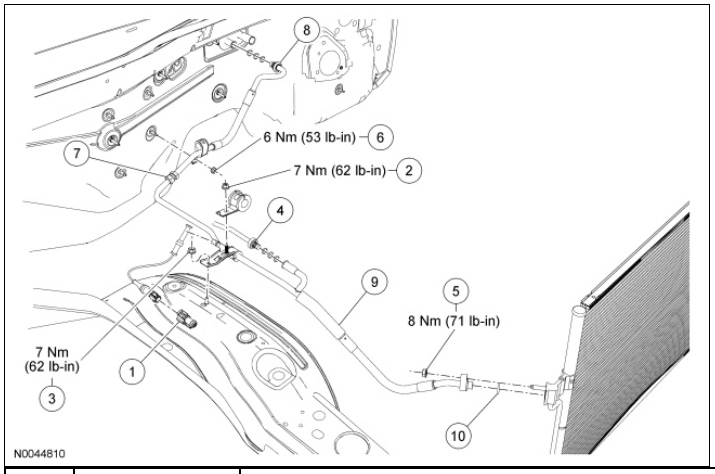
13. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

14. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Condenser to Evaporator Line

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	-	Wheel speed sensor electrical connector (part of 14398)
2	W707137	Suction accumulator-to-compressor line bracket nut
3	N621905	Condenser-to-evaporator line bracket nut
4	-	Auxiliary evaporator inlet line fitting (part of 19835) (if equipped)
5	W520413	Condenser outlet fitting nut
6	W705760	A/C line bracket nut
7	-	Evaporator core orifice access fitting (part of 19835)
8	-	Evaporator inlet fitting (part of 19835)
9	19835	Condenser-to-evaporator line
10	19E889	O-ring seal (7 required)

Removal and Installation

All vehicles

1. Remove the Air Cleaner (ACL) and ACL outlet tube. For additional information, refer to Section 303-12 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the PCM and PCM bracket. For additional information, refer to Section 303-14 .

4. Disconnect the RH wheel speed sensor electrical connector and detach the wire harness from the condenser-to-evaporator line bracket.

Vehicles equipped with 4.6L engine

5. Remove the suction accumulator-to-compressor line bracket nut.
    - To install, tighten to 7 Nm (62 lb-in).

All vehicles

6. Disconnect the evaporator core orifice access fitting.
    - Discard the O-ring seal.

7. Remove the condenser-to-evaporator line bracket nut.
    - To install, tighten to 7 Nm (62 lb-in).

8. Remove the condenser outlet fitting nut and disconnect the fitting.
    - Discard the O-ring seal.
    - To install, tighten to 8 Nm (71 lb-in).

9. Disconnect the auxiliary evaporator inlet line fitting (if equipped).
    - Discard the O-ring seals.

10. Remove the front portion of the condenser-to-evaporator line.

11. Remove the A/C line bracket nut at the dash panel and detach the bracket.
    - To install, tighten to 6 Nm (53 lb-in).

12. Disconnect the evaporator inlet fitting.
    - Discard the O-ring seals.

13. Remove the rear portion of the condenser-to-evaporator line.

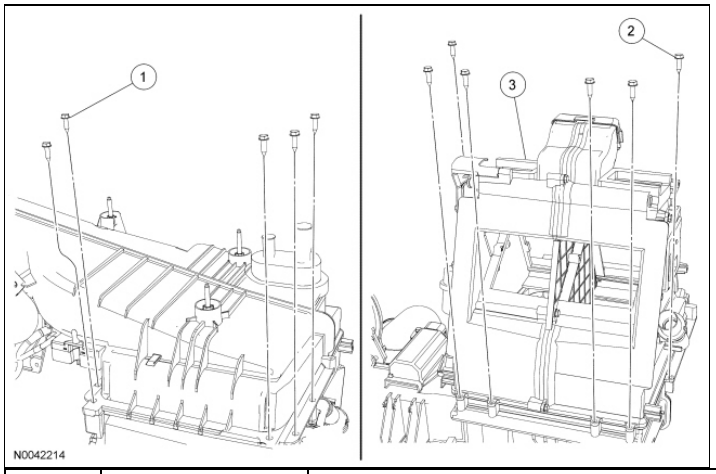
14. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

15. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Evaporator Core

Material

Item	Specification
RTV Silicone Sealant TA-31	-



Item	Part Number	Description
1	W701696	Outer evaporator core cover screw (5 required)
2	W701696	Inner evaporator core cover screw (6 required)
3	-	Evaporator core cover (part of 19850)

Removal and Installation

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle. For additional information, refer to Section 412-00 .

1. Remove the heater core. For additional information, refer to Heater Core in this section.

2. Remove the 5 outer evaporator core cover screws.

3. Remove the 6 inner evaporator core cover screws.

4. Separate the evaporator core cover from the heater core and evaporator core housing.
   - Discard the rope seal.

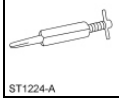
5. Remove the evaporator core.

6. To install, reverse the removal procedure.
   - Apply a bead of RTV sealant around the entire evaporator core housing groove joint in place of the rope seal.
   - Tighten the evaporator core cover screws in a diagonal pattern to distribute the RTV sealant

evenly.

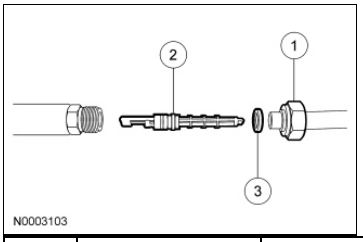
Evaporator Core Orifice

Special Tool(s)

 ST1223-A	Remover, Broken Orifice 412-035 (T83L-19990-B)
 ST1224-A	Remover/Installer, Fixed Orifice 412-034 (T38L-19990-A)

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



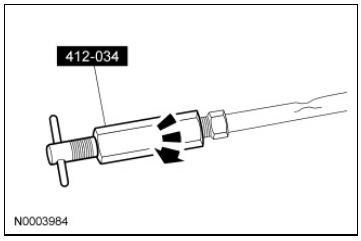
Item	Part Number	Description
1	-	Evaporator core orifice access fitting (part of 19835)
2	19D990	Evaporator core orifice
3	19E889	O-ring

Removal

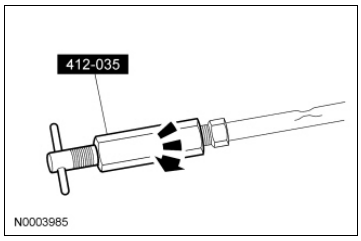
1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. **NOTE:** The evaporator core orifice access fitting is located in the condenser-to-evaporator line below the powertrain control module.

   Disconnect the evaporator core orifice access fitting.

   - Discard the O-ring seal.
3. Inspect the evaporator core orifice for damage before attempting to remove it from the line.
4. If the evaporator core orifice is intact, engage the Fixed Orifice Remover/Installer. Hold the T-handle stationary while rotating the tool body to remove the evaporator core orifice.

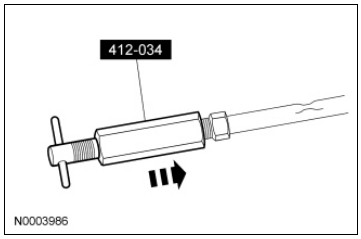


5. If the evaporator core orifice is broken, screw the end of the Broken Orifice Remover into the broken orifice. Hold the T-handle stationary while rotating the tool body to remove the evaporator core orifice.



Installation

1. Lubricate the evaporator core orifice O-rings with clean PAG oil and install the evaporator core orifice using the Fixed Orifice Remover/Installer.

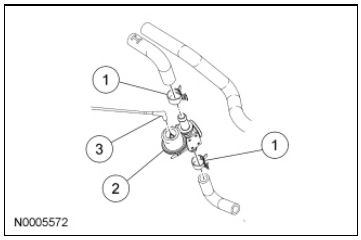


2. Install a new O-ring seal and connect the evaporator core orifice access fitting.
   - To install, tighten to 18 Nm (159 lb-in).

3. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

4. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Heater Control Valve



Item	Part Number	Description
1	8287	Inlet and outlet hose clamps (2 required)
2	18495	Heater control valve
3	-	Heater control valve vacuum connector (part of 18C581)

Removal and Installation

Vehicles with 4.0L and oil cooler, without auxiliary climate control

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

All vehicles

2. Drain the engine coolant. For additional information, refer to Section 303-03 .
3. Disconnect the 2 inlet and outlet heater hose clamps.
4. Disconnect the heater control valve vacuum hose.

Vehicles with 4.0L and oil cooler, without auxiliary climate control

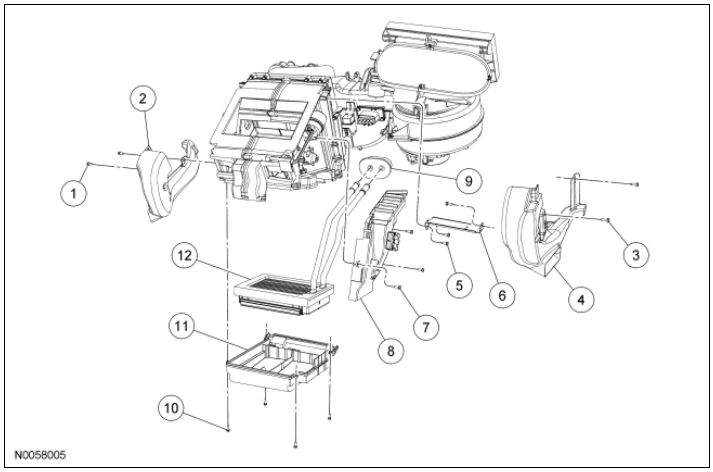
5. Remove the heater control valve bolt.

All vehicles

6. Remove the heater control valve.
7. **NOTE:** Lubricate the coolant hoses with plain water only if needed.

   To install, reverse the removal procedure.
8. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Heater Core



Item	Part Number	Description
1	W701696	LH floor duct screw (2 required)
2	18C433	LH floor duct
3	W701696	RH floor duct screw (2 required)
4	18C433	RH floor duct
5	W701696	Housing brace screw (3 required)
6	19C897	Housing brace
7	W701696	Heater tube cover screw (3 required)
8	18N332	Heater tube cover
9	18658	Heater tube seal
10	W701696	Heater core cover screw (4 required)
11	18B299	Heater core cover
12	18476	Heater core

Removal and Installation

NOTE: If a heater core leak is suspected, the heater core must be pressure leak tested before it is removed from the vehicle.

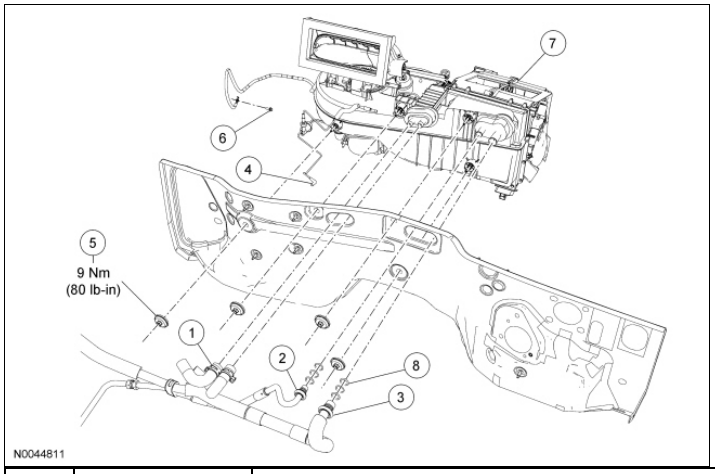
1. Remove the heater core and evaporator core housing. For additional information, refer to Heater Core And Evaporator Core Housing in this section.
2. Remove the 2 LH floor duct screws.
3. Remove the LH floor duct.
4. Remove the 2 RH floor duct screws.
5. Remove the RH floor duct.
6. Remove the 3 housing brace screws.

7. Remove the housing brace.
8. Remove the 3 heater tube cover screws.
9. Remove the heater tube cover.
10. Remove the heater tube seal.
11. Remove the 4 heater core cover screws.
12. Remove the heater core cover.
13. Remove the heater core.
14. To install, reverse the removal procedure.

Heater Core And Evaporator Core Housing

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	8287	Heater hose clamp (2 required) (part of 18C553)
2	-	Evaporator inlet fitting (part of 19835)
3	-	Evaporator outlet fitting (part of 19835)
4	-	Vacuum connector (2 required) (part of 18C581)
5	W708206	Heater core and evaporator core housing nut (4 required)
6	W706287	Ground terminal bolt
7	19850	Heater core and evaporator core housing
8	19E889	O-ring seal (6 required)

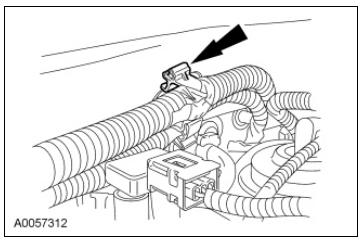
Removal and Installation

NOTE: If an evaporator core leak is suspected, the evaporator core must be vacuum leak tested before it is removed from the vehicle.

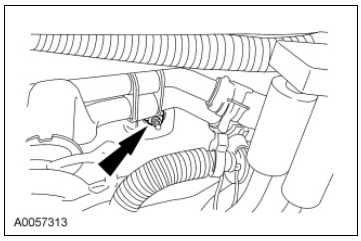
NOTE: Lubricate the coolant hoses with plain water only if needed.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. Drain the engine coolant. For additional information, refer to Section 303-03 .
3. Remove the instrument panel. For additional information, refer to Section 501-12 .

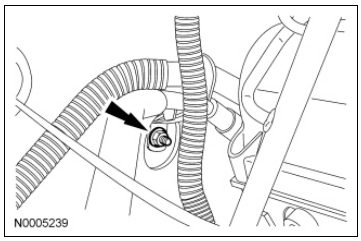
4. Detach the wiring harness bracket and position the harness aside.



5. Remove the heater tube bracket nut.



6. Remove the dash panel A/C line bracket nut.
    - To install, tighten to 11 Nm (97 lb-in).

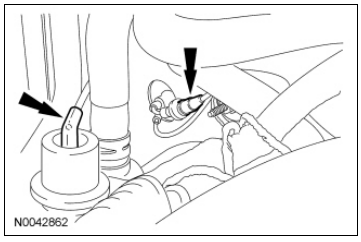


7. Disconnect the 2 heater hose clamps at the heater core.

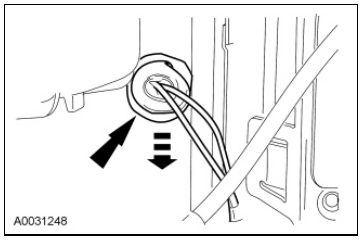
8. Disconnect the evaporator inlet fitting.
    - Discard the O-ring seals.

9. Disconnect the evaporator outlet fitting.
    - Discard the O-ring seals.

10. Disconnect the 2 vacuum connectors.



11. Detach the grommet and push the vacuum lines into the passenger compartment.



12. Remove the 4 heater core and evaporator core housing nuts.
    - To install, tighten to 9 Nm (80 lb-in).

13. Disconnect the ground terminal bolt.

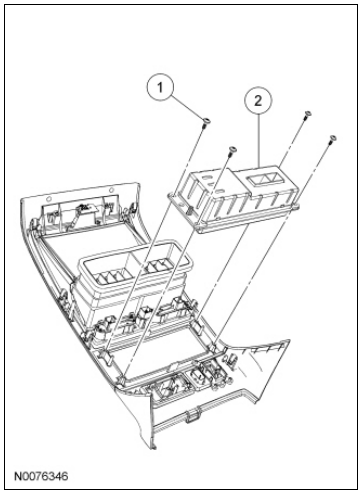
14. Remove the heater core and evaporator core housing.

15. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

16. Fill and the engine cooling system. For additional information, refer to Section 303-03 .

17. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Heating Ventilation Air Conditioning (HVAC) Module



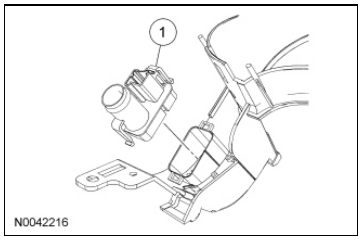
Item	Part Number	Description
1	W701679	HVAC module screw (4 required)
2	19980	HVAC module

Removal and Installation

NOTE: If installing a new HVAC module, the new module must be configured for the vehicle. For additional information, refer to Section 418-01 .

1. Remove the center instrument panel finish panel. For additional information, refer to Section 501-12 .
2. Remove the 4 HVAC module screws.
3. Remove the HVAC module.
4. To install, reverse the removal procedure.

In-Vehicle Temperature Sensor

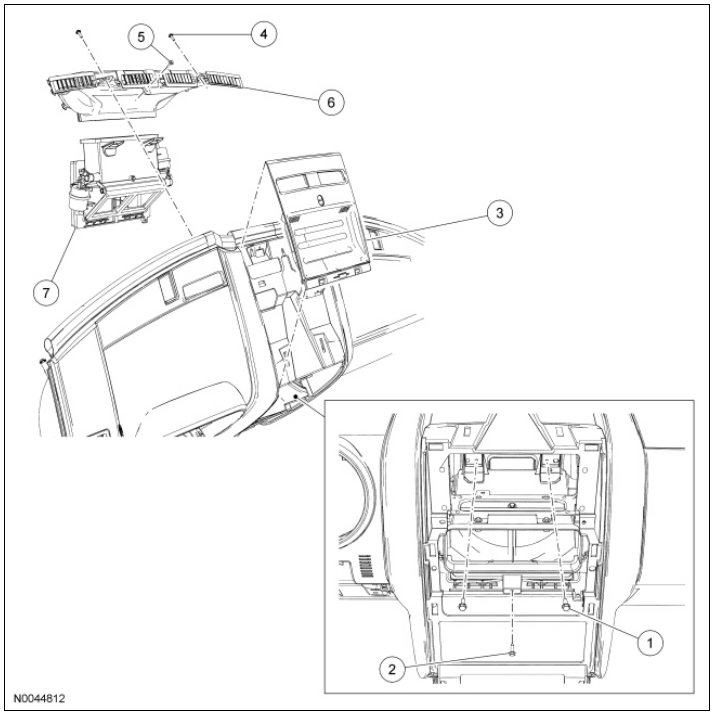


Item	Part Number	Description
1	19C734	In-vehicle temperature sensor

Removal and Installation

1. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
2. Remove the in-vehicle temperature sensor.
3. To install, reverse the removal procedure.

Plenum Chamber



Item	Part Number	Description
1	W707628	Upper plenum chamber screw (2 required)
2	W707281	Lower plenum chamber screw
3	78044A92	Instrument panel upper finish panel
4	W707281	Outer defroster duct screw (2 required)
5	W707628	Center defroster duct screw
6	18490	Defroster duct
7	18471	Plenum chamber

Removal and Installation

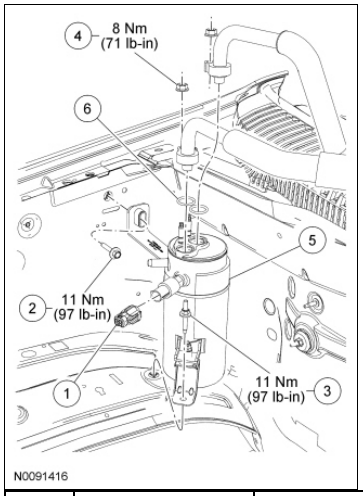
1. Remove the instrument panel. For additional information, refer to Section 501-12 .
2. Remove the Audio Control Module (ACM). For additional information, refer to Section 415-00 .
3. Remove the 3 plenum chamber screws.
4. Remove the instrument panel upper finish panel.
5. Remove the 3 defroster duct screws.
6. Remove the defroster duct.
7. Remove the plenum chamber.

8. To install, reverse the removal procedure.

Suction Accumulator

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	-	A/C cycling switch electrical connector (part of 14398)
2	W711973	Suction accumulator bolt
3	W711897	Suction accumulator stud
4	W703845	Suction accumulator fitting nut (2 required)
5	19C836	Suction accumulator
6	19E889	O-ring seal (2 required)

Removal and Installation

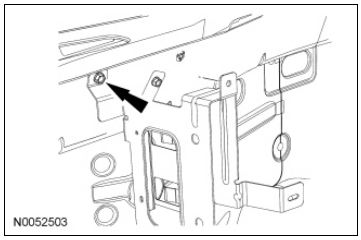
NOTICE: **Care must be taken to minimize exposure of the inside of the suction accumulator to outside air. If multiple Air Conditioning (A/C) system components are being removed and installed, the suction accumulator should be installed last. The suction accumulator shipping caps should not be removed until the fittings are ready to be connected. Evacuation of the A/C system must be started as soon as the suction accumulator is installed. Excessive exposure of the inside of the suction accumulator to outside air will result in moisture contamination of the suction accumulator desiccant.**

NOTE: Installation of a new suction accumulator is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator. Damage to the suction accumulator includes leaks in the suction accumulator, physical damage to the suction accumulator shell or desiccant, or moisture contamination. Moisture contamination results only from a complete loss of refrigerant, and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than 1 hour. If even a slight amount of positive refrigerant pressure is present in

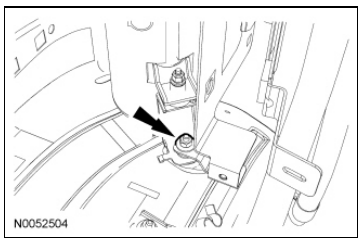
the refrigerant system before repairs are carried out, the suction accumulator should not be replaced.

All vehicles

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. Remove the PCM. For additional information, refer to Section 303-14 .
3. Disconnect the A/C cycling switch electrical connector.
4. Remove the suction accumulator bolt.
   - To install, tighten to 11 Nm (97 lb-in).
5. Remove the PCM bracket bolt.



6. Remove the PCM bracket nut and the PCM bracket.



7. Remove the suction accumulator stud.
   - To install, tighten to 11 Nm (97 lb-in).

4.6L vehicles

8. Remove the suction accumulator-to-compressor line bracket nut at the condenser-to-evaporator line bracket.

All vehicles

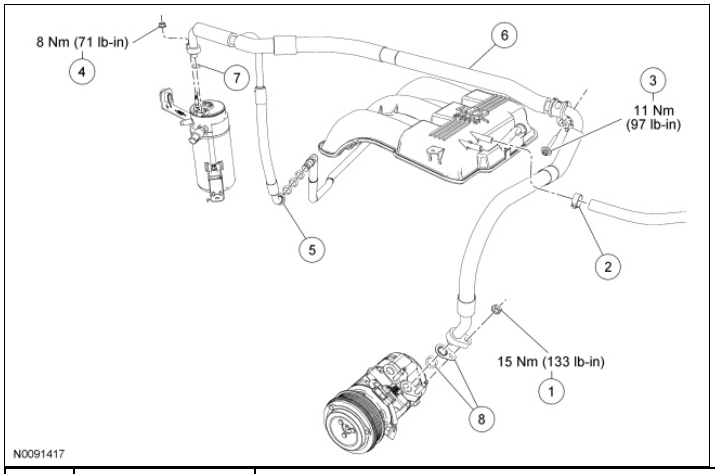
9. Remove the suction accumulator bracket bolt and suction accumulator.
10. Remove the 2 suction accumulator fitting nuts and disconnect the fittings.
    - Discard the O-ring seals.
    - To install, tighten to 8 Nm (71 lb-in).
11. Remove the suction accumulator.
12. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

13. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Suction Accumulator to Compressor Line - 4.0L SOHC

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Compressor suction fitting nut
2	382984	Brake booster vacuum hose clamp
3	W712189	Suction accumulator-to-compressor line bracket bolt
4	W520413	Suction accumulator outlet fitting nut
5	-	Auxiliary evaporator outlet line fitting (part of 19867)
6	19867	Suction accumulator-to-compressor line
7	19E889	O-ring seal (4 required)
8	19B596	O-ring seal and gasket seal kit

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the compressor suction fitting nut and disconnect the fitting.
   - Discard the O-ring seal and gasket seal.
   - To install, tighten to 15 Nm (133 lb-in).

4. Release the brake booster vacuum hose clamp and disconnect the hose.

5. Remove the suction accumulator-to-compressor line bracket bolt at the dash panel.
    - To install, tighten to 11 Nm (97 lb-in).

6. Remove the suction accumulator outlet fitting nut.
    - To install, tighten to 8 Nm (71 lb-in).

7. Disconnect the auxiliary evaporator outlet line fitting (if equipped).
    - Discard the O-ring seals.

8. Remove the suction accumulator-to-compressor line.
    - Discard the O-ring seal.

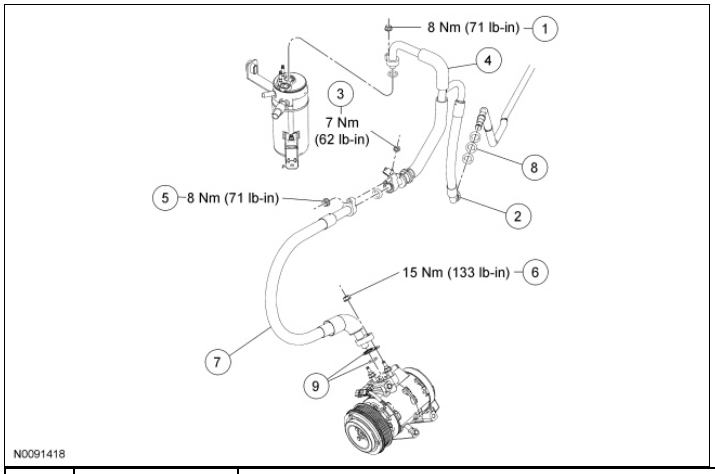
9. To install, reverse the removal procedure.
    - Install new O-ring seals and a new gasket seal.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

10. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Suction Accumulator to Compressor Line - 4.6L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Suction accumulator outlet fitting nut
2	-	Auxiliary evaporator outlet line fitting (part of 19867) (if equipped)
3	W707137	Suction accumulator-to-compressor line bracket nut
4	19867	Rear suction accumulator-to-compressor line
5	W520413	Suction accumulator-to-compressor line middle fitting nut
6	W520413	Compressor suction fitting nut
7	19D742	Front suction accumulator-to-compressor line
8	19E889	O-ring seal (5 required)
9	19B596	O-ring seal and gasket seal kit

Removal and Installation

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Remove the suction accumulator outlet fitting nut.
   - To install, tighten to 8 Nm (71 lb-in).

3. Disconnect the auxiliary evaporator outlet line fitting.
   - Discard the O-ring seals.

4. Remove the suction accumulator-to-compressor line bracket nut.
    - To install, tighten to 7 Nm (62 lb-in).

5. Remove the suction accumulator-to-compressor line middle fitting nut and disconnect the fitting.
    - Discard the O-ring seal.
    - To install, tighten to 8 Nm (71 lb-in).

6. Remove the rear suction accumulator-to-compressor line.
    - Discard the O-ring seal.

7. **NOTE:** The compressor suction fitting nut can be accessed through the RH wheel well.

   Remove the compressor suction fitting nut and disconnect the fitting.

    - Discard the O-ring seal and gasket seal.
    - To install, tighten to 15 Nm (133 lb-in).

8. Remove the front suction accumulator-to-compressor line.

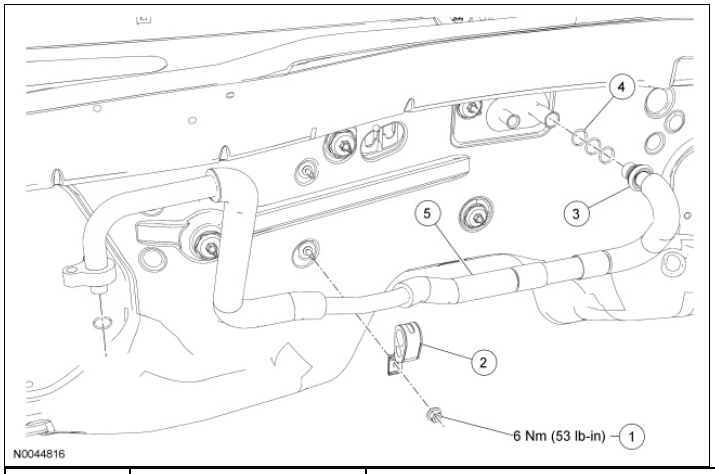
9. To install, reverse the removal procedure.
    - Install new O-ring seals and a new gasket seal.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

10. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Suction Accumulator To Evaporator Line

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W705760	A/C line bracket nut
2	19812	A/C line bracket
3	-	Evaporator outlet fitting (part of 19835)
4	19E889	O-ring seal (4 required)
5	19835	Suction accumulator-to-evaporator line

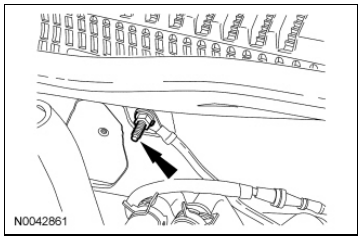
Removal and Installation

All vehicles

1. Remove the suction accumulator. For additional information, refer to Suction Accumulator in this section.

2. Remove the A/C line bracket nut at the dash panel and remove the A/C line bracket.
   - To install, tighten to 6 Nm (53 lb-in).

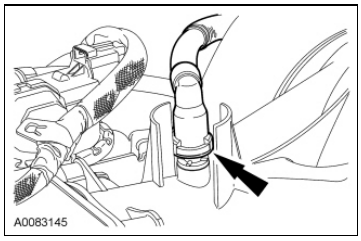
3. Remove the ground strap bolt at the dash panel.



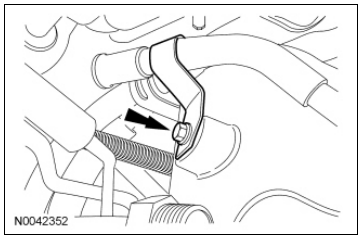
4. Disconnect the evaporator outlet fitting.
    - Discard the O-ring seals.

Vehicles with 4.0L engine

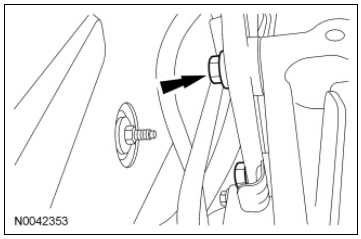
5. Disconnect the Evaporative Emission (EVAP) return line fitting at the intake manifold.



6. Remove the fuel line bracket bolt at the rear of the RH valve cover.



7. Remove the wire harness bolt at the rear of the RH cylinder head.

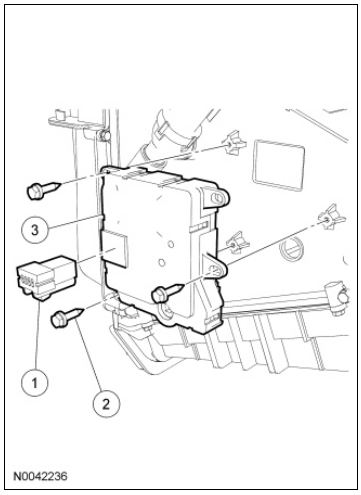


All vehicles

8. Remove the suction accumulator-to-evaporator line.

9. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

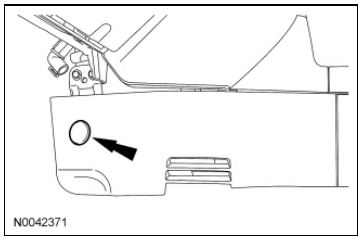
Temperature Blend Door Actuator - LH



Item	Part Number	Description
1	-	LH temperature blend door actuator electrical connector (part of 14401)
2	W701696	LH temperature blend door actuator screw (3 required)
3	19E616	LH temperature blend door actuator

Removal and Installation

1. Remove the LH floor console finish panel.



2. Position the in-vehicle temperature sensor aspirator hose away from the LH temperature blend door actuator.

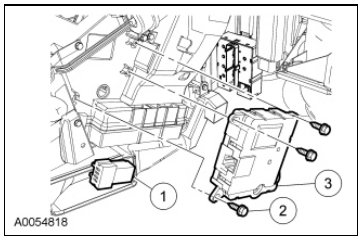
3. Remove the 3 LH temperature blend door actuator screws.

4. Disconnect the LH temperature blend door actuator electrical connector.

5. Remove the LH temperature blend door actuator.

6. To install, reverse the removal procedure.

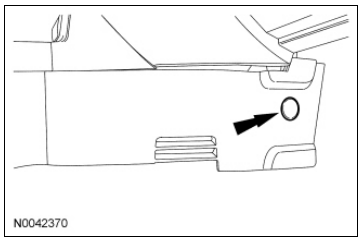
Temperature Blend Door Actuator - RH, EATC



Item	Part Number	Description
1	-	RH temperature blend door actuator electrical connector (part of 14401)
2	W701696	RH temperature blend door actuator screw (3 required)
3	19E616	RH temperature blend door actuator

Removal and Installation

1. Remove the RH floor console finish panel.

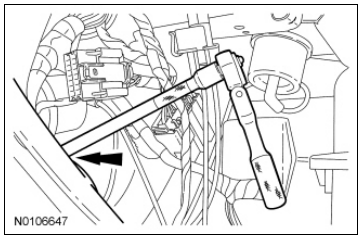


2. Lower the glove compartment.

3. Disconnect the RH temperature blend door actuator electrical connector.

4. **NOTE:** The upper RH temperature blend door actuator screw can be removed using a shallow 1/4-inch drive swivel-type socket and extension.

   Working through the glove compartment opening, remove the upper RH temperature blend door actuator screw.

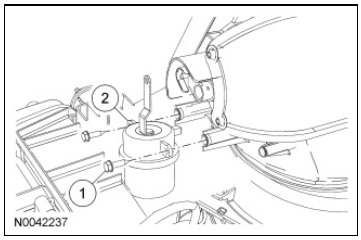


5. Remove the 2 remaining RH temperature blend door actuator screws.

6. Remove the RH temperature blend door actuator.

7. To install, reverse the removal procedure.

Vacuum Control Motor - Air Inlet Door

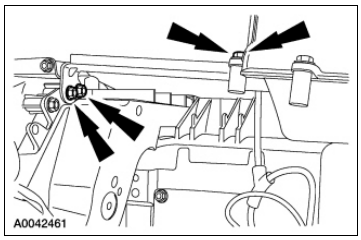


Item	Part Number	Description
1	W701696	Air inlet door vacuum control motor screw (2 required)
2	18A318	Air inlet door vacuum control motor

Removal and Installation

1. Lower the glove compartment.

2. Remove the screws and the heater core and evaporator core housing support brace.



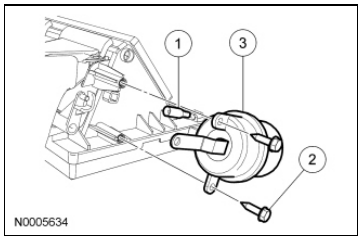
3. Disconnect the air inlet door vacuum control motor vacuum connector.

4. Remove the 2 air inlet door vacuum control motor screws.

5. Rotate the air inlet door vacuum control motor until it clears the retaining arm and remove the vacuum control motor.

6. To install, reverse the removal procedure.

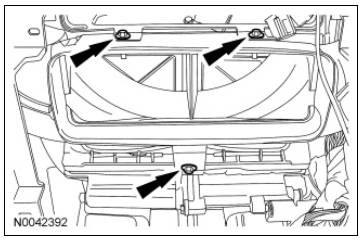
Vacuum Control Motor - Defroster Door



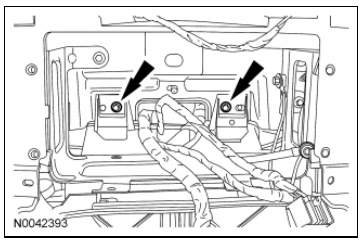
Item	Part Number	Description
1	-	Defrost door vacuum control motor vacuum connector (part of 19C827)
2	W701696	Defrost door vacuum control motor screw (2 required)
3	18A318	Defrost door vacuum control motor

Removal and Installation

1. Remove the Audio Control Module (ACM). For additional information, refer to Section 415-00 .
2. Remove the lower steering column cover. For additional information, refer to Section 501-12 .
3. Remove the 3 center panel duct screws and position the center panel duct aside.



4. Remove the 2 plenum chamber screws.

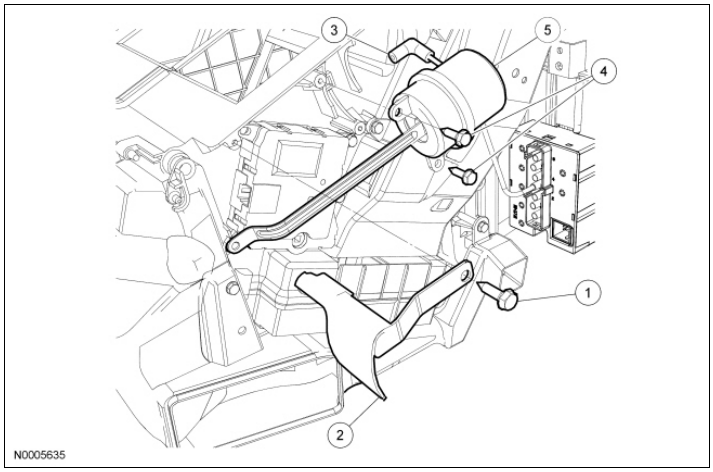


5. Disconnect the defrost door vacuum control motor vacuum connector.
6. Remove the 2 defrost door vacuum control motor screws.
7. **NOTE:** The plenum chamber must be slightly repositioned to allow the defrost door vacuum control motor to be rotated far enough to clear the retaining arm.

Rotate the defrost door vacuum control motor until it clears the retaining arm and remove the defrost door vacuum control motor.

8. To install, reverse the removal procedure.

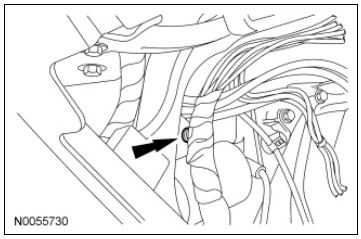
Vacuum Control Motor - Floor Door



Item	Part Number	Description
1	W701696	Shield screw
2	19A804	Shield
3	-	Floor door vacuum control motor vacuum connector (part of 18C581)
4	W701696	Floor door vacuum control motor screws (2 required)
5	18A318	Floor door vacuum control motor

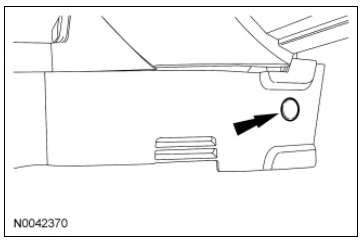
Removal and Installation

1. Remove the center instrument panel finish panel. For additional information, refer to Section 501-12 .
2. Remove the shield screw.
3. Remove the shield.
4. Lower the glove compartment.
5. Disconnect the floor door vacuum control motor vacuum connector.
6. Detach the instrument panel harness pin-type retainer and position the harness aside.



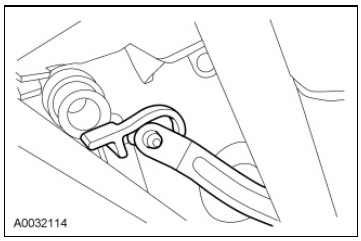
7. Remove the 2 floor door vacuum control motor screws.

8. Remove the RH floor console finish panel.



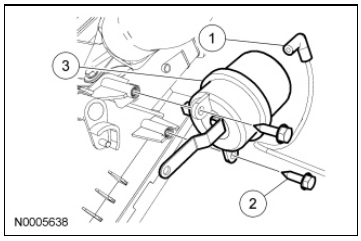
9. **NOTE:** The retaining arm must be slightly deflected away from the vacuum control motor arm to provide clearance.

   Partially actuate and rotate the floor door vacuum control motor until it clears the retaining arm and remove the vacuum control motor.



10. To install, reverse the removal procedure.

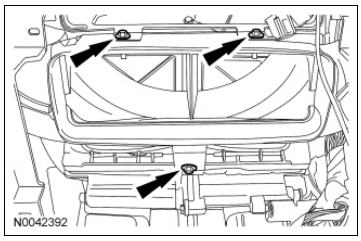
Vacuum Control Motor - Panel Door



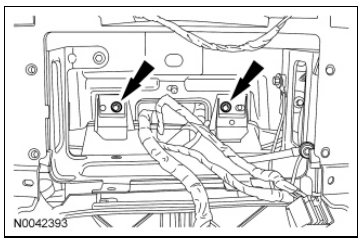
Item	Part Number	Description
1	-	Panel door vacuum control motor vacuum connector (part of 19C827)
2	W701696	Panel door vacuum control motor screw (2 required)
3	18A318	Panel door vacuum control motor

Removal and Installation

1. Remove the Audio Control Module (ACM). For additional information, refer to Section 415-00 .
2. Lower the glove compartment.
3. Remove the 3 center panel duct screws and position the center panel duct aside.



4. Remove the 2 plenum chamber screws.

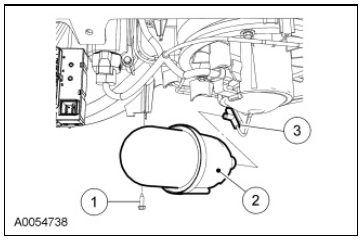


5. Disconnect the panel door vacuum control motor vacuum connector.
6. Remove the 2 panel door vacuum control motor screws.
7. **NOTE:** The plenum chamber must be slightly repositioned to allow the panel door vacuum control motor to be rotated far enough to clear the retaining arm.

Rotate the panel door vacuum control motor until it clears the retaining arm and remove the panel door vacuum control motor.

8. To install, reverse the removal procedure.

Vacuum Reservoir



Item	Part Number	Description
1	W701696	Vacuum reservoir screw
2	19A566	Vacuum reservoir
3	-	Vacuum connector (part of 18C581)

Removal and Installation

1. Remove the vacuum reservoir screw.
2. Remove the vacuum reservoir.
3. Disconnect the vacuum connector.
4. To install, reverse the removal procedure.

Material

Item	Specification	Fill Capacity
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	47 ml (16 fl oz) (with auxiliary climate control)

Torque Specifications

Description	Nm	lb-ft	lb-in
Auxiliary evaporator line fitting nuts	8	-	71
Auxiliary heater core and evaporator core housing bolts	6	-	53
Auxiliary heater core and evaporator core housing nut	6	-	53
Auxiliary line bracket bolts	6	-	53
Auxiliary line bracket nuts	6	-	53
Auxiliary line floorpan bracket nuts	8	-	71
Thermostatic Expansion Valve (TXV) fittings	23	17	-

Auxiliary Climate Control

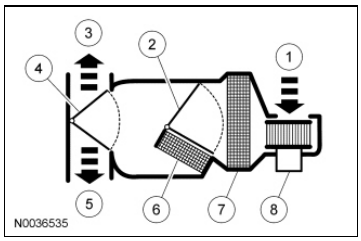
The auxiliary climate control system is a one-piece unit that is located on the LH side of the vehicle between the side windows and the floorpan, behind the rear wheel well. The driver has control of the auxiliary climate control system using the auxiliary climate control assembly.

All of the auxiliary climate control system components are serviceable from the inside of the vehicle except the lines.

Auxiliary System Air Distribution

A vertical air distribution duct supplies air to the integral headliner air distribution duct. Airflow is then directed to the passengers through adjustable registers. The floor duct supplies air to a fixed register which is integral to the side trim panel and directs airflow through the fixed register to the passenger compartment.

System Airflow



Item	Part Number	Description
1	-	Recirc air inlet
2	-	Temperature blend door (part of 18C424)
3	-	Panel headliner airflow
4	-	Mode door (part of 18C424)
5	-	Floor airflow
6	18476	Heater core
7	-	Evaporator core (part of 18C424 assembly)
8	19805	Blower motor

The auxiliary climate control system has the following features:

- The auxiliary blower motor recirculates the air inside the vehicle. Outside air is not available to the auxiliary climate control system.
- Air is cooled and dehumidified by the auxiliary evaporator core only if the instrument panel mounted climate control assembly is adjusted to a position that requires A/C compressor operation.
- The temperature blend door and the air distribution mode door are controlled by electronic actuator motors.
- Movement of the auxiliary temperature control between COOL and WARM causes a corresponding movement of the temperature blend door to direct blower motor airflow through and/or around the auxiliary heater core.
- Toggling of the auxiliary air distribution control between PANEL and FLOOR causes a corresponding movement of the air distribution door to direct airflow between the panel (headliner) registers and the floor duct.

Blower Motor

The auxiliary climate control system contains a blower motor which is controlled by the blower motor switch on the auxiliary climate control assembly. The blower motor is located on the auxiliary heater core and evaporator core housing and can be accessed through an access panel in the LH quarter trim panel.

Control Assembly

The auxiliary climate control assembly consists of temperature, blower speed and air distribution mode. The auxiliary climate control assembly is mounted in the overhead console.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer the heat to air passing through the auxiliary heater core and evaporator core housing. The heater core is located in the auxiliary heater core and evaporator core housing.

Evaporator Core

The evaporator core is an aluminum plate/fin type and is located in the auxiliary heater core and evaporator core housing. A mixture of refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube and then moves out of the evaporator core through the evaporator core outlet tube as a vapor. When the A/C compressor is operating, air from the blower motor is cooled and dehumidified as it flows through the evaporator core fins.

The evaporator core is located in the auxiliary heater core and evaporator core housing.

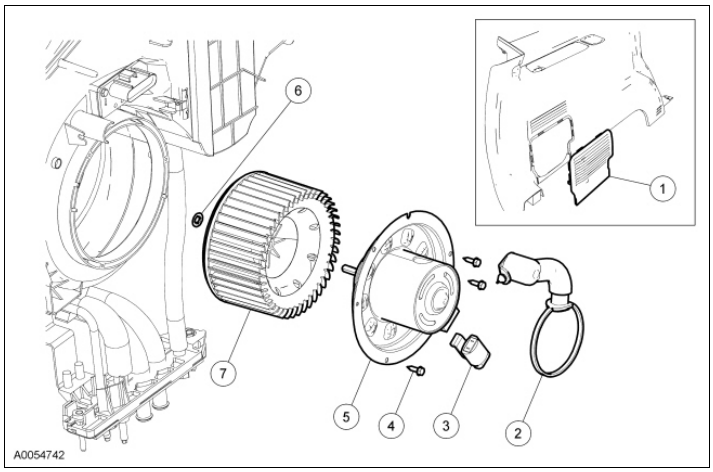
Thermostatic Expansion Valve

NOTE: An in-line filter is installed in the auxiliary evaporator inlet line at the floorpan bracket connection. A restriction in this filter may cause misdiagnosis of a failed Thermostatic Expansion Valve (TXV). This filter must be inspected before a new TXV is installed.

The TXV restricts the flow of refrigerant from the high pressure side of the refrigerant system and separates the low pressure and high pressure sides of the auxiliary refrigerant system. Refrigerant entering the auxiliary evaporator core passes through the TXV . A temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures and increases the amount of refrigerant entering the evaporator core at higher temperatures.

The TXV is mounted to the evaporator core inlet and outlet fittings behind the LH quarter trim panel.

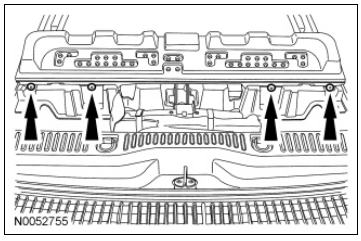
Auxiliary Blower Motor



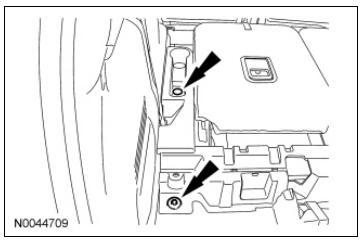
Item	Part Number	Description
1	7831013	Access panel
2	19A786	Vent tube
3	-	Blower motor electrical connector (part of 19D887)
4	W701696	Blower motor screw (3 required)
5	19805	Blower motor
6	18A287	Blower motor wheel retainer
7	18504	Blower motor wheel

Removal and Installation

1. Remove the bolts and the rear cargo management cover.



2. Remove the screw and pin-type retainer and remove the rear cargo management system.

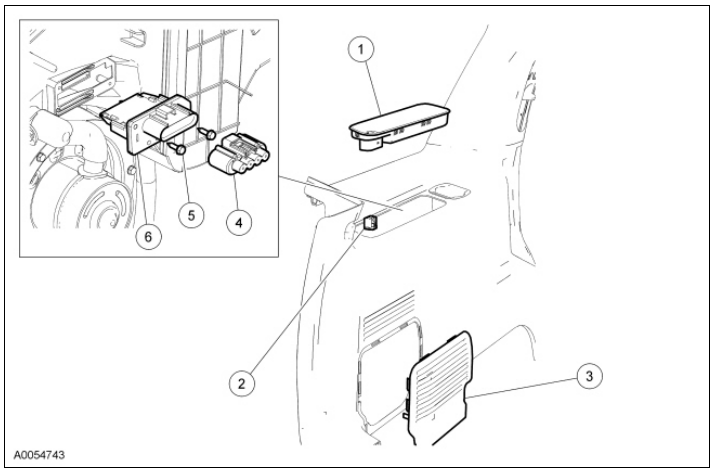


3. Remove the access panel.

4. Remove the vent tube.

5. Disconnect the blower motor electrical connector.
6. Remove the 3 blower motor screws.
7. Remove the blower motor.
8. Remove the blower motor retainer.
9. Remove the blower motor wheel.
10. To install, reverse the removal procedure.

Auxiliary Blower Motor Resistor

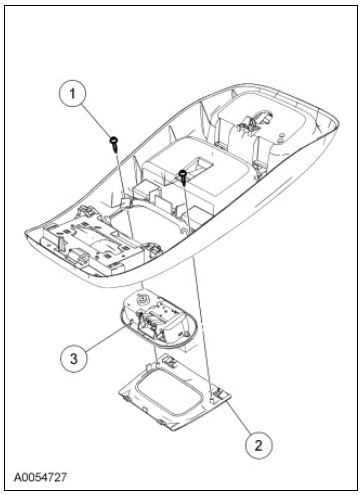


Item	Part Number	Description
1	7831013	Switch bezel
2	-	Power lock switch electrical connector (part of 14A488)
3	7831013	Access panel
4	-	Auxiliary blower motor resistor electrical connector (part of 19D887)
5	W701606	Auxiliary blower motor resistor screw (2 required)
6	19A706	Auxiliary blower motor resistor

Removal and Installation

1. Remove the switch bezel.
2. Disconnect the power lock switch electrical connector.
3. Remove the access panel.
4. Disconnect the auxiliary blower motor resistor electrical connector.
5. Remove the 2 auxiliary blower motor resistor screws.
6. Remove the auxiliary blower motor resistor.
7. To install, reverse the removal procedure.

Auxiliary Climate Control Assembly



Item	Part Number	Description
1	-	Screw (2 required)
2	78519D06	Bezel
3	19980	Auxiliary climate control assembly

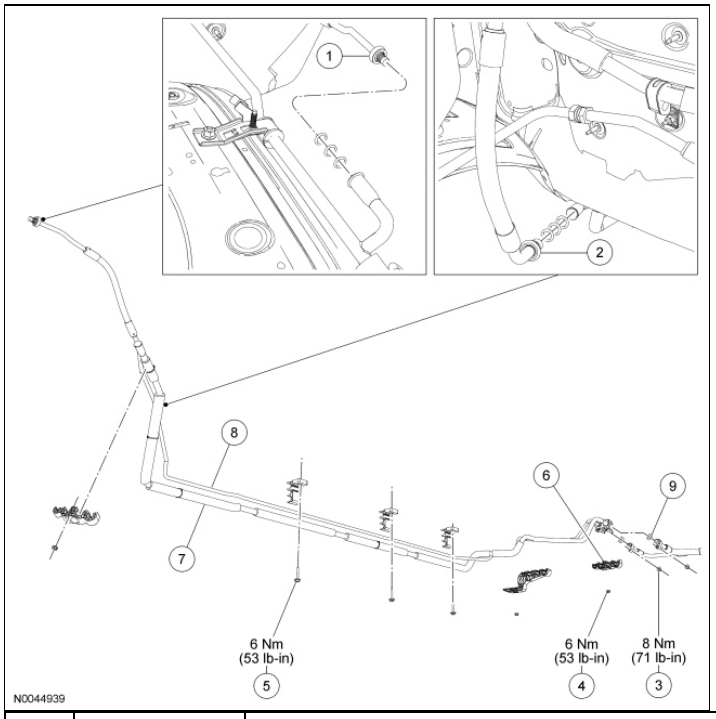
Removal and Installation

1. Remove the overhead console. For additional information, refer to Section 501-12 .
2. Remove the 2 screws.
3. Remove the bezel.
4. Remove the auxiliary climate control assembly.
5. To install, reverse the removal procedure.

Auxiliary Evaporator Outlet and Inlet Line - Front

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	-	Front auxiliary evaporator inlet line front fitting (part of 19835)
2	-	Front auxiliary evaporator outlet line front fitting (part of 19867)
3	W520413	Front auxiliary evaporator line fitting nut (2 required)
4	W520512	Auxiliary line bracket nut (3 required)
5	W505426	Auxiliary line bracket bolt (3 required)
6	18N332	Auxiliary line bracket (6 required) (3 types)
7	19867	Front auxiliary evaporator outlet line
8	19835	Front auxiliary evaporator inlet line
9	19E889	O-ring

Removal and Installation

1. Recover the refrigerant. For additional information, refer to Section 412-00 .

2. Disconnect the front auxiliary evaporator inlet line front fitting.
    - Discard the O-ring seals.

3. Remove the RH running board. For additional information, refer to Section 501-08 .

4. Disconnect the front auxiliary evaporator outlet line front fitting.

5. Remove the RH rear wheel.

6. Remove the front auxiliary evaporator line fitting nuts and disconnect the fittings.
    - Discard the O-ring seals.
    - To install, tighten to 8 Nm (71 lb-in).

7. Remove the 3 auxiliary line bracket nuts.
    - To install, tighten to 6 Nm (53 lb-in).

8. Remove the 3 auxiliary line bracket bolts.
    - To install, tighten to 6 Nm (53 lb-in).

9. Remove the 6 auxiliary line brackets.

10. Remove the front auxiliary evaporator outlet and inlet lines.

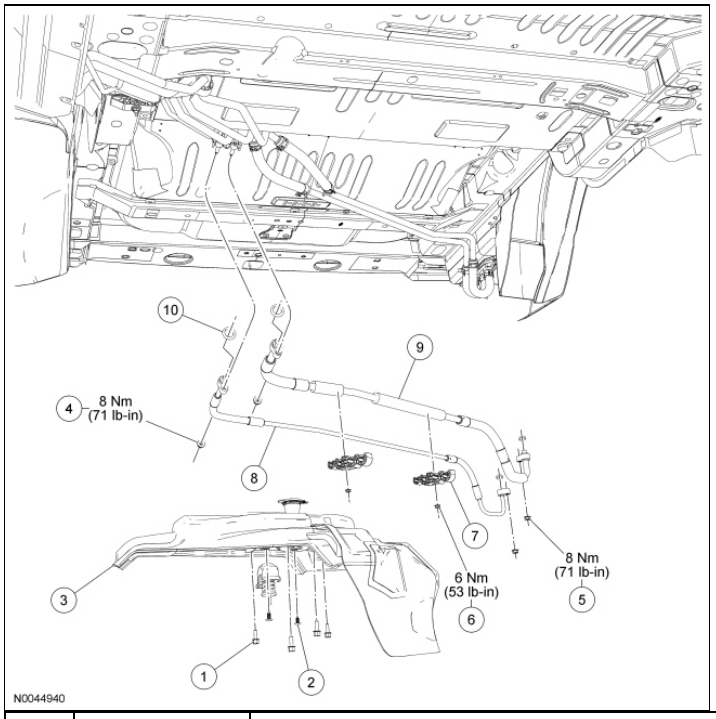
11. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

12. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Auxiliary Evaporator Outlet and Inlet Line - Rear

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W500624	Spare tire carrier bolt (4 required)
2	-	Spare tire carrier shield pin-type retainer
3	1K353	Spare tire carrier
4	W520413	Rear auxiliary evaporator line front fitting nut (2 required)
5	W520413	Rear auxiliary evaporator line rear fitting nut (2 required)
6	W520512	Auxiliary line bracket nut (2 required)
7	18N332	Auxiliary line bracket (2 required)
8	19835	Rear auxiliary evaporator inlet line
9	19867	Rear auxiliary evaporator outlet line
10	19E889	O-ring seal (4 required)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Remove the spare tire.

4. Remove the 4 spare tire carrier bolts and the 2 spare tire carrier shield pin-type retainers.

5. Remove the spare tire carrier.

6. Remove the 2 rear auxiliary evaporator line front fitting nuts and disconnect the fittings.
   - Discard the O-ring seals.
   - To install, tighten to 8 Nm (71 lb-in).

7. Remove the 2 rear auxiliary evaporator line rear fitting nuts and disconnect the fittings.
   - Discard the O-ring seals.
   - To install, tighten to 8 Nm (71 lb-in).

8. Remove the auxiliary line bracket nut.
   - To install, tighten to 6 Nm (53 lb-in).

9. Remove the 2 auxiliary line brackets.

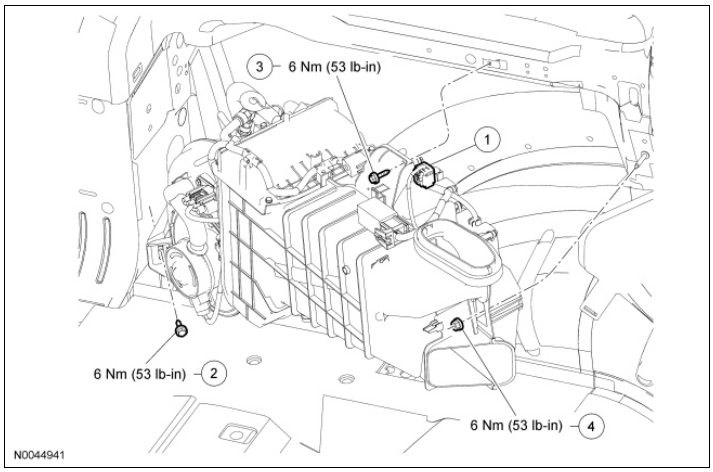
10. Remove the rear auxiliary evaporator outlet line.

11. Remove the rear auxiliary evaporator inlet line.
    - Discard the Thermostatic Expansion Valve (TXV) filter.

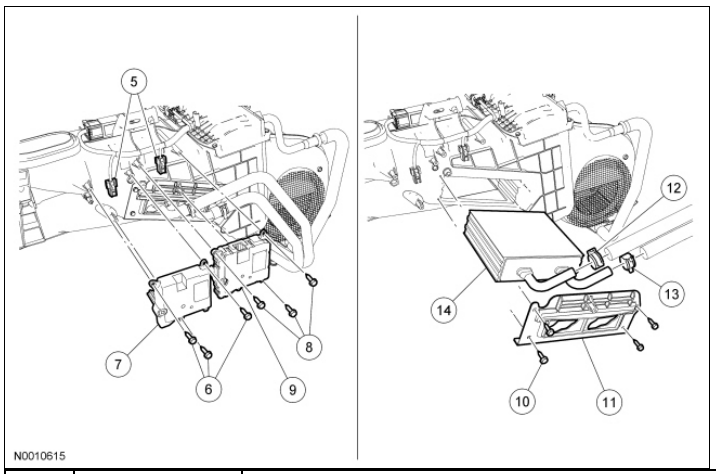
12. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Install a new TXV filter.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

13. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Auxiliary Heater Core



Item	Part Number	Description
1	-	Auxiliary harness electrical connector (part of 14A488)
2	W705549	Auxiliary heater core and evaporator core housing bolt
3	W705549	Auxiliary heater core and evaporator core housing bolt
4	W705277	Auxiliary heater core and evaporator core housing nut



Item	Part Number	Description
5	-	Auxiliary actuator electrical connectors (2 required) (part of 19D887)
6	W701696	Auxiliary mode door actuator screws (3 required)
7	19E616	Auxiliary mode door actuator
8	W701696	Auxiliary temperature blend door actuator screws (3 required)
9	19E616	Auxiliary temperature blend door actuator
10	W701696	Heater core cover screw (4 required)

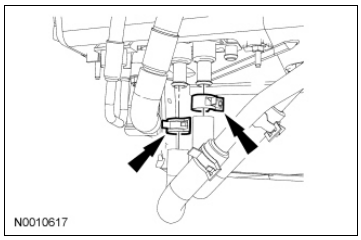
11	18N276	Heater core cover
12	8287	Heater core hose clamp
13	8287	Heater core hose clamp
14	18476	Auxiliary heater core

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

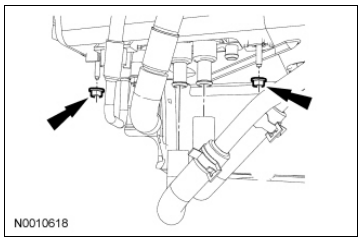
2. Drain the engine coolant. For additional information, refer to Section 303-03 .

3. Release the 2 heater hose clamps and disconnect the heater hoses.



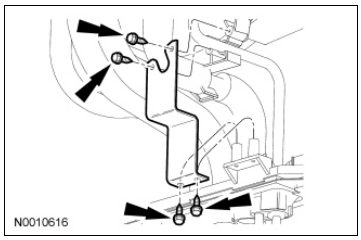
4. Remove the rear quarter trim panel. For additional information, refer to Section 501-05 .

5. Remove the 2 auxiliary line floorpan bracket nuts.



6. **NOTE:** The screw and line bracket are located inside the vehicle above the floorpan line bracket.

   Remove the 4 line bracket screws and the line bracket.



7. Disconnect the auxiliary harness electrical connector.

8. Remove the 2 auxiliary heater core and evaporator core housing bolts and auxiliary heater core and evaporator core housing nut.
   - To install, tighten to 6 Nm (53 lb-in).

9. Disconnect the 2 auxiliary actuator electrical connectors.

10. Remove the 3 auxiliary mode door actuator screws.

11. Remove the auxiliary mode door actuator.

12. Remove the 3 auxiliary temperature blend door actuator screws.

13. Remove the auxiliary temperature blend door actuator.

14. Remove the 4 heater core cover screws.

15. Remove the heater core cover.

16. Disconnect the 2 heater core hose clamps.

17. Remove the auxiliary heater core.

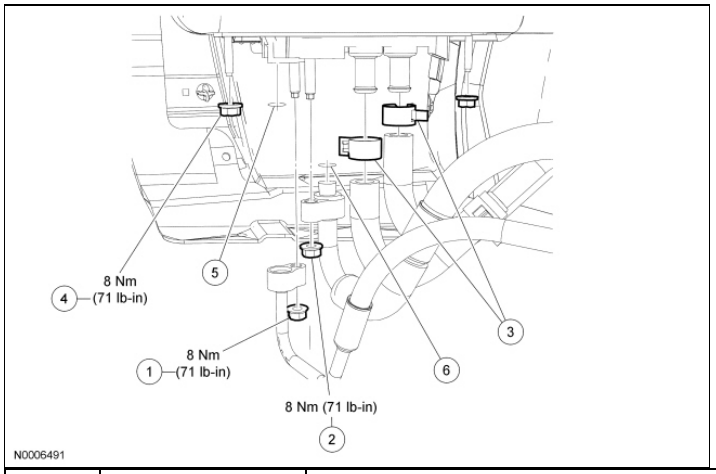
18. To install, reverse the removal procedure.
    - Lubricate the coolant hoses with plain water only if needed.

19. Fill the engine cooling system. For additional information, refer to Section 303-03 .

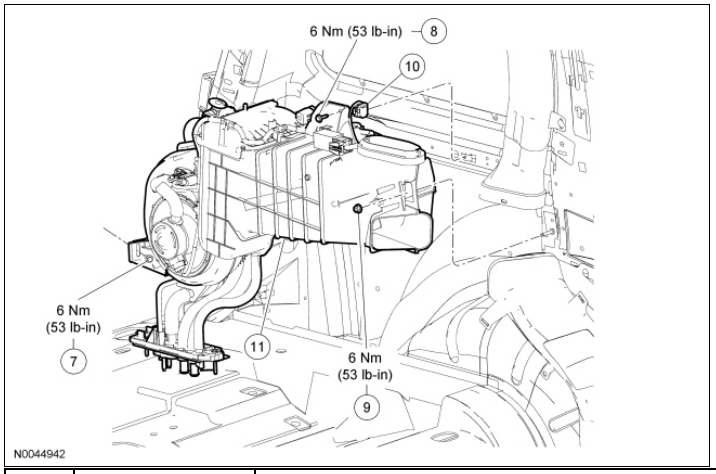
Auxiliary Heater Core and Evaporator Core Housing

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B



Item	Part Number	Description
1	W520413	Auxiliary evaporator inlet line fitting nut
2	W520413	Auxiliary evaporator outlet line fitting nut
3	8287	Heater hose clamps (2 required)
4	N807609	Auxiliary line floorpan bracket nut (2 required)
5	19E889	O-ring
6	19E889	O-ring



Item	Part Number	Description

7	W705549-S	Auxiliary heater core and evaporator core housing bolt
8	W705549-S	Auxiliary heater core and evaporator core housing bolt
9	W705277	Auxiliary heater core and evaporator core housing nut
10	-	Auxiliary harness electrical connector (part of 14335)
11	18C424	Auxiliary heater core and evaporator core housing

Removal and Installation

NOTE: Clean and lubricate the coolant hoses with plain water only if needed.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Recover the refrigerant. For additional information, refer to Section 412-00 .

3. Drain the engine coolant. For additional information, refer to Section 303-03 .

4. Remove the LH quarter trim panel. For additional information, refer to Section 501-05 .

5. Detach the headliner duct from the auxiliary climate control housing.

6. Remove the auxiliary evaporator inlet and outlet line fitting nuts.
   - Discard the O-ring seals.
   - Discard the Thermostatic Expansion Valve (TXV) filter.
   - To install, tighten to 8 Nm (71 lb-in).

7. Release the heater hose clamps and disconnect the heater hoses.
   - After disconnecting the heater hoses, allow any residual coolant to drain from the auxiliary heater core to avoid coolant spilling inside the passenger compartment.

8. Remove the 2 auxiliary line floorpan bracket nuts.
   - To install, tighten to 8 Nm (71 lb-in).

9. Remove the 2 auxiliary heater core and evaporator core housing bolts.
   - To install, tighten to 6 Nm (53 lb-in).

10. Remove the auxiliary heater core and evaporator core housing nut.
    - To install, tighten to 6 Nm (53 lb-in).

11. Disconnect the auxiliary harness electrical connector.

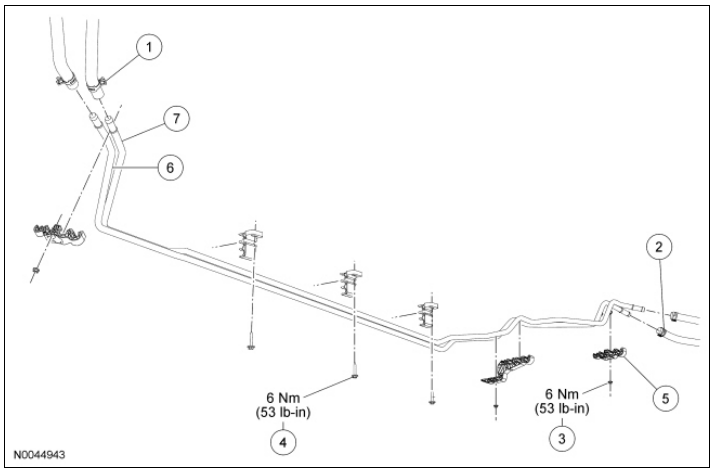
12. Remove the auxiliary heater core and evaporator core housing.

13. To install, reverse the removal procedure.
    - Clean and lubricate the coolant hoses with plain water only if needed.
    - Install new O-ring seals.
    - Install a new TXV filter.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

14. Fill the engine cooling system. For additional information, refer to Section 303-03 .

15. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Auxiliary Heater Outlet and Inlet Line - Front



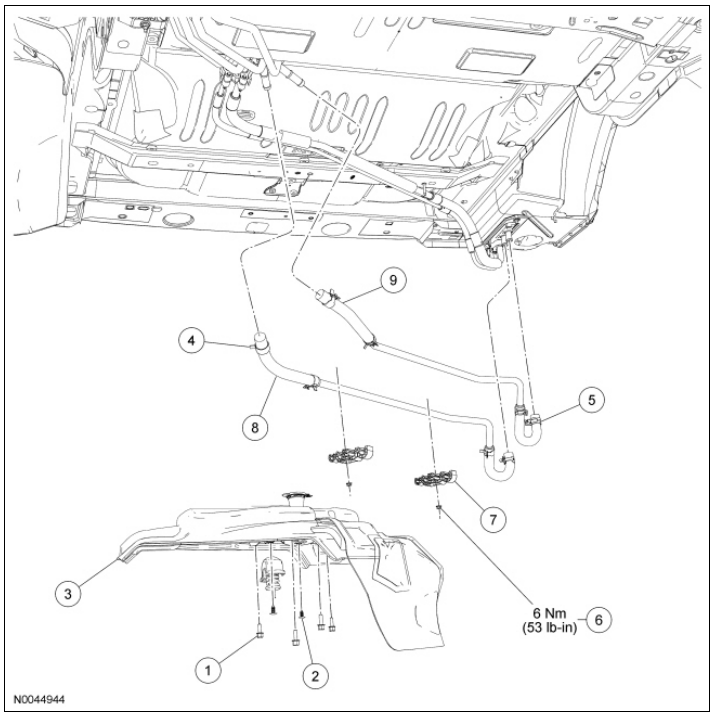
Item	Part Number	Description
1	8287	Front auxiliary heater line front clamp (2 required)
2	8287	Front auxiliary heater line rear clamp (2 required)
3	W520512	Auxiliary line bracket nut (3 required)
4	W505426	Auxiliary line bracket bolt (3 required)
5	18N332	Auxiliary line bracket (6 required) (3 types)
6	18663	Front auxiliary heater outlet line
7	18696	Front auxiliary heater inlet line

Removal and Installation

1. Remove the RH running board. For additional information, refer to Section 501-08 .
2. Drain the engine coolant. For additional information, refer to Section 303-03 .
3. Remove the RH rear wheel.
4. Release the front auxiliary heater line front clamps and disconnect the heater hoses.
5. Release the front auxiliary heater line rear clamps and disconnect the heater hoses.
6. Remove the 3 auxiliary line bracket nuts.
   - To install, tighten to 6 Nm (53 lb-in).
7. Remove the 3 auxiliary line bracket bolts.
   - To install, tighten to 6 Nm (53 lb-in).
8. Remove the 6 auxiliary line brackets.
9. Remove the front auxiliary heater outlet and inlet lines.
10. To install, reverse the removal procedure.

11. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Auxiliary Heater Outlet and Inlet Line - Rear



Item	Part Number	Description
1	W705195	Spare tire carrier bolt (4 required)
2	-	Spare tire carrier shield pin-type retainer
3	1A131	Spare tire carrier
4	8287	Rear auxiliary heater line front hose clamp (2 required)
5	8287	Rear auxiliary heater line rear hose clamp (2 required)
6	W520512	Auxiliary line bracket nut (2 required)
7	18N332	Auxiliary line bracket (2 required)
8	18696	Rear auxiliary heater inlet line
9	18663	Rear auxiliary heater outlet line

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Drain the engine coolant. For additional information, refer to Section 303-03 .

3. Remove the spare tire.

4. Remove the 4 spare tire carrier bolts and the 2 spare tire carrier shield pin-type retainers.

5. Remove the spare tire carrier.

6. Release the 2 rear auxiliary heater line front hose clamps and disconnect the hoses.

7. Release the 2 rear auxiliary heater line rear hose clamps and disconnect the hoses.

8. Remove the 2 auxiliary line bracket nuts.
   - To install, tighten to 8 Nm (71 lb-in).

9. Remove the 2 auxiliary line brackets.

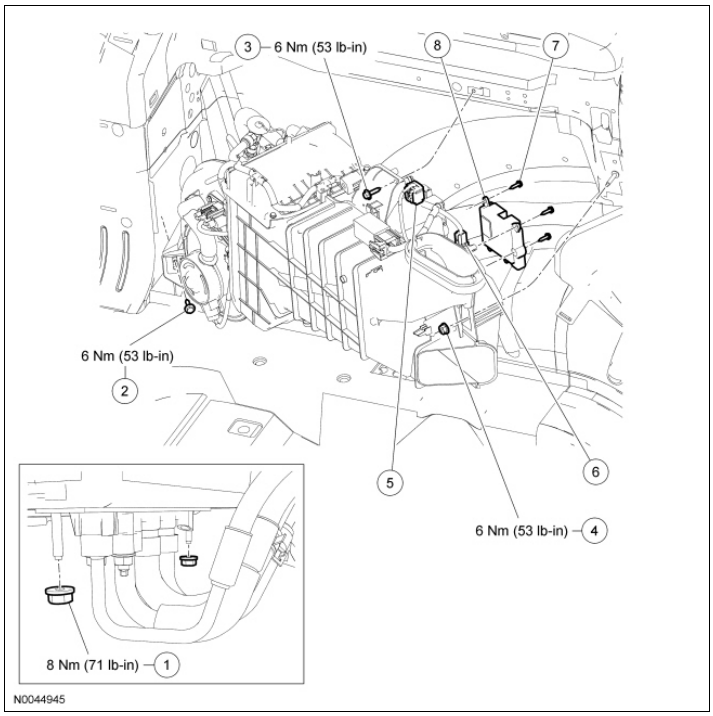
10. Remove the rear auxiliary heater outlet line.

11. Remove the rear auxiliary heater inlet line.

12. To install, reverse the removal procedure.

13. Fill the engine cooling system. For additional information, refer to Section 303-03 .

Auxiliary Mode Door Actuator



Item	Part Number	Description
1	N807609	Auxiliary line floorpan bracket nut (2 required)
2	W705549	Auxiliary heater core and evaporator core housing bolt
3	W705549	Auxiliary heater core and evaporator core housing bolt
4	W705277	Auxiliary heater core and evaporator core housing nut
5	14A488	Auxiliary harness electrical connector
6	-	Auxiliary mode door actuator electrical connector (part of 19D887)
7	W701696	Auxiliary mode door actuator screw (3 required)
8	19E616	Auxiliary mode door actuator

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the LH quarter trim panel. For additional information, refer to Section 501-05 .

3. Remove the 2 auxiliary line floorpan bracket nuts.
   - To install, tighten to 8 Nm (71 lb-in).

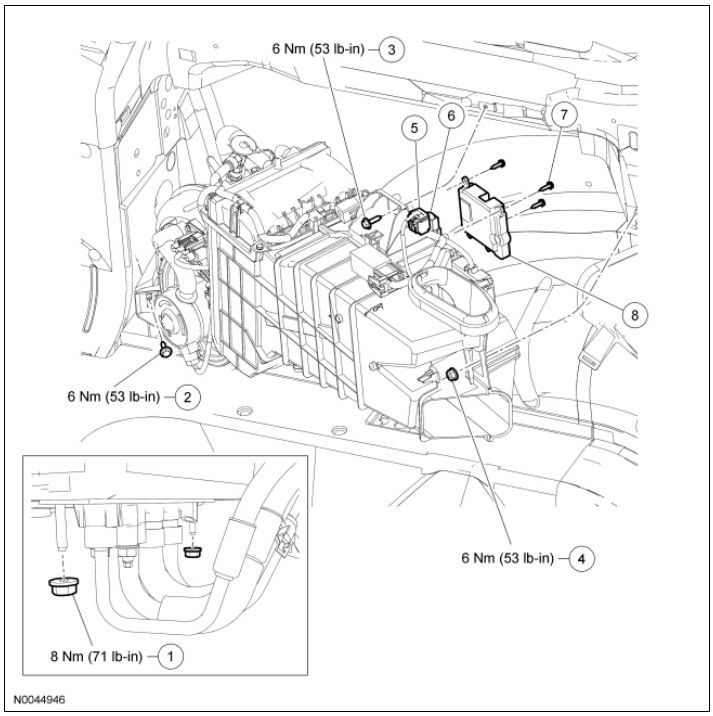
4. Remove the 2 auxiliary heater core and evaporator core housing bolts.
   - To install, tighten to 6 Nm (53 lb-in).

5. Remove the auxiliary heater core and evaporator core housing nut.

- To install, tighten to 6 Nm (53 lb-in).

6. Disconnect the auxiliary harness electrical connector.
7. Disconnect the auxiliary mode door actuator electrical connector.
8. Remove the 3 auxiliary mode door actuator screws.
9. Remove the auxiliary mode door actuator.
10. To install, reverse the removal procedure.

Auxiliary Temperature Blend Door Actuator



Item	Part Number	Description
1	N807609	Auxiliary line floorpan bracket nut (2 required)
2	W705549	Auxiliary heater core and evaporator core housing bolt
3	W705549	Auxiliary heater core and evaporator core housing bolt
4	W705277	Auxiliary heater core and evaporator core housing nut
5	-	Auxiliary harness electrical connector (part of 14A488)
6	-	Auxiliary temperature blend door actuator electrical connector (part of 14A488)
7	W701696	Auxiliary temperature blend door actuator screw (3 required)
8	19E616	Auxiliary temperature blend door actuator

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Remove the LH quarter trim panel. For additional information, refer to Section 501-05 .

3. Remove the 2 auxiliary line floorpan bracket nuts.
   - To install, tighten to 8 Nm (71 lb-in).

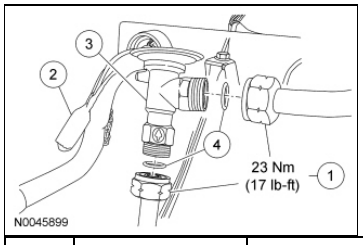
4. Remove the 2 auxiliary heater core and evaporator core housing bolts.
   - To install, tighten to 6 Nm (53 lb-in).

5. Remove auxiliary heater core and evaporator core housing nut.
    - To install, tighten to 6 Nm (53 lb-in).
6. Disconnect the auxiliary harness electrical connector.
7. Disconnect the auxiliary temperature blend door actuator electrical connector.
8. Remove the 3 auxiliary temperature blend door actuator screws.
9. Remove the auxiliary temperature blend door actuator.
10. To install, reverse the removal procedure.

Thermostatic Expansion Valve

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

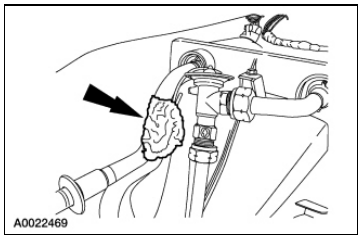


Item	Part Number	Description
1	-	Thermostatic Expansion Valve (TXV) fittings (part of 19849)
2	-	Temperature sensing bulb (part of 19849)
3	19849	TXV
4	19E889	O-ring seals

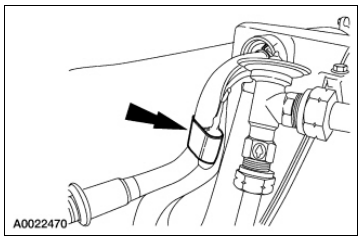
Removal and Installation

NOTE: An in-line filter is installed in the auxiliary evaporator inlet line at the floorpan bracket connection. A restriction in this filter may cause misdiagnosis of a failed Thermostatic Expansion Valve (TXV). This filter must be inspected before a new TXV is installed.

1. Recover the refrigerant. For additional information, refer to Section 412-00 .
2. Remove the D-pillar trim panel. For additional information, refer to Section 501-05 .
3. Detach the rear portion of the LH quarter trim panel and position away from the TXV .
4. Remove the 4 clips and the TXV cover.
5. Remove the insulating tape.
   - Retain the tape for reuse.



6. Remove the temperature sensing bulb clip and detach the temperature sensing bulb from the evaporator outlet line.



7. Disconnect the 2 TXV fittings and remove the TXV .
    - Discard the O-ring seals.
    - To install, tighten to 23 Nm (17 lb-ft).

8. To install, reverse the removal procedure.
    - Install new O-ring seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to Section 412-00 .

9. Evacuate, leak test and charge the refrigerant system. For additional information, refer to Section 412-00 .

Instrument Cluster and Panel Illumination

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The Instrument Cluster (IC) and panel illumination is used to provide backlighting to the instrument panel, switches, and control components when the parking lamps are on, and the ambient light sensor status senses or equals night. The level of intensity is adjustable by rotating the instrument panel dimmer switch either up to increase intensity or down to decrease intensity.

The IC and panel illumination system consists of both dimmable and non-dimmable (fixed) illumination sources. The IC and panel illumination is used to provide backlighting to the instrument panel, switches, and control components when the parking lamps are on.

The dimmable backlighting system provides backlighting to the following components:

- Audio Control Module (ACM)
- Adjustable pedal switch (if equipped)
- Auxiliary climate control (if equipped)
- HVAC module
- Floor shifter
- Four-Wheel Drive (4WD) mode select switch (if equipped)
- Headlamp switch
- Heated seat/windshield switch (if equipped)
- IC
- Message center switch (if equipped)
- Memory set switch (if equipped)
- Traction control switch
- Steering wheel control switches

The fixed backlighting system consists of the following component:

- Window control switches
- Door lock control switches
- Heated mirror switch

Instrument Cluster and Panel Illumination

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

Dimmable Backlighting

When the parking lamps are on, the SJB monitors the input from the instrument panel dimmer switch. The SJB sends a pulse-width modulated voltage to the hardwired dimmable components based on input received from the instrument panel dimmer switch. The SJB also sends a message over the Controller Area Network (CAN) to the Audio Control Module (ACM), and the Instrument Cluster (IC) to indicate the backlighting intensity level.

The ACM and IC default to full nighttime brightness if they do not receive the illumination message.

Fixed Backlighting

When the accessory delay relay is energized, switched voltage is supplied to the non-dimmable components and switches. The window control switches and the door lock control switches are the only non-dimmable components.

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at the time of the fault. The circuit then resets after a customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure can not be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function

returns.

Each circuit has 3 predefined levels of short circuit tolerance established in the module based on each circuits' capability. When the first or second level is reached, the continuous DTC associated with the circuit sets along with DTC B106E. These DTCs may be cleared using the Clear DTC operation on the scan tool as long as the fault itself has been corrected. If any of the circuits are shorted past the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. These DTCs cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the instrument panel illumination system are for the LED backlighting output circuit.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Smart Junction Box (SJB) fuse 23 (15A) • Bulb • Wiring, terminals or connectors • Traction control switch • Memory set switch (if equipped) • Auxiliary climate control (if equipped) • Door lock control switches • Window control switches • Headlamp switch • HVAC module • Audio Control Module (ACM) • Heated seat/windshield switch (if equipped) • Adjustable pedal switch (if equipped) • Four-Wheel Drive (4WD) mode select switch (if equipped) • Message center switch (if equipped) • Steering wheel control switches • Floor shifter • Heated mirror switch • SJB • Instrument Cluster (IC)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B2026	Incandescent Backlighting Output Circuit Failure	If all the hardwired backlighting components are inoperative, GO to Pinpoint Test D . If all the hardwired backlighting components are always on, GO to Pinpoint Test E .
B2027	LED Backlighting Output Circuit Failure	If all the hardwired backlighting components are inoperative, GO to Pinpoint Test D . If all the hardwired backlighting components are always on, GO to Pinpoint Test E .
B2121	Illumination Switch Short To Battery	If the control illumination is inoperative, GO to Pinpoint Test B . If the control illumination does not dim, GO to Pinpoint Test F .
B2132	Dimmer Switch Circuit Short to Gnd	If the control illumination is inoperative, GO to Pinpoint Test B . If the control illumination does not dim, GO to Pinpoint Test F .
	-	

All other DTCs		REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Control Illumination Is Inoperative - All Hardwired Illumination

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

When the parking lamps are on, the Smart Junction Box (SJB) sends a pulse-width modulated voltage to the dimmable illumination sources based on input received from the instrument panel dimmer switch.

This pinpoint test is intended to diagnose the following:

- Fuse
- SJB

PINPOINT TEST A: THE CONTROL ILLUMINATION IS INOPERATIVE - ALL HARDWIRED ILLUMINATION

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 CHECK THE EXTERIOR LAMP OPERATION	
• Place the headlamp switch in the PARKING LAMPS ON position. • **Are the parking lamps illuminated?**	**Yes** VERIFY the SJB fuse 23 (15A) is OK. If OK, GO to A2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. **No** REFER to Section 417-01 .
A2 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern

♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	may have been caused by a loose or corroded connector.

Pinpoint Test B: The Control Illumination Is Inoperative - All Network Controlled And Hardwired Components

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) monitors the input from the instrument panel dimmer switch by sending a voltage reference signal through circuit CLN27 (WH/BN) to the instrument panel dimmer switch. The return signal is sent through circuit CLN17 (BN) back to the SJB . Based on the return signal intensity, the SJB sends a pulse-width modulated voltage signal to the dimmable illumination sources. If the SJB detects a concern with the circuitry to the instrument panel dimmer switch, the SJB defaults the backlighting to a full intensity level.

- DTC B2132 (Dimmer Switch Circuit Short to Gnd) - a continuous and on-demand DTC that may set when the SJB detects a short to ground on the dimmer switch input circuit.

This pinpoint test is intended to diagnose the following:

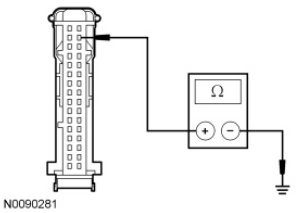
- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST B: THE CONTROL ILLUMINATION IS INOPERATIVE - ALL NETWORK CONTROLLED AND HARDWIRED COMPONENTS

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
B1 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Ignition OFF. • Disconnect: Instrument Panel Dimmer Switch C2298. • Carry out the instrument panel dimmer switch component test.	**Yes** GO to B2 . **No** INSTALL a new instrument panel dimmer switch. REFER to Instrument Panel Dimmer Switch in this section. TEST the system for normal operation.

Refer to Wiring Diagrams Cell 149 for component testing. • **Is the instrument panel dimmer switch OK?**	
B2 CHECK CIRCUIT CLN27 (WH/BN) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280d. • Measure the resistance between the SJB C2280d-18, circuit CLN27 (WH/BN), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B3 . **No** REPAIR the circuit. TEST the system for normal operation.
B3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: The Steering Wheel Control Illumination Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a pulse-width modulated voltage to the steering wheel controls through circuit CLN04 (BU/BN) to the clockspring. The voltage passes through the clockspring to the steering wheel harness and on to the steering wheel control switches. Ground is supplied through the clockspring on circuit GD143 (BK/VT).

This pinpoint test is intended to diagnose the following:

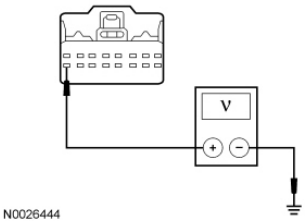
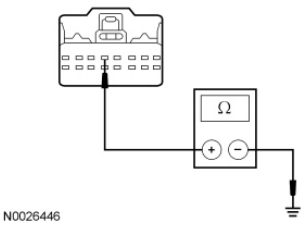
- Wiring, terminals or connectors
- Steering wheel harness
- Steering wheel control switch

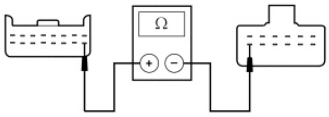
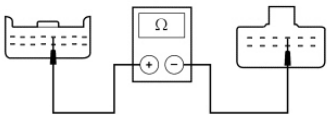
- Clockspring

PINPOINT TEST C: THE STEERING WHEEL CONTROL ILLUMINATION IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
C1 CHECK CIRCUIT CLN04 (BU/BN) FOR AN OPEN	
• Ignition OFF. • Depower the Supplemental Restraint System (SRS). Refer to Section 501-20B . • Disconnect: Clockspring C218a. • Connect: Negative Battery Cable. • Place the headlamp switch in the PARKING LAMPS ON position. • Rotate the instrument panel dimmer switch to the full illumination position. • Measure the voltage between the clockspring C218a-16, circuit CLN04 (BU/BN), harness side and ground.  N0026444 • **Is the voltage great than 10 volts?**	**Yes** TURN the parking lamps off. GO to C2 . **No** REPAIR the circuit. REPOWER the SRS . REFER to Section 501-20B . TEST the system for normal operation.
C2 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the clockspring C218a-5, circuit GD143 (BK/VT), harness side and ground.  N0026446 • **Is the resistance less than 5 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit. REPOWER the SRS . REFER to Section 501-20B . TEST the system for normal operation.

C3 CHECK THE CLOCKSPRING FOR AN OPEN	
• Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring C218b. • Measure the resistance between the clockspring C218a pin 16, component side and the upper clockspring C218b pin 7, component side.  N0069076 • Measure the resistance between the clockspring C218a pin 5, component side and the upper clockspring C218b pin 4, component side.  N0072676 • **Are the resistances less than 5 ohms?**	**Yes** GO to C4 . **No** INSTALL a new clockspring. REFER to Section 501-20B . TEST the system for normal operation.
C4 CHECK THE STEERING WHEEL HARNESS	
• Disconnect: Steering Wheel Control Switch C203 and Audio/Climate Control Switch C2208. • Measure the resistance between the upper clockspring, harness side, and the steering wheel control switch as follows: **Connector-Pin** / **Connector-Pin** / **Circuit** C218b-7 / Speed control switch C203-4 / CLN04 (OG) C218b-7 / Audio/climate control switch C2208-6 / CLN04 (OG) C218b-4 / Speed control switch C203-3 / GD143 (BU) C218b-4 / Audio/climate control switch C2208-1 / GD143 (BU)	**Yes** INSTALL a new steering wheel control switch. REFER to Section 310-03 or Section 415-00 as necessary. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation. **No** REPAIR or INSTALL a new steering wheel harness. INSTALL the driver air bag module. REFER to Section 501-20B . TEST the system for normal operation.

• **Are the resistances less than 5 ohms?**	

Pinpoint Test D: An Individual/More Than One Hardwired Component Illumination Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a pulse-width modulated voltage to the dimmable components through circuit CLN04 (BU/BN). Ground for the illumination source is supplied through circuits GD138 (BK/WH), GD133 (BK), GD151 (BK/GN), GD149 (BK/GY) and GD145 (BK/BU). The SJB also controls the accessory delay relay. The accessory delay relay sends a set voltage to the door lock control switches through circuit CBP05 (YE). The LH door lock control switch is grounded through circuit GD133 (BK). The RH door lock control switch is grounded through circuit GD151 (BK/YE).

- B2026 (Incandescent Backlighting Output Circuit Failure) - a continuous and on-demand DTC that may set if a short to ground is present from the illumination supply circuit.
- B2027 (LED Backlighting Output Circuit Failure) - a continuous and on-demand DTC that may set if a short to ground is present from the illumination supply circuit.

This pinpoint test is intended to diagnose the following:

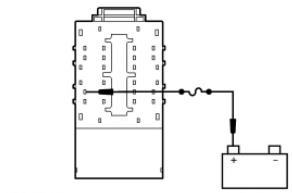
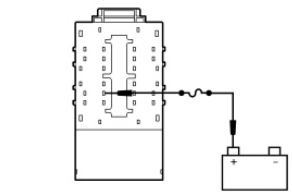
- Wiring, terminals or connectors
- Four-Wheel Drive (4WD) mode select switch
- Memory set switch (if equipped)
- HVAC module
- Heated seat/windshield switch (if equipped)
- Auxiliary climate control switches (if equipped)
- Adjustable pedal switch (if equipped)
- Message center switch (if equipped)
- Traction control switch (if equipped)
- Headlamp switch
- Floor shifter
- Door lock control switch
- Heated mirror switch
- SJB

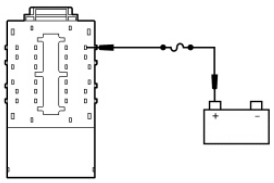
PINPOINT TEST D: AN INDIVIDUAL/MORE THAN ONE HARDWIRED COMPONENT ILLUMINATION IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
D1 CHECK THE ILLUMINATION SOURCE(S) OPERATION	
	Yes For the floor shifter

• Place the headlamp switch in the PARKING LAMPS ON position and turn the dimmer switch to the full illumination position. • **Is only one illumination source inoperative?**	on vehicles without auxiliary climate controls and with automatic temperature control, GO to D2 . For all others, GO to D3 . **No** GO to D2 .
D2 CHECK THE ILLUMINATION OUTPUT FOR A SHORT TO GROUND	
NOTE: If the jumper wire fuse fails, refer to the Wiring Diagrams Manual to identify the possible causes of the circuit short. • Ignition OFF. • Disconnect: SJB C2280a (Door Lock Control Switches). • Disconnect: SJB C2280c (Dimmable Components). • If both door lock control switches are inoperative, connect a fused jumper wire between the SJB C2280a-9, circuit CBP05 (YE), harness side and battery positive.  N0088207 • If the floor shifter is inoperative, connect a fused jumper wire between the SJB C2280c-10, circuit CLN04 (BU/BN), harness side and battery positive.  N0075536 • If all other instrument panel switch illumination is inoperative, connect a fused jumper wire between the SJB C2280c-28, circuit CLN04 (BU/BN), harness side and battery positive.	**Yes** REMOVE the jumper wire. GO to D5 . **No** REMOVE the jumper wire. For the floor shifter on vehicles without auxiliary climate controls and with automatic temperature control, GO to D3 . For all others, REPAIR the circuit in question for an open. TEST the system for normal operation.



N0075537

- **Do the components in question illuminate?**

D3 CHECK THE VOLTAGE TO THE SINGLE ILLUMINATION SOURCE FOR AN OPEN

NOTE: If the headlamp switch is the inoperative source, unplug the headlamp switch connector to measure the illumination circuit voltage. Unplugging the connector causes the SJB to turn the exterior lights on by default for 10 minutes, so it is unnecessary to turn the headlamp switch on.

- Connect: SJB C2280c.
- Ignition OFF.
- Disconnect: Inoperative Illumination Source.
- Place the headlamp switch to the PARKING LAMPS ON position.
- Rotate the instrument panel dimmer switch to the full illumination position.
- Measure the voltage between the inoperative illumination source, harness side and ground as follows:

Component	Connector-Pin	Circuit
4WD mode select switch	C284-1	CLN04 (BU/BN)
Memory set switch	C2094-3	CLN04 (BU/BN)
Heated seat/windshield switch	C2347-1	CLN04 (BU/BN)
HVAC module (automatic climate control)	C228b-16	CLN04 (BU/BN)
HVAC module (manual climate control)	C294c-10	CLN04 (BU/BN)
Auxiliary climate control	C951b-6	CLN04 (BU/BN)
Adjustable pedals switch	C2089-5	CLN04 (BU/BN)
Message center switch	C253-1	CLN04 (BU/BN)
Traction control switch	C280-3	CLN04 (BU/BN)
Headlamp switch	C205-2	CLN04 (BU/BN)
Floor shifter	C2008-7	

Yes
GO to D4 .

No
REPAIR the circuit in question for an open. TEST the system for normal operation.

		CLN04 (BU/BN)
LH door lock control switch	C505-2	CBP05 (YE)
RH door lock control switch	C605-2	CBP05 (YE)
Heated mirror switch	C2382-5	CLN04 (BU/BN)

- **Is the voltage greater than 10 volts?**

D4 CHECK THE GROUND CIRCUIT TO THE SINGLE ILLUMINATION SOURCE FOR AN OPEN

- Place the headlamp switch in the OFF position.
- Disconnect: Negative Battery Cable.
- Measure the resistance between the inoperative illumination source, harness side and ground as follows:

Component	Connector-Pin	Circuit
4WD mode select switch	C284-4	GD138 (BK/WH)
Memory set switch	C2094-4	GD138 (BK/WH)
Heated seat/windshield switch	C2347-6	GD138 (BK/WH)
HVAC module (automatic climate control)	C228a-2	GD145 (BK/BU)
HVAC module (manual climate control)	C294c-6	GD138 (BK/WH)
Auxiliary climate control	C951a-1 C951b-9	GD149 (BK/GY)
Adjustable pedals switch	C2089-4	GD138 (BK/WH)
Message center switch	C253-4	GD138 (BK/WH)
Traction control switch	C280-2	GD138 (BK/WH)
Headlamp switch	C205-1	GD138 (BK/WH)
Floor shifter	C2008-6	GD138 (BK/WH)
LH door lock control switch	C505-4	GD133 (BK)
RH door lock control switch	C605-4	GD151 (BK/GN)
Heated mirror switch	C2382-6	GD138 (BK/WH)

Yes
INSTALL a new component in question. TEST the system for normal operation.

No
REPAIR the ground circuit in question for an open. TEST the system for normal operation.

• **Is the resistance less than 5 ohms?**	
D5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Control Illumination Is Always On - All Hardwired Illumination

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) supplies a pulse-width modulated voltage signal to the dimmable illumination sources on circuit CLN04 (BU/BN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST E: THE CONTROL ILLUMINATION IS ALWAYS ON - ALL HARDWIRED ILLUMINATION

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
E1 CHECK THE EXTERIOR LIGHTING	
• Ignition OFF. • Place the headlamp switch in the OFF position. • Observe the exterior lighting components. • **Are any exterior lighting components illuminated?**	**Yes** REFER to Section 417-01 . **No** GO to E2 .
E2 CHECK THE DIMMABLE LIGHTING OUTPUT FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280c.	**Yes** REPAIR circuit CLN04 (BN/BU) for a short to

• Disconnect: SJB C2280a. • Ignition ON. • **Do any dimmable backlighting components continue to illuminate?**	voltage. TEST the system for normal operation. **No** GO to E3 .
E3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: All Control Illumination Does Not Dim

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) monitors the input from the instrument panel dimmer switch by sending a voltage reference signal through circuit CLN27 (WH/BN) to the instrument panel dimmer switch. The return signal is sent through circuit CLN17 (BN) back to the SJB . Based on the input, the SJB sends a pulse-width modulated voltage signal to the dimmable illumination sources. If the SJB detects a concern with the circuitry to the instrument panel dimmer switch, the SJB defaults the backlighting to a full intensity level.

- DTC B2121 (Illumination Switch Short to Battery) - a continuous and on-demand DTC that may set when the SJB detects an open or short to voltage on the illumination dimmer switch input circuit.
- DTC B2132 (Dimmer Switch Circuit Short to Gnd) - a continuous and on-demand DTC that may set when the SJB detects a short to ground on the dimmer switch input circuit.

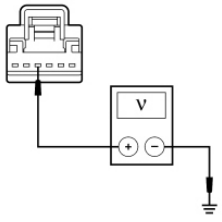
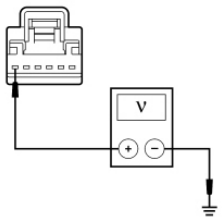
This pinpoint test is intended to diagnose the following:

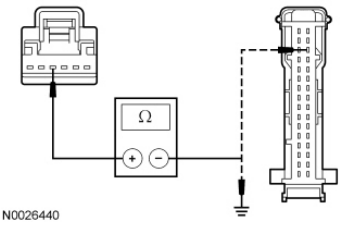
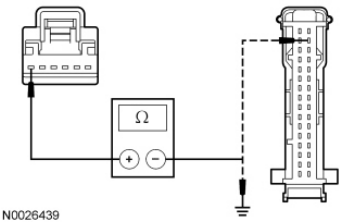
- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST F: ALL CONTROL ILLUMINATION DOES NOT DIM

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
F1 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Ignition OFF. • Disconnect: Instrument Panel Dimmer Switch C2298.	**Yes** GO to F2 .

• Carry out the instrument panel dimmer switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the instrument panel dimmer switch OK?**	**No** INSTALL a new instrument panel dimmer switch. REFER to Instrument Panel Dimmer Switch in this section. TEST the system for normal operation.
F2 CHECK CIRCUIT CLN17 (BN) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280d. • Ignition ON. • Measure the voltage between the instrument panel dimmer switch C2298-4, circuit CLN17 (BN), harness side and ground.  N0026447 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to F3 .
F3 CHECK CIRCUIT CLN27 (WH/BN) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the instrument panel dimmer switch C2298-6, circuit CLN27 (WH/BN), harness side and ground.  N0026448 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to F4 .
F4 CHECK CIRCUIT CLN17 (BN) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the instrument panel dimmer switch C2298-4, circuit CLN17 (BN), harness side and the SJB C2280d-19, circuit CLN17 (BN), harness side; and between the instrument panel dimmer switch C2298-4, circuit CLN17 (BN), harness side and ground.	**Yes** GO to F5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

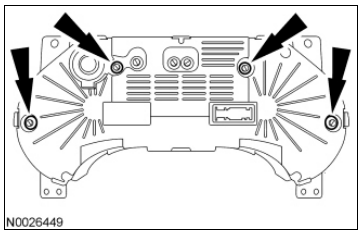
 N0026440 • **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**	
F5 CHECK CIRCUIT CLN27 (WH/BN) FOR AN OPEN OR SHORT TO GROUND	
• Measure the resistance between the instrument panel dimmer switch C2298-6, circuit CLN27 (WH/BN), harness side and the SJB C2280d-18, circuit CLN27 (WH/BN), harness side; and between the instrument panel dimmer switch C2298-6, circuit CLN27 (WH/BN), harness side and ground.  N0026439 • **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**	**Yes** GO to F6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F6 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Instrument Cluster Bulb

1. Remove the Instrument Cluster (IC). For additional information, refer to Section 413-01 .

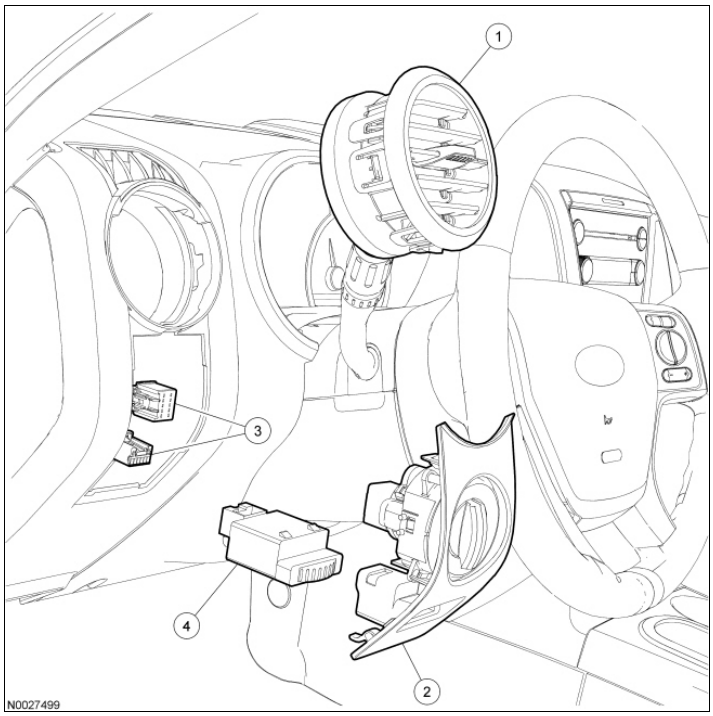
2. **NOTE:** To remove the illumination bulb, rotate the bulb one quarter turn counterclockwise and lift out from the IC .

   Remove the illumination bulb(s).



3. To install, reverse the removal procedure.

Instrument Panel Dimmer Switch



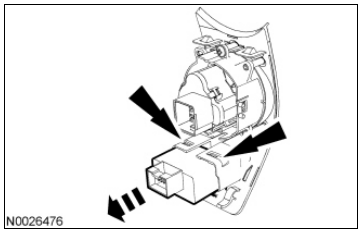
Item	Part Number	Description
1	19893	Driver side register
2	04338	Headlamp switch and bezel
3	-	Headlamp switch electrical connectors (part of 14401)
4	11691	Instrument panel dimmer switch

Removal and Installation

1. Remove the driver side register.

2. Remove the headlamp switch and bezel as an assembly.
   - Disconnect the electrical connectors.

3. Release the 2 tabs and remove the instrument panel dimmer switch.

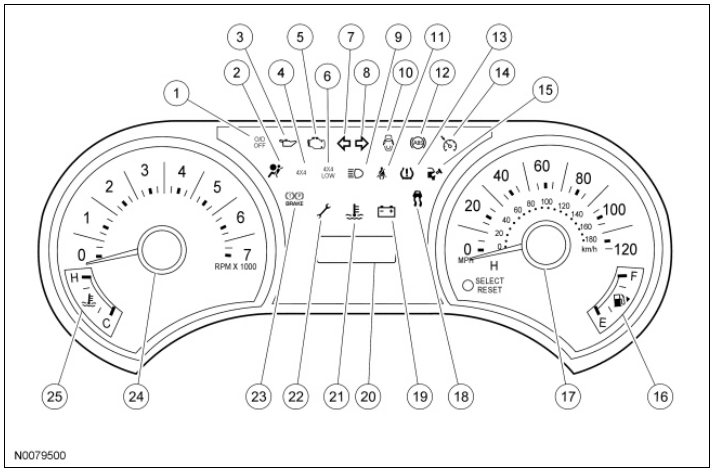


4. To install, reverse the removal procedure.

Instrument Cluster (IC)

NOTE: Base Instrument Cluster (IC) shown, other clusters are similar.

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).



Item	Part Number	Description
1	-	Overdrive (O/D) off indicator
2	-	Air bag warning indicator
3	-	Low engine oil pressure warning indicator
4	-	Four-Wheel Drive (4WD) high indicator
5	-	Malfunction Indicator Lamp (MIL) indicator
6	-	4WD low indicator
7	-	LH turn indicator
8	-	RH turn indicator
9	-	High beam indicator
10	-	Door ajar warning indicator
11	-	Safety belt warning indicator
12	-	ABS warning indicator
13	-	Low Tire Pressure Monitoring System (TPMS) indicator
14	-	Speed control indicator
15	-	Check fuel cap indicator (base IC only)
16	-	Fuel gauge
17	-	Speedometer
18	-	Traction control with Roll Stability Control (RSC®) indicator
19	-	Charging system indicator (base IC only)
20	-	Message center/integrated display
21	-	

		Engine over temperature warning indicator (base IC only)
22	-	Powertrain malfunction (wrench) indicator (base IC only)
23	-	Brake warning indicator
24	-	Tachometer
25	-	Engine coolant temperature gauge

The Instrument Cluster (IC) is available with an integrated Liquid Crystal Display (LCD) (base IC) or with a message center (high series IC). Both the base IC and the message center IC contain gauges, indicator lamps, and warning lamps that are designed to provide the driver with a system status and to alert the driver that certain conditions exist in the vehicle. The IC lens and mask assembly, and some of the indicator bulbs are the only parts that may be installed separately.

Gauges

Gauges provide information to the driver indicating the status of systems. The system that use gauges are as follows:

- Engine coolant temperature
- Engine rpm
- Fuel level
- Vehicle speed

Informational Indicators

Informational indicators provide information to the driver of conditions that exist in the vehicle. The informational indicators are grouped into the following system/subsystems:

- Engine/powertrain control
  - ♦ Malfunction Indicator Lamp (MIL)
  - ♦ Powertrain malfunction (wrench)
  - ♦ Transmission (overdrive)
  - ♦ Evaporative emission system
- Lighting
  - ♦ High beam
  - ♦ Turn signal
- Vehicle control
  - ♦ Speed control
  - ♦ Traction control
  - ♦ 4WD control

Warning Indicators

Warning indicator lamps provide information to the driver of conditions that could potentially alter vehicle performance. The warning indicators are grouped into the following system/subsystem:

- Engine/powertrain control
  - ♦ Charging system
  - ♦ Low engine oil pressure
  - ♦ Engine over-temperature
- Occupant/drive safety
  - ♦ Door ajar
  - ♦ Safety belt

    - Low Tire Pressure Monitoring System (TPMS)
    - Supplemental Restraint System (SRS) (air bag)
- Vehicle control
    - ABS
    - Brake system

Hardwired Inputs

The hardwired inputs are provided from the following systems or components:

- Engine oil pressure switch
- Fuel level
- Message center switch
- Compass
- Washer fluid level
- Outside air temperature

Network Message Inputs

Module messaging is becoming the standard for sending and receiving information required to operate the IC . For a complete list of module messages with the message origination sources, refer to Section 418-00 .

The status and information message that the IC requires from other vehicle inputs are grouped into the following systems/subsystems:

- ABS
    - Anti-lock braking
    - Traction control
- Base brake system
    - Brake fluid level status
    - Parking brake status
- Lighting system
    - LH/RH turn
    - High beam
- Powertrain
    - Charging
    - Engine rpm
    - Overdrive (O/D) off
    - Engine temperature
    - Evaporative emission system
    - Vehicle speed
    - SRS
    - TPMS
    - 4WD control

Information And Message Center

The message center is a Liquid Crystal Display (LCD), integrated into the Instrument Cluster (IC). The message center functions are controlled by the SELECT/RESET button on base IC , and by the message center switches on high series IC . The base series IC message center has a display format of 2 lines x 12 characters, and the high series IC message center has a display format of 4 lines x 12 characters. The message center displays important vehicle information by constantly monitoring different vehicle systems. The message center notifies the driver of a potential vehicle problem by displaying a warning message pertaining to the system in which a fault has been detected.

The message center information can be selected through the SELECT/RESET button (base instrument cluster [IC]) and by the INFO, SETUP, and RESET buttons (high series IC).

The message center provides the following features:

- Information displays
- Setup displays
- System check messages
- Warning messages

Outside Air Temperature Sensor (IC Without Electronic Automatic Temperature Control (EATC))

The IC receives the outside air temperature data from the outside air temperature sensor. This data is then displayed on the message center. The outside air temperature sensor is located on the radiator core support behind the front grill assembly and is fastened with a pin-type retainer. If equipped with EATC , the outside air temperature data from the outside air temperature sensor is displayed in the HVAC module. Refer to Section 412-00 for the outside air temperature display in the EATC .

Compass

The compass heading is displayed as one of N, NE, E, SE, S, SW, W and NW in the message center display. The compass reading may be affected when you drive near large buildings, bridges, power lines and powerful broadcast antenna. Magnetic or metallic objects placed in, on or near the vehicle may also affect compass accuracy. The compass sensor module is mounted behind the interior rear view mirror.

Message Center Configuration

The message center has the capability of configuring items such as language and display units (English or metric) as well as a variety of systems on/off status such as easy entry (if equipped) or auto locks.

Oil Life and Oil Life Start Value

The oil life is displayed in percentages and is preset to a maximum of approximately 12,000 km (7,500 miles) or 180 days. The oil life start value is used to increase or decrease the starting point of the oil life. The value can be changed back to the maximum of approximately 12,000 km (7,500 miles) if the value was previously changed or to lower the value by 10% increments down to 30%. Each 10% reduction lowers the oil life in both mileage and the days.

For example, if the oil life start value is lowered to 50%, the maximum mileage is 6,000 km (3,750 miles) or 90 days. The oil life remains at the selected setting (50% in this example) until the driver changes the oil life

start value. When the oil life (**not oil life start value**) is reset back to 100% following an oil change, the oil life resets to 6,000 km (3,750 miles). For configuration of the oil life and oil life start value, refer to Message Center Configuration in this section.

Information Displays

Base Instrument Cluster (IC)

The information displays are non-timed modes. The selected mode remains on until the driver presses the SELECT/RESET switch to change the mode, or until it is overridden by another mode. The information display modes are:

- Odometer/trip odometer, compass headings
- Outside air temperature display (if equipped)
- Distance to empty
- Average fuel economy
- Setup menu

High Series Instrument Cluster (IC)

The information displays are non-timed modes. The selected mode remains on until the driver presses a message center switch to change the mode, or until it is overridden by another mode. The information display modes are:

- Odometer/trip odometer, compass headings, outside air temperature display
- Distance to empty
- Average fuel economy
- Instantaneous fuel economy
- Fuel used
- Trip elapsed drive time
- Blank

Setup Displays

Base Instrument Cluster (IC)

The setup displays are timed modes and terminate after a finite interval. Press the SELECT/RESET button to scroll through the SETUP MENU display sequence. If the SELECT/RESET button is not pressed within 4 seconds, the message center returns to the INFO MENU. The setup display modes are:

- System check
- Units (English/metric)
- Language
- Autolamp
- Autolock
- Auto-unlock
- Parking aid (if equipped)
- Oil life reset and start value
- Trailer sway control

High Series Instrument Cluster (IC)

The setup displays are timed modes and terminate after a finite interval. Press the SETUP button for the following displays:

- System check
- Units (English/metric)
- Language
- Autolamp
- Autolock
- Auto-unlock
- Running boards (if equipped)
- Easy entry/exit seat (if equipped)
- Parking aid (if equipped)
- Compass zone
- Compass calibration
- Oil life reset and start value
- Trailer sway control

System Check Displays

Selecting this function from the SETUP MENU causes the message center to cycle through each of the systems being monitored. For each of the monitored systems, the message center indicates either an OK message or a warning message for 2 seconds. For base IC , the SELECT/RESET button must be held down after pressing the SELECT/RESET button to cycle the messages through each of the systems being monitored. For high series IC , pressing the RESET control switch cycles the message center through each of the systems being monitored. The system check report is as follows:

- OIL LIFE
- CHARGING SYSTEM
- WASHER FLUID
- DOOR AJAR
- EXTERIOR LAMPS
- BRAKE FLUID LEVEL
- PARK BRAKE
- FUEL LEVEL AND DISTANCE TO EMPTY (high series IC)
- MILES TO EMPTY (base IC)
- FUEL LEVEL LOW (base IC)

System Warnings

The system warnings alert the operator to possible problems or malfunctions in the vehicle operating systems. The message center displays the last selected feature if there are no more warning messages. This allows the operator full functionality of the message center after acknowledgement of the warning message by pressing the reset button and clearing the message. The warning messages are divided into 4 categories:

- They cannot be cleared until the condition is corrected.
- They reappear on the display 10 minutes from the reset if the condition has not been corrected.
- They do not reappear until an ignition OFF-ON cycle has been completed.
- They reappear if the condition clears then reoccurs within the same ignition ON-OFF cycle.

The warning displays that cannot be reset are:

- DOOR AJAR

The warning messages that reoccur after 10 minutes are:

- FUEL LEVEL LOW
- PARK BRAKE ENGAGED

- CHECK BRAKE SYSTEM

The warning messages that display whenever the ignition switch is turned from the OFF position to the ON position are:

- CHECK PARK AID (if equipped)
- BRAKE FLUID LEVEL LOW
- CHECK HEADLAMP
- CHECK HIGHBEAM
- CHECK TURN LAMP
- WASHER FLUID LOW LEVEL
- OIL CHANGE REQUIRED
- ENGINE OIL CHANGE SOON
- TRAILER SWAY REDUCE SPEED

The warning messages that return after a condition has cleared then reoccurs within the same ignition ON-OFF cycle are:

- LIFTGATE/GLASS AJAR
- CLEAR OBJECTS BY PASS SEAT
- CHECK CHARGING SYSTEM
- LOW TIRE PRESSURE
- TIRE MONITOR FAULT
- TIRE SENSOR FAULT

The message center displays messages that indicate a system state during the operation of the Four-Wheel Drive (4WD) system. The displayed warning messages are as follows:

- FOR 4X4 LOW STOP VEHICLE (if equipped)
- FOR 4X4 LOW SHIFT TO N (if equipped)
- TO EXIT 4X4 LOW STOP VEHICLE (if equipped)
- TO EXIT 4X4 LOW SHIFT TO N (if equipped)

The message center displays messages that indicate a system state during repair procedures related to the tire pressure monitoring system (TPMS). The displayed warning messages are as follows:

- TRAIN TIRES
- TIRES TRAINED
- TIRES NOT TRAINED

The message center displays messages that indicate a system state during repair procedures related to the compass display. The displayed warning messages are as follows:

- COMPASS ZONE XX (base IC)
- RESET FOR ZONE SETTING (high series IC)
- ZONE XX RESET TO CHANGE (high series IC)
- ZONE XX IS SET
- PRESS RESET FOR CALIBRATION (high series IC)
- CIRCLE SLOW TO CALIBRATE (base IC)
- CIRCLE SLOWLY TO CALIBRATE (high series IC)
- CALIBRATION COMPLETED

The message center displays messages that indicate a system state during repair procedures related to the oil life and oil life start value. The displayed warning messages are as follows:

- HOLD RESET IF NEW OIL
- OIL LIFE SET TO 100%
- OIL LIFE START VALUE SET TO XXX% (high series IC)
- OIL LIFE SET TO XXX% (base IC)

Warning Chimes

The warning chime sounds to remind or alert the driver:

- To turn the headlamps off when exiting the vehicle.
- To remove the ignition key when exiting the vehicle.
- To close the doors after starting the vehicle.
- To fasten the safety belt after starting the vehicle.
- To turn off the turn signal.
- To disengage the parking brake.
- That a fault is present in the air bag warning indicator circuit.
- When the message center displays a door ajar, Tire Pressure Monitoring System (TPMS), and/or a low fuel level warning message.

The Instrument Cluster (IC) controls the warning chime function using various inputs to determine when to sound the warning chime. The warning chime sounds:

- If the headlamps are on with the key removed from the ignition lock cylinder and the driver door is ajar.
- If the key is in the ignition lock cylinder in the OFF position and the driver door is ajar.
- If a door is ajar and the ignition key is in the ON position.
- If the safety belts are not fastened and the ignition key is in the ON position.
- If the turn signal is on for more than 3.2 km (2 miles).
- If the parking brake is engaged and the vehicle is moving at a speed higher than 5 km/h (3 mph).
- If the ignition switch is in the ON position, a secondary air bag warning chime request is received from the Restraints Control Module (RCM), and the IC determines a fault is present in the air bag warning indicator.
- When the message center displays a door ajar, TPMS, and/or a low fuel level warning message.

Audible signals are also provided to confirm operation of the following vehicle systems:

- Turn signal
- Hazard signal

Instrumentation, Message Center and Warning Chimes

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST1473-A	Instrument Gauge System Tester 014-R1063 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

NOTE: Whenever a network message is suspected as missing and confirmed by a missing message DTC (U-code), it is important to look for other symptoms that may also be present in the Instrument Cluster (IC) and throughout the vehicle. Once a DTC is set in the IC , it may be helpful to review the complete message list available in Section 418-00 to see what other modules also rely on the same message and run the self-test for those modules. If the message is missing from other modules, the same DTC may also be set in those modules. Confirmation of missing messages common to multiple modules may indicate that the originating module is the source of the concern or the communication network may be experiencing some problems.

The IC utilizes a microprocessor to control the gauge, indicator, message center and warning chime functions. Data is sent to the IC over the High Speed Controller Area Network (HS-CAN), the Medium Speed Controller Area Network (MS-CAN) and through hardwired circuitry from individual components. The IC uses each input to output an action to the gauges or indicators.

The IC uses input messages from other modules to control the gauges, informational indicators, warning indicators and reconfigurable telltale indicators over the communication networks. If a required message is missing or invalid for less than 5 seconds, the gauge or indicator that requires the message remains at the last commanded state based upon the last known good message. For example, if the brake status message is missing for less than 5 seconds and the brake warning indicator was on, the indicator remains in the on state until the next good message is received. If the message remains missing or invalid for greater than 5 seconds, the IC sets a U-code DTC and the output becomes a default action for the indicator or gauge. Each indicator or gauge utilizes a different default strategy depending on the nature of the indication. Refer to the normal operation descriptions located before each individual pinpoint test for a further description of the default action specific to each indicator or gauge. If the messaged input to the IC returns at any time, the normal function of the gauge or indicator resumes.

It is very important to understand:

- where the input originates.
- all the information necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input control the output of the feature, or does it output a message over the communication network to another module.
- which module controls the output of the feature.

Instrument Cluster (IC)

IC Gateway Function

The IC acts as a gateway module by receiving information in one format and transmitting it to other modules using another format. For example, the IC receives the vehicle speed data from the PCM over the HS-CAN , converts the data into a MS-CAN message and sends (gateways) the message to other network modules such as the HVAC module, the Audio Control Module (ACM), and the SJB . This enables network communication between modules that do not communicate using the same network (HS-CAN or the MS-CAN).

IC Configuration

The IC contains items that are configurable. While some configurable items are customer preference items, which are configurable using the scan tool, most items are configured at the end of the line production and only available for configuration using the Programmable Module Installation (PMI) procedures. Refer to PMI in Section 418-01 for module configuration.

NOTE: When installing a new IC , it is necessary to upload the module configuration to the scan tool. Following installation of the IC , download the module configuration from the scan tool into the new IC . Refer to Section 418-01 to carry out PMI . Following installation of a new IC , the IC and the PCM need to be mated. Refer to Section 419-01 to carry out a parameter reset procedure.

The following are the configurable customer preference items:

- Auto lock
- Auto-unlock
- Belt-Minder®
- Language
- Oil life warning threshold

IC Prove-Out

The IC and other vehicle modules carry out a display prove-out to verify that all module controlled warning/indicator lamps and monitored systems are functioning correctly within the IC . When the ignition switch is cycled to the ON position with the engine off, the indicators illuminate to prove-out according the following table:

Indicator	Indicator Type	Prove-Out Duration
Air bag	Warning	6 seconds
ABS	Warning	3 seconds

Brake	Warning	3 seconds
Charge	Informational	Engine start up
Check fuel cap (Sport Trac base IC only)	Informational	3 seconds
Door ajar	Warning	No prove-out
Engine coolant over-temperature	Warning	3 seconds
Four-Wheel Drive (4WD) low	Informational	3 seconds (if equipped)
4WD high	Informational	3 seconds (if equipped)
High beam	Informational	No prove-out
Low engine oil pressure	Warning	Engine startup
Malfunction Indicator Lamp (MIL)	Warning	Engine startup
Overdrive (O/D) off	Informational	No prove-out
Powertrain malfunction (wrench) (base IC)	Informational	3 seconds
RH/LH turn signals	Informational	No prove-out
Safety belt	Warning	60 seconds if the safety belt is unbuckled, turns off when the safety belt is buckled
Speed control	Informational	No prove-out
Traction control/stability assist	Informational	3 seconds
Tire Pressure Monitoring System (TPMS)	Warning	3 seconds

Information And Message Center

The message center is an integral part of the IC that receives and acts upon much of the same information that is input and used to operate the IC gauges, informational indicators, and warning indicators. The message center, located in the center of the IC is a Liquid Crystal Display (LCD). The message center electronic functions use both hardwired and the Controller Area Network (CAN) circuitry to transmit and receive information.

Whenever conditions are present that require a warning message, the message center replaces the last selected display with the new warning display. Once the message is reset or cleared, the message center returns to the last selected display. If multiple warnings are present, the message center displays each warning for approximately 4 seconds. Warning messages are also generally associated with other observable IC indications. For example, when the LH front door is opened, the message center displays the message DRIVER DOOR AJAR along with the door ajar warning indicator. This allows the message center to be a more informative supplement to the IC gauges and indicators.

Trailer Sway Message

The message center provides the trailer sway message to inform the driver that the current traction control event is due to trailer sway. If the ABS module determines that the trailer is causing the vehicle to sway, the traction control/stability assist indicator is turned on along with the TRAILER SWAY REDUCE SPEED message in the message center.

Warning Chimes

The IC uses different chimes to alert the driver of various vehicle conditions as follows:

- Safety belt warning (repetitive chime)
- Belt-Minder® warning (repetitive chime after a delay and after the safety belt chime is completed)
- Key-in-ignition warning (repetitive chime)
- Headlamps on warning (repetitive chime)
- Turn signal on warning (single tone chime after 3.2 km [2 miles])
- Turn signal tone (tick-tock chime)
- Parking brake warning (repetitive chime)
- Air bag secondary warning chime (repetitive chime)
- Message center general tone (single tone)

Safety Belt Warning Chime

The safety belt warning chime warns that the safety belt is not fastened. The safety belt warning chime sounds when the driver safety belt is not fastened and the ignition key is turned from the OFF/LOCK or ACC to the RUN or START position.

The safety belt warning chime stops sounding when the safety belt is fastened, when the ignition key is turned from the RUN or START position to the OFF/LOCK or ACC position, or when the chime has sounded for approximately 6 seconds.

The safety belt warning chime inputs are the:

- Ignition switch RUN/START status
- Driver safety belt switch data communicated by the Restraints Control Module (RCM) to the IC through the CAN

Belt-Minder®

The Belt-Minder® is configurable. To configure using a scan tool, refer to Section 418-01 . To configure without using a scan tool, refer to Belt-Minder® Deactivating/Activating in this section.

The Belt-Minder® feature supplements the current safety belt warning function. The Belt-Minder® is enabled after the current safety belt warning is complete. The Belt-Minder® reminds the driver that the driver or passenger safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the IC once the vehicle speed exceeds 5 km/h (3 mph). While activated, the Belt-Minder® alternates the chime and indicator from on for 6 seconds to off for 60 seconds.

NOTE: The Belt-Minder® is disabled for one ignition switch on cycle if the safety belt is buckled then unbuckled during that specific cycle.

Key-In-Ignition Warning Chime

The key-in-ignition warning chime warns that the key is still in the ignition lock cylinder when the driver door is ajar. The key-in-ignition warning chime sounds when the driver door is ajar, the key is in the ignition lock cylinder and in the OFF/LOCK or ACC position.

The key-in-ignition warning chime stops sounding when the driver door is closed, the key is removed from the ignition lock cylinder, or if the ignition key is turned to the RUN position.

The key-in-ignition warning chime inputs are the:

- Ignition switch RUN/START status
- Door ajar data communicated by the SJB to the IC through the CAN
- Key-in-ignition switch signal from the ignition switch

Headlamps On Warning Chime

The headlamps on warning chime warns that the headlamps are on when the driver door is ajar and the key is removed from the ignition lock cylinder. The headlamps on warning chime sounds if the driver door is ajar, the headlamp switch is in the HEADLAMP or PARKING LAMP on position, and the ignition switch in the OFF/LOCK position.

The headlamps on warning chime stops sounding when any one of the above conditions are removed.

The headlamps on warning chime inputs are the:

- Ignition switch RUN/START status
- Driver door ajar data communicated by the SJB to the IC through the CAN
- Headlamp switch data communicated by the SJB to the IC through the CAN

Turn Signal On Warning Chime

The turn signal on warning chime warns that the turn signal has not been cancelled. The turn signal on warning chime sounds if the left or right turn signal is on and the vehicle has traveled more than 3.2 km (2 miles).

The turn signal on warning chime stops sounding if the turn signal is turned off, or if the ignition key is turned to the OFF or ACC position.

The turn signal on warning chime inputs are the:

- Turn signal data communicated by the SJB to the IC through the CAN communication
- Odometer count data communicated by the PCM to the IC through the CAN

Parking Brake Warning Chime

The parking brake warning chime warns that the parking brake is engaged when the vehicle is in motion. The parking brake warning chime sounds if the ignition key is in the RUN position, the parking brake is engaged, and the vehicle speed is greater than 5 km/h (3 mph).

The parking brake warning chime stops sounding if the parking brake is released, the ignition key is not in the RUN position, or if the vehicle speed is less than 5 km/h (3 mph).

The parking brake warning chime inputs are the:

- Ignition switch RUN/START status
- Parking brake switch data communicated by the SJB to the IC through the CAN
- Vehicle speed data communicated by the PCM to the IC through the CAN

Air Bag Secondary Warning Chime

The air bag secondary warning chime warns that the air bag warning indicator light does not work correctly. The IC monitors the air bag warning indicator status internally. When a fault is present in the air bag warning indicator and the IC receives an air bag warning indicator on request from the RCM , the air bag secondary warning chime sounds.

The air bag secondary warning chime inputs are the:

- Ignition switch RUN/START status
- Air bag warning indicator request data communicated by the RCM to the IC

Turn/Hazard On Tone

The turn/hazard on tone provides an audible tick-tock in addition to the turn/hazard indicator lamps. The turn/hazard on tone sounds if the turn or hazard signals are on.

The turn/hazard on tone inputs are the:

- Left turn indicator signal from the SJB to the IC
- Right turn indicator signal from the SJB to the IC

Message Center Warning Chime

The message center warning chime sounds when a new warning message is displayed on the message center. If multiple warning messages are present, a chime tone sounds for each of the warnings that are displayed. The message center warning chime inputs are the warning messages displayed on the message center. The message center warning chime sounds to alert the driver when a concern is detected in one of the following systems:

- Tire Pressure Monitoring System (TPMS)
- Door ajar
- Low fuel level

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Accessory drive belt • Brake fluid level • Door adjustment • Engine coolant level • Engine oil level • Fuel tank • Fuel evaporative system • Liftgate adjustment • Tire pressure • Washer fluid level	• Smart Junction Box (SJB) fuse(s): ♦ 8 (15A) ♦ 18 (10A) ♦ 24 (10A) • Wiring, terminals or connectors • Bulb(s) • Message center switch • Key-in-ignition warning switch (part of the ignition switch) • Instrument Cluster (IC)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before

proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the IC , ABS module, Restraints Control Module (RCM), SJB and PCM.

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart - Instrument Cluster (IC) , GO to Symptom Chart - Information And Message Center or GO to Symptom Chart - Warning Chimes .

IC Dealer Test Mode

To enter the IC dealer test mode with the engine off, press and hold the SELECT/RESET button (base IC) or the message center RESET button (message center IC). Turn the ignition switch to the ON position and hold the button for approximately 3 to 5 seconds. Release the button and press the reset button one time to display ENGINEERING TEST MODE. Press the reset button once to advance to each stage of the self-test. The information from this mode is displayed in the odometer display. All gauges and lamps will operate normally during this test mode unless otherwise noted.

To exit the IC self-test mode, turn the ignition to the OFF position.

Message Center IC Display	Description
ENGINEERING TEST MODE	Initial entry display into the self-test mode.
GAUGE TEST	Carries out a gauge sweep of all the gauges, then displays the present gauge values.
	Carries out the prove-out of all dot matrix pixels in all characters.

All pixels illuminated	
TELLTALE TEST	Illuminates all the micro-controlled lamps and LEDs.
PART NUMBER, XXXX - XX	Return to normal operation of all micro controlled lamps/LEDs and displays the alpha-numeric prefix and suffix IC part number.
ROM LEVEL $XXXX	Carries out checksum tests on ROM. Displays Hex and ROM level and type.
NVM LEVEL $XX	Carries out checksum tests on NVM.
MANUFACTURE DATE $XXXX	Displays the final manufacturing test date.
Auto configuration BYTE 1 $XX	Displays the Hex coding of first (1) byte of module configuration settings.
B&A CONFIG BYTE 1 $XX	Displays the Hex coding of second (2) byte of module configuration settings.
MANUF CONFIG BYTE 1 $XX	Displays the Hex coding of the NVM module configuration settings.
CONTINUOUS DTC $XXXX	Displays a 16-bit DTC in hexadecimal format. DTCs displayed are those detected in continuous operation, not during the self-test.
VEHICLE SPD XXX.X MPH	Displays the English speed value being input. The speedometer indicates the present speed.
VEHICLE SPD XXX.X KMH	Displays the metric speed value being input. The speedometer indicates the present speed.
TACHOMETER XXXX RPM	Displays the tachometer value being input to the IC . Tachometer indicates present rpm.
FUEL LEVEL XXX INST	Displays the present fuel level analog/digital ratio input in decimal. The IC indicates present fuel level.
FUEL LEVEL %, STATUS XXX	Displays the present fuel level percent status in decimal.
INSTANT DTE XXX MILES	Displays the instant calculated DTE.
FUEL ON/OFF Z XXX XXX XXX	Displays the key-on, key-off and zero speed fuel level values.
F#S ON/OFF Z XXX XXX XXX	Displays the key-on, key-off and zero speed fuel number of samples.
COOLANT TEMP XXX C	Displays the last temperature gauge input value from High Speed Controller Area Network (HS-CAN) in degrees C. The temperature gauge indicates present value.
ODOMETER XXX COUNTS	Displays the odometer input received from HS-CAN in decimal format. Value is a rolling count.
TRIP ODO XXX.X MI	Displays the trip odometer value stored in RAM in miles.
BATTERY XX.X VOLTS	Displays the present VBAT analog/digital readings in volts, compensated to yield voltage at IC input pin.
KEY IN SW X	Displays the input status of key-in-ignition switch.
DIMMING CMD XXX	Displays the Smart Junction Box (SJB) dimming command in decimal.
DIMMING STEP XX	Displays the IC dimming step in decimal.
	Displays the present message center switch input analog/digital counts in decimal.

MC SWITCH XXX A/D CNTS	
LWF OPS OAT X X XXX	Displays the present low washer fluid, oil pressure switch and outside air temperature input analog/digital counts in decimal.
COMPASS XXX	Displays the present input from sensor in decimal.
LAST CHIME SOUNDED XX	Displays either the last chime sounded by the IC or the chime that is presently sounding, this excludes the trip reset button chime used to enter ETM or scroll through ETM. AB = air bag chime, BU = backup, BM = Belt-Minder®, F1 = failsafe cooling 1, F2 = failsafe cooling 2, HL = headlamps on, KI = key in ignition, MB = message center button press, MW = message center warning, OS = overspeed, PB = park brake, SB = seatbelt, TS = turn signal, TR = turn signal reminder, TP = tire pressure low, TL = losing tire pressure, -- = none.
GAUGE TEST	Repeats the test display cycle.

DTC Charts

Instrument Cluster (IC) DTC Chart

DTC	Description	Action
B1203	Fuel Sender Circuit Short to Battery	GO to Pinpoint Test B .
B1204	Fuel Sender Circuit Short to Ground	GO to Pinpoint Test B .
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	REFER to Section 419-01 .
B1255	Air Temperature External Sensor Circuit Open	GO to Pinpoint Test AE .
B1257	Air Temperature External Sensor Circuit Short to Ground	GO to Pinpoint Test AE .
B1317	Battery Voltage High	GO to Pinpoint Test AO .
B1318	Battery Voltage Low	GO to Pinpoint Test AP .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is still present, REPROGRAM the IC . REFER to Section 418-01 . If the DTC is still present after the reprogramming, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
B1600	PATS Ignition Key Transponder Signal Is Not Received	REFER to Section 419-01 .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	REFER to Section 419-01 .
B1602	PATS Received Invalid Format Of Key-Code From Ignition Key Transponder	REFER to Section 419-01 .
B1681	PATS Transceiver Module Signal Is Not Received	REFER to Section 419-01 .

B1868	Lamp Air Bag Warning Indicator Circuit Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B1868 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
B1915	Air Bag Driver Circuit Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B1915 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
B2097	Compass Module Failure	GO to Pinpoint Test AB .
B2103	Antenna Not Connected	REFER to Section 419-01 .
B2141	NVM Configuration Failure	REFER to Section 419-01 .
B2143	NVM Memory Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B2143 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
B2431	Transponder Programming Failed	REFER to Section 419-01 .
B2477	Module Configuration Failure	CARRY OUT the IC Programmable Module Installation (PMI). REFER to Section 418-01 . CLEAR the DTCs. REPEAT the self-test. If DTC B2477 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section.
U0140	Lost Communication With Body Control Module (GEM)	GO to Pinpoint Test AQ .
U0159	Lost Communication With Parking Assist Control Module (PAM)	GO to Pinpoint Test AR .
U0208	Lost Communication With Seat Control Module (DSM)	GO to Pinpoint Test AS .
U0244	Lost Communication With Running Board Control Module (PRB)	GO to Pinpoint Test AT .
U1900	CAN Communication Bus Fault - Receive Error	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key off then on and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to Section 418-00 .
U2013	Compass Module is Not Responding	GO to Pinpoint Test AB .
U2023	Fault Received From External Node	DTC U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.
U2050	No Application Present	REPROGRAM the IC . REFER to Section 418-01 . If the DTC occurs after the reprogramming, REPROGRAM the IC again. If the DTC is present after each attempt to reprogram, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

U2051	One or More Calibration Files Missing/Corrupt	CARRY OUT the Programmable Module Installation (PMI) for the IC . REFER to Section 418-01 . If the DTC is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
U2510	CAN - Invalid data for Vehicle Security	REFER to Section 419-01 .
U2511	CAN - Data Mis-Match (Receive data does not match expected)	REFER to Section 419-01 .
U261A	CAN Data Configuration Setup Mismatch	REFER to Section 419-01 .

PCM DTC Chart

DTC	Description	Action
P0457	Evaporative Emission System Leak Detected (Fuel Cap Loose/Off)	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. GO to Pinpoint Test AA .
P0460	Fuel Level Sensor A Circuit	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0461	Fuel Level Sensor A Circuit Range/Performance	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0462	Fuel Level Sensor A Circuit Low	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
P0463	Fuel Level Sensor A Circuit High	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first. If sent here from the PC/ED manual, GO to Pinpoint Test B .
All other DTCs	-	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Charts

Symptom Chart - Instrument Cluster (IC)

Symptom Chart - Information And Message Center

Symptom Chart - Warning Chimes

Pinpoint Tests

Pinpoint Test A: The Instrument Cluster (IC) Is Inoperative

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

With the ignition switch in the START or RUN position, the Instrument Cluster (IC) receives voltage from the ignition switch through circuit CDC34 (WH/OG). With the ignition switch in the OFF position, the IC receives its keep-alive voltage from the Smart Junction Box (SJB) through circuit SBP24 (VT/RD). The IC is grounded through circuit GD145 (BK/BU).

This pinpoint test is intended to diagnose the following:

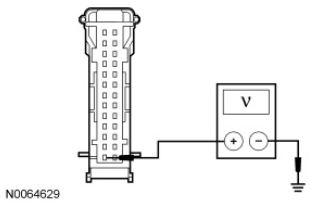
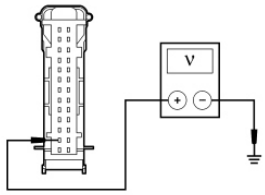
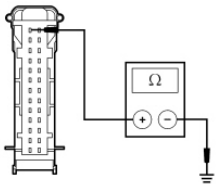
- Fuse
- Wiring, terminals or connectors
- IC

PINPOINT TEST A: THE IC IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
A1 CHECK CIRCUIT SBP24 (VT/RD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: IC C220. • Measure the voltage between the IC C220-1, circuit SBP24 (VT/RD), harness side and ground.	**Yes** GO to A2 . **No** VERIFY the SJB fuse 24 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible cause of the circuit short.

 N0064629 • **Is the voltage greater than 10 volts?**	
A2 CHECK CIRCUIT CDC34 (WH/OG) FOR VOLTAGE	
• Ignition ON. • Measure the voltage between the IC C220-2, circuit CDC34 (WH/OG), harness side and ground.  N0094137 • **Is the voltage greater than 10 volts?**	**Yes** GO to A3 . **No** REPAIR the circuit. TEST the system for normal operation.
A3 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the IC C220-13, circuit GD145 (BK/BU), harness side and ground.  N0058826 • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded

• Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	connector.

Pinpoint Test B: Incorrect Fuel Gauge Indication

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The fuel pump module is hardwired to the Instrument Cluster (IC) through the input circuit VMC11 (YE/VT) and return circuit RMC32 (GN/BU). The fuel level sender (part of the pump module) is a variable resistor actuated by a float with resistance ranging between 180 ohms ± 4 ohms at empty (E) to 10 ohms ± 2 ohms at full (F). The IC provides a reference voltage to the fuel pump module on the input circuit. As the fuel level changes, the fuel level sender float moves up or down according to the fuel level altering the fuel level signal voltage through the resistor. The IC interprets this signal and commands the fuel gauge pointer to sweep to the correct level.

The IC uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

Anti-Slosh Mode

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sender readings caused by fuel moving around in the tank), the fuel gauge takes approximately 55 minutes to go from empty (E) to full (F).

Key OFF Fueling Mode

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The key must be in the OFF position throughout the entire refueling of the vehicle.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.
- The IC must receive a valid key ON fuel sender reading within 1 second of the key being put into the RUN position. The key ON sample readings are considered valid if the fuel sender reading is between 10 ohms ± 2 ohms and 180 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

Key ON Fueling Mode

The key ON fueling mode (approximately 90 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The transmission is in PARK (P).
- The key is in the RUN position.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.

In key ON fueling mode, a 30-second timer activates after the transmission is placed in the PARK (P) position. When the 30-second time has elapsed and at least 15% of the vehicle's fuel capacity has been added, the fuel gauge response time is 90 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P), the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the key in the RUN position.

Recovery Mode

Recovery mode is incorporated into the IC strategy to recover from a missing fuel level input after a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sender or its circuits. Recovery mode (empty [E] to full [F] approximately 20 minutes) is initiated when the following 2 conditions are met:

- The IC is in the anti-slosh (default) mode.
- The actual fuel level in the tank is greater than what is being displayed by the fuel gauge.

Instrument Cluster (IC) DTCs

DTC Description	Fault Trigger Condition
• DTC B1203 - Fuel Sender Circuit Short to Battery	A continuous and on-demand DTC that sets if the IC detects an open or short to voltage on the input circuit VMC11 (YE/VT) for more than 33 seconds.
• DTC B1204 - Fuel Sender Circuit Short to Ground	A continuous and on-demand DTC that sets if the IC detects a short to ground on the input circuit VMC11 (YE/VT) or a short together between the input circuit VMC11 (YE/VT) and the return circuit RMC32 (BN/BU) for more than 33 seconds.

PCM DTCs

DTC Description	Fault Trigger Condition
• P0460 - Fuel Level Sensor A Circuit	Sets when the PCM determines the value of the fuel pump module signal is stuck, that the fuel level input signal does not change or does not correspond with the calculated fuel usage.
• P0461 - Fuel Level Sensor A Circuit Range/Performance	Sets when the PCM determines the fuel pump module signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.
• P0462 - Fuel Level Sensor A Circuit Low	Sets in the PCM when the PCM detects a short to ground on the fuel pump module signal circuit based on the messaged input received from the IC .

• P0463 - Fuel Level Sensor A Circuit High	Sets in the PCM when the PCM detects an open or a short to voltage on the fuel pump module signal circuit based on the messaged input received from the IC .

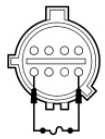
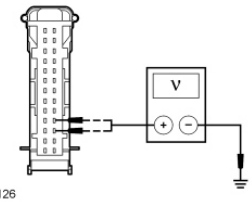
This pinpoint test is intended to diagnose the following:

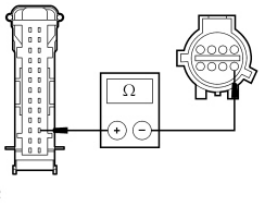
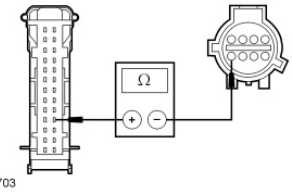
- Wiring, terminals or connectors
- Fuel level sender (float and card)
- Fuel pump module assembly
- Fuel tank
- IC

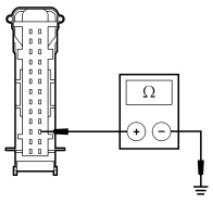
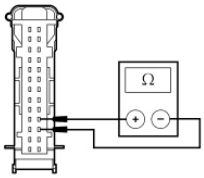
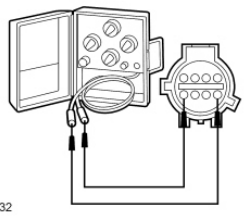
PINPOINT TEST B: INCORRECT FUEL GAUGE INDICATION

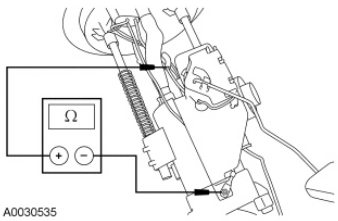
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Ignition OFF. • Check for recorded IC DTCs from the self-test. • **Are any IC DTCs recorded?**	**Yes** For DTC B1203, GO to B3 . For DTC B1204, GO to B7 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to B2 .
B2 CARRY OUT THE IC FUEL GAUGE ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC fuel gauge (FUEL) active command. Command and scroll the fuel gauge level at 0%, 20%, 80% and 100%. • **Does the fuel gauge display empty (E) with 0%, approximately 1/4 tank with 20%, 3/4 tank with 80% and full (F) with 100%?**	**Yes** GO to B10 . **No** GO to B13 .
B3 CHECK THE FUEL PUMP MODULE FOR AN OPEN	

• Disconnect: Fuel Pump Module In-Line C495. • Connect a fused jumper wire between the fuel pump module in-line C495-8, circuit VMC11 (YE/VT), harness side and the fuel pump module in-line C495-5, circuit RMC32 (GN/BU), harness side.  N0056227 • Ignition ON. • Wait one minute. • Enter the following diagnostic mode on the scan tool: IC Self-Test. • **NOTE:** It may be normal for DTC B1203 to be present when carrying out this test step and should be ignored. • Clear the IC DTCs. Repeat the IC self-test. • **Is DTC B1204 retrieved?**	**Yes** REMOVE the jumper wire. GO to B12 . **No** REMOVE the jumper wire. GO to B4 .
B4 CHECK CIRCUITS VMC11 (YE/VT) AND RMC32 (GN/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: IC C220. • Ignition ON. • Measure the voltage between the IC C220-16, circuit VMC11 (YE/VT), harness side and ground; and between the IC C220-17, circuit RMC32 (GN/BU), harness side and ground.  N0057126 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. REPEAT the self-test. CLEAR the DTCs. **No** GO to B5 .
B5 CHECK CIRCUIT VMC11 (YE/VT) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the IC C220-16, circuit VMC11 (YE/VT), harness side and the fuel pump module in-line C495-8, circuit VMC11 (YE/VT), harness side.	**Yes** GO to B6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0072702 • **Is the resistance less than 5 ohms?**	
B6 CHECK CIRCUIT RMC32 (GN/BU) FOR AN OPEN	
• Measure the resistance between the IC C220-17, circuit RMC32 (GN/BU), harness side and the fuel pump module C495-5, circuit RMC32 (BK/OG), harness side.  N0072703 • **Is the resistance less than 5 ohms?**	**Yes** GO to B13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B7 CHECK THE FUEL PUMP MODULE FOR A SHORT TO GROUND	
• Disconnect: Fuel Pump Module In-Line C495. • Wait one minute. • Enter the following diagnostic mode on the scan tool: IC Self-Test. • **NOTE:** It may be normal for DTC B1204 to be present when carrying out this test step and should be ignored. • Clear the IC DTCs. Repeat the IC self-test. • **Is DTC B1203 retrieved?**	**Yes** GO to B12 . **No** GO to B8 .
B8 CHECK CIRCUIT VMC11 (YE/VT) FOR A SHORT TO GROUND	
• Disconnect: IC C220. • Measure the resistance between the IC C220-16, circuit VMC11 (YE/VT), harness side and ground.	**Yes** GO to B9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0057129 • **Is the resistance greater than 10,000 ohms?**	
B9 CHECK CIRCUITS VMC11 (YE/VT) AND RMC32 (GN/BU) FOR A SHORT TOGETHER	
• Measure the resistance between the IC C220-16, circuit VMC11 (YE/VT), harness side and the IC C220-17, circuit RMC32 (GN/BU), harness side.  N0058749 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to B13 .
B10 CHECK THE FUEL INPUT TO THE IC	
NOTE: Since the IC may be in anti-slosh fuel indication mode, the PID values may not match the fuel gauge readings. The actual gauge indication should be disregarded during this test step. • Ignition OFF. • Disconnect: Fuel Pump Module In-Line C495. • Connect one lead of the instrument gauge tester to the fuel pump module C495-8, circuit VMC11 (YE/VT), harness side and the other lead of the instrument gauge tester to the fuel pump module C495-5, circuit RMC32 (BK/OG), harness side.  N0027032 • Ignition ON. • Enter the IC Dealer Test Mode. • **NOTE:** The XXX represents a numeric value that displays the current analog/digital (A/D) ratio fuel level input in decimal format.	**Yes** DISCONNECT the instrument gauge tester. GO to B11 . **No** DISCONNECT the instrument gauge tester. GO to B13 .

• Press and release the SELECT/RESET button (base IC) or RESET button (message center IC) to advance to FUEL LEVEL XXX INST. • **NOTE:** It is extremely important to confirm the gauge tester settings with an ohmmeter to make sure that the gauge tester is in the correct position. Failure to follow this check may result in inaccurate test results. • Monitor the fuel level fuel level input displayed with the gauge tester set at 180 ohms, 90 ohms, 55 ohms, 30 ohms then 10 ohms. • **Does the fuel level input display approximately 3, change to 70, 127, 185 then 251?**	
B11 CHECK THE FUEL TANK	
• Check the fuel tank for any damage or deformation. • **Is the fuel tank OK?**	**Yes** GO to B12 . **No** VERIFY the fuel level sender and the fuel pump module are OK. INSTALL a new fuel tank. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test.
B12 CHECK THE FUEL LEVEL SENDER	
NOTE: The fuel level sender resistance measures between 10 ohms ± 2 ohms at the upper stop position and 180 ohms ± 4 ohms at the lower stop position. • Remove the fuel pump module. Refer to Section 310-01 . • **NOTE:** Disconnect the fuel level sender input wire from the fuel level sender for this measurement. • Measure the resistance between the fuel level sender input wire and the fuel level sender ground while slowly moving the float arm between the upper stop to the lower stop position.  A0030535 • **Does the resistance slowly increase from approximately 10 ohms at the upper stop to 180 ohms at the lower stop?**	**Yes** INSTALL a new fuel pump module. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new fuel level sender. REFER to Section 310-01 . CLEAR the DTCs. REPEAT the self-test.
B13 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector.	**Yes** INSTALL a new IC . REFER to

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test C: The Temperature Gauge Is Inoperative

Normal Operation

The PCM receives the Engine Coolant Temperature (ECT) status through hardwired circuitry to the ECT sensor (4.0L engine), or from the Cylinder Head Temperature (CHT) sensor (4.6L engine). The Instrument Cluster (IC) receives the ECT data from the PCM over the High Speed Controller Area Network (HS-CAN). The IC monitors the engine coolant temperature data received from the PCM and commands the temperature gauge indication with a corresponding movement of the pointer.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST C: THE TEMPERATURE GAUGE IS INOPERATIVE

Test Step	Result / Action to Take
C1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to C2 .
C2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to C3 .
C3 CARRY OUT THE IC TEMPERATURE GAUGE ACTIVE COMMAND USING THE SCAN TOOL	

• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC temperature gauge (ENGCOOLNT) active command. Command the temperature gauge on and off. Observe the temperature gauge. • **Does the temperature gauge start at C (cold) and move to H (hot) when commanded on, and return to C (cold) when commanded off?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test D: Incorrect Temperature Gauge Indication

Normal Operation

The PCM receives the engine coolant temperature status through hardwired circuitry to the Engine Coolant Temperature (ECT) sensor (4.0L engine), or from the Cylinder Head Temperature (CHT) sensor (4.6L engine). The Instrument Cluster (IC) receives the ECT data from the PCM over the High Speed Controller Area Network (HS-CAN). The IC monitors the ECT data received from the PCM and commands the temperature gauge indication with a corresponding movement of the pointer.

This pinpoint test is intended to diagnose the following:

- ECT sensor (4.0L)
- CHT sensor (4.6L)
- PCM concern
- IC

PINPOINT TEST D: INCORRECT TEMPERATURE GAUGE INDICATION

Test Step	Result / Action to Take
D1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to D2 .
D2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No**

	GO to D3 .
D3 CARRY OUT THE TEMPERATURE GAUGE ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • **NOTE:** The coolant temperature should range between 0°-59°C (32°-138°F) with the gauge in the cold (C) range, between 60°-120°C (140°-248°F) with the gauge in the normal or mid-range and above 121°C (249°F) with the gauge in the hot (H) range. • Select the temperature gauge (ENGCOOLNT) active command. Command the temperature gauge to 50°C (122°F), 100°C (212°F) and 125°C (257°F) while monitoring the gauge. • **Does the temperature begin in approximately the center of the cold (C) range, move to approximately the center of the gauge then to the full hot (H) position?**	**Yes** GO to D4 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
D4 CHECK THE COOLANT TEMPERATURE INPUT USING THE IC DEALER TEST MODE	
• Ignition ON. • Enter the IC Dealer Test Mode. • **NOTE:** The display below uses xxx's to represent a numeric or alpha-numeric value. The value may display the same amount of characters represented by the xxx's or there may be more/less depending on the type of display and that the minus symbol in parenthesis will only appear if the temperature is below 0°C. For example: COOLANT TEMP/xxx C may display COOLANT TEMP/20 C. Note that there were 3 x's in the display description but only 2 digits in the actual display. • Scroll down to COOLANT TEMP/xxx C. • Start the engine and run the engine through a variety of engine temperatures. • **NOTE:** The coolant temperature should range between 0°-59°C (32°-138°F) with the gauge in the cold (C) range, between 60°-120°C (140°-248°F) with the gauge in the normal or mid-range and above 121°C (249°F) with the gauge in the hot (H) range. • Monitor the ECT input to the IC and the coolant temperature gauge indication. • **Does the engine coolant input agree with the position of the temperature gauge indication?**	**Yes** GO to D5 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
D5 CHECK THE PCM TEMPERATURE PIDs	
NOTE: The coolant temperature should range between 0°-59°C (32°-138°F) with the gauge in the cold (C) range, between 60°-120°C (140°-248°F) with the gauge in the normal or mid-range and above 121°C (249°F) with the gauge in the hot (H) range. • Enter the following diagnostic mode on the scan tool: PCM DataLogger.	**Yes** INSTALL a new CHT sensor or ECT sensor. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in

• Select the PCM PID (ECT) (4.0L) or CHT (4.6L). With the engine running, monitor the PCM ECT PID. • **Does the PCM PID agree with the position of the temperature gauge indication?**	this section. TEST the system for normal operation.

Pinpoint Test E: The Tachometer Is Inoperative

Normal Operation

The tachometer is electrically operated and indicates the engine speed in revolutions per minute (rpm). The tachometer range is 0 to 7,000 rpm. The PCM uses the Crankshaft Position (CKP) sensor to measure the engine rpm. The PCM sends the engine rpm data to the Instrument Cluster (IC), over the High Speed Controller Area Network (HS-CAN), to command the tachometer gauge. If the rpm information sent to the IC is invalid or missing, the IC defaults the tachometer to 0 rpm.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST E: THE TACHOMETER IS INOPERATIVE

Test Step	Result / Action to Take
E1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to E2 .
E2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to E3 .
E3 CARRY OUT THE IC TACHOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC tachometer (TACH_IND) active command. Command the tachometer on and off. Observe the tachometer.	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for

• **Does the tachometer start at 0 rpm and move to 7,000 rpms when commanded on, and return to 0 when commanded off?**	normal operation.

Pinpoint Test F: Incorrect Tachometer Indication

Normal Operation

The tachometer is electrically operated and indicates the engine speed in revolutions per minute (rpm). The tachometer range is 0 to 7,000 rpm. The PCM uses the Crankshaft Position (CKP) sensor to measure the engine rpm. The PCM sends the engine rpm data to the Instrument Cluster (IC), over the High Speed Controller Area Network (HS-CAN), to command the tachometer gauge. If the rpm information sent to the IC is invalid or missing, the IC defaults the tachometer to 0 rpm.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST F: INCORRECT TACHOMETER INDICATION

Test Step	Result / Action to Take
F1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to F2 .
F2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to F3 .
F3 CARRY OUT THE TACHOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC tachometer (TACH_IND) active command. Command the tachometer in increments of 10% while	**Yes** GO to F4 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this

monitoring the tachometer. The tachometer indication should increase in increments of approximately 700 rpm for each 10% change. • **Does the tachometer indication increase within specifications?**	section. TEST the system for normal operation.
F4 CHECK THE ENGINE RPM INPUT USING THE IC DEALER TEST MODE	
• Ignition ON. • Enter the IC Dealer Test Mode. • **NOTE:** The display below uses xxx's to represent a numeric or alpha-numeric value. The value may display the same amount of characters represented by the xxx's or there may be more/less depending on the type of display. For example: TACHOMETER xxx RPM may display TACHOMETER 650 RPM. • Scroll down to TACHOMETER xxx RPM. • Start the engine and operate the engine at 1,000, 1,500 and 2,000 rpm while monitoring both the tachometer and the engine rpm input in the dealer test mode. • **Does the engine rpm input agree with the position of the tachometer indication?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test G: The Speedometer/Odometer Is Inoperative

Normal Operation

The Instrument Cluster (IC) receives the vehicle speed data from the PCM over the High Speed Controller Area Network (HS-CAN). The IC monitors the vehicle speed input from the PCM and commands the speedometer with a corresponding movement of the pointer.

The vehicle speed on the 5R55 transmission is generated by the PCM and calculated from the transmission Output Shaft Speed (OSS) input and the tire size and axle ratio that is programmed at the end of the production line in the Vehicle Identification (VID) block.

The vehicle speed on the 6R60 transmission is generated by the PCM and calculated from the transmission OSS input sent from the Transmission Control Module (TCM) over the HS-CAN bus and the tire size and axle ratio that is programmed at the end of the production line in the VID block. If the OSS signal to the PCM is missing or the OSS Controller Area Network (CAN) message is missing, then the PCM will use an ABS vehicle speed sent by the ABS module to the PCM over the HS-CAN bus.

The odometer indicates the vehicle distance traveled whenever the ignition switch is in the RUN position, based upon rolling count data sent from the PCM over the HS-CAN . The IC provides a reset button to allow the trip odometer to be reset to 0. When the reset button is pressed, the trip odometer is reset. The trip odometer accumulates and registers up to 999.9 kilometers or 999.9 miles.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST G: THE SPEEDOMETER/ODOMETER IS INOPERATIVE

Test Step	Result / Action to Take
G1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to G2 .
G2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to G3 .
G3 CARRY OUT THE IC SPEEDOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC speedometer (SPDOMETER) active command. Command the speedometer on and off. Observe the speedometer. • **Does the speedometer start at 0 and move to 193 km/h (120 mph) when commanded on, and return to 0 when commanded off?**	**Yes** GO to G4 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
G4 MONITOR THE DISPLAY SEGMENT CONTROL DISPLAY	
• Observe the odometer in the message center (message center IC) or integrated circuit (base IC) display area. • **Does the odometer display ERROR?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.

Pinpoint Test H: Incorrect Speedometer Indication

Normal Operation

The Instrument Cluster (IC) receives the vehicle speed data from the PCM over the High Speed Controller Area Network (HS-CAN). The IC monitors the vehicle speed input from the PCM and commands the speedometer with a corresponding movement of the pointer.

The vehicle speed on the 5R55 transmission is generated by the PCM and calculated from the transmission Output Shaft Speed (OSS) input and the tire size and axle ratio that is programmed at the end of the production line in the Vehicle Identification (VID) block.

The vehicle speed on the 6R60 transmission is generated by the PCM and calculated from the transmission OSS input sent from the Transmission Control Module (TCM) over the HS-CAN bus and the tire size and axle ratio that is programmed at the end of the production line in the VID block. If the OSS signal to the PCM is missing or the OSS Controller Area Network (CAN) message is missing, then the PCM will use an ABS vehicle speed sent by the ABS module to the PCM over the HS-CAN bus.

The IC provides a tolerance which biases the speed indication and displays between 3% below and 7% above the actual vehicle speed. This means that with an actual vehicle speed of 96.6 km/h (60 mph), the speedometer may indicate between 93.7-103.3 km/h (58.2-64.2 mph). Other factors that could potentially affect the speedometer accuracy are incorrect tire size, tire size configuration and axle ratio configuration.

This pinpoint test is intended to diagnose the following:

- Tire size configuration
- Axle ratio configuration
- ABS concern
- PCM concern
- IC

PINPOINT TEST H: INCORRECT SPEEDOMETER INDICATION

Test Step	Result / Action to Take
H1 VERIFY THE VEHICLE TIRE SIZE AND AXLE RATIO CONFIGURATION	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Module Programming. • Select programmable parameters and confirm that the axle ratio and tire size are correctly configured. • **Are the axle ratio and tire size correctly configured?**	**Yes** GO to H2 . **No** Configure the axle ratio or tire size as required. TEST the system for normal operation.
H2 VERIFY THE VEHICLE TIRE SIZE	
• Referring to the vehicle certification label, check to make sure the vehicle has the correct tire size. Refer to Section 100-01 . • **Does the tire size match the door sticker specification?**	**Yes** GO to H3 . **No** ADVISE the customer that incorrect tire size affects speedometer accuracy.
H3 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No**

	GO to H4 .
H4 RETRIEVE THE RECORDED DTCs FROM THE ABS MODULE SELF-TEST	
• Check for recorded ABS module DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** REFER to Section 206-09 . **No** GO to H5 .
H5 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to H6 .
H6 CARRY OUT THE SPEEDOMETER ACTIVE COMMAND USING THE SCAN TOOL	
• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the speedometer (SPDOMETER) active command. Command the speedometer in 10% increments while monitoring the speedometer. The speed indicated should increase in increments of approximately 19.2 km/h (12 mph) for each 10% change. • **Does the speed indicated increase within specifications?**	**Yes** GO to H7 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
H7 CHECK THE PCM VSS PID	
• Enter the following diagnostic mode on the scan tool: PCM DataLogger. • Select the PCM vehicle speed sensor (VSS) PID and monitor the PID while driving the vehicle at 32 km/h (20 mph), 64 km/h (40 mph) and 97 km/h (60 mph). • **Does the speedometer indicate between 31-34 km/h (19-21mph), 63-69 km/h (39-43 mph) and 93-103 km/h (58-64 mph) at the 3 PCM PID values?**	**Yes** The speedometer is operating correctly at this time. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test I: The Brake Warning Indicator Is Never On

Refer to Wiring Diagrams Cell 60 , Instrment Cluster for schematic and connector information.

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

When the parking brake is applied, circuit CCB09 (GY/BU), to the Smart Junction Box (SJB), is grounded by the parking brake switch through circuit GD143 (BK/VT). The SJB receives the ground signal and sends the Instrument Cluster (IC) a message over the Medium Speed Controller Area Network (MS-CAN) to illuminate the brake warning indicator. The brake fluid level switch is hardwired to the ABS module through circuits CMC19 (GY/VT) and RMC19 (YE/GY). The brake fluid level switch is grounded through circuit GD120 (BK/GN). The ABS module monitors the brake fluid level and when the brake fluid level is low or a base brake system concern is detected, the ABS module sends a signal to the IC over the High Speed Controller Area Network (HS-CAN) to illuminate the brake warning indicator.

NOTE: When the ABS module detects an Electronic Brake Distribution (EBD) fault, the ABS module sends a message to the IC . Whenever the IC receives an EBD message from the ABS module, the IC turns on both the brake warning indicator and the ABS warning indicator simultaneously.

This pinpoint test is intended to diagnose the following:

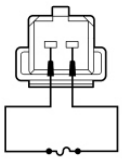
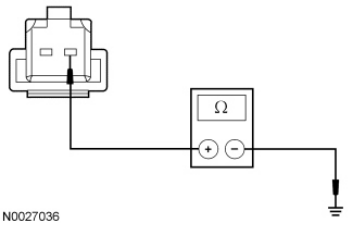
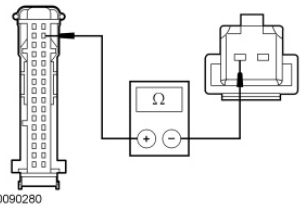
- Wiring, terminals or connectors
- Parking brake switch
- Brake fluid level switch (part of the master cylinder)
- ABS module
- SJB
- IC

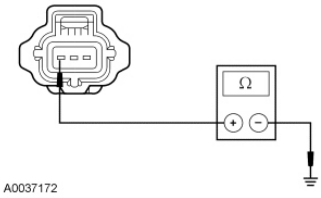
PINPOINT TEST I: THE BRAKE WARNING INDICATOR IS NEVER ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
I1 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC brake warning indicator (BRK_LAMP). Command the brake warning indicator on. Observe the brake warning indicator. • **Does the brake warning indicator illuminate when commanded on?**	**Yes** GO to I2 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
I2 CHECK THE PARKING BRAKE SWITCH PID	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Select the SJB parking brake switch PID (PRK_BRK) while applying the parking brake. • **Does the PID agree with the parking brake position?**	**Yes** GO to I6 . **No** GO to I3 .

I3 CHECK THE PARKING BRAKE SWITCH	
• Ignition OFF. • Disconnect: Parking Brake Switch C2015. • Ignition ON. • Connect a fused jumper wire between the parking brake switch C2015-1, circuit GD143 (BK/VT), harness side and the parking brake switch C2015-2, circuit CCB09 (GY/BU), harness side.  N0002774 • **Does the brake warning indicator illuminate?**	**Yes** INSTALL a new parking brake switch. TEST the system for normal operation. **No** REMOVE the jumper wire. GO to I4 .
I4 CHECK CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the parking brake switch C2015-1, circuit GD143 (BK/VT), harness side and ground.  N0027036 • **Is the resistance less than 5 ohms?**	**Yes** GO to I5 . **No** REPAIR the circuit. TEST the system for normal operation.
I5 CHECK CIRCUIT CCB09 (GY/BU) FOR AN OPEN	
• Disconnect: SJB C2280b. • Measure the resistance between the SJB C2280b-18, circuit CCB09 (GY/BU), harness side and the parking brake switch C2015-2, circuit CCB09 (GY/BU), harness side.  N0090280 • **Is the resistance less than 5 ohms?**	**Yes** GO to I9 . **No** REPAIR the circuit. TEST the system for normal operation.
I6 CHECK THE ABS MODULE OPERATION	
	Yes

• Ignition OFF. • Disconnect: Brake Fluid Level Switch C124. • Ignition ON. • Observe the brake warning indicator after the IC proves out. • **Does the brake warning indicator illuminate with the brake fluid level switch disconnected?**	REMOVE the jumper wire. GO to I7 . **No** REMOVE the jumper wire. GO to I8 .
I7 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the brake fluid level switch C124-1, circuit GD120 (BK/GN), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new brake master cylinder. REFER to Section 206-06 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
I8 CHECK FOR CORRECT ABS MODULE OPERATION	
• Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Correct the ABS module connector and make sure it seats correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
I9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Brake Warning Indicator Is Always On

Refer to Wiring Diagrams Cell 60 , Instrment Cluster for schematic and connector information.

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

When the parking brake is applied, circuit CCB09 (GY/BU), to the Smart Junction Box (SJB), is grounded by the parking brake switch through circuit GD143 (BK/VT). The SJB receives the ground signal and sends the Instrument Cluster (IC) a message over the Medium Speed Controller Area Network (MS-CAN) to illuminate the brake warning indicator. The brake fluid level switch is hardwired to the ABS module through circuits CMC19 (GY/VT) and RMC19 (YE/GY). The brake fluid level switch is grounded through circuit GD120 (BK/GN). The ABS module monitors the brake fluid level and when the brake fluid level is low or a base brake system concern is detected, the ABS module sends a signal to the IC over the high High Speed Controller Area Network (HS-CAN) to illuminate the brake warning indicator.

NOTE: When the ABS module detects an Electronic Brake Distribution (EBD) fault, the ABS module sends a message to the IC . Whenever the IC receives an EBD message from the ABS module, the IC turns on both the brake warning indicator and the ABS warning indicator simultaneously.

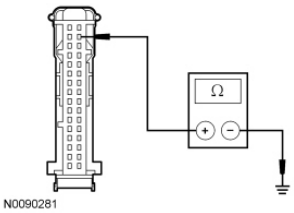
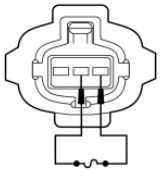
This pinpoint test is intended to diagnose the following:

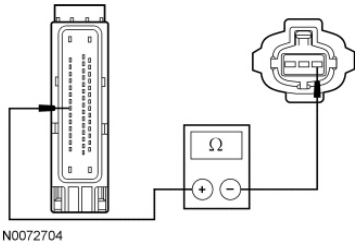
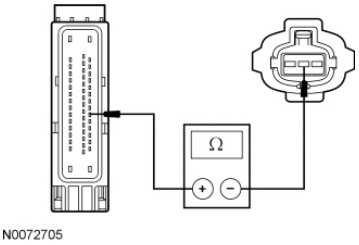
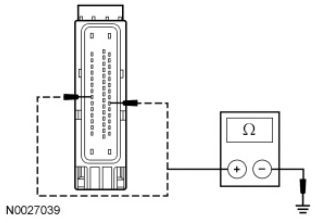
- Wiring, terminals or connectors
- Parking brake switch
- Brake fluid level switch (part of the master cylinder)
- SJB
- ABS module
- IC

PINPOINT TEST J: THE BRAKE WARNING INDICATOR IS ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
J1 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC brake warning lamp (BRK_LAMP) active command. Command the brake warning indicator on and off. Observe the brake warning indicator. • **Does the brake warning indicator illuminate when commanded on and turn off when commanded off?**	**Yes** GO to J2 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
J2 CHECK THE SJB PARKING BRAKE INPUT	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB parking brake PID (PRK_BRK) with the parking brake fully released. • **Does the PID indicate the parking brake is off?**	**Yes** GO to J5 . **No** GO to J3 .
J3 CHECK THE PARKING BRAKE SWITCH	

• Disconnect: Parking Brake Switch C2015. • Observe the brake warning indicator. • **Does the brake warning indicator continue to illuminate?**	**Yes** GO to J4 . **No** INSTALL a new parking brake switch. TEST the system for normal operation.
J4 CHECK CIRCUIT CCB09 (GY/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280b. • Measure the resistance between the SJB C2280b-18, circuit CCB09 (GY/BU), harness side and ground.  N0090281 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to J10 . **No** REPAIR the circuit. TEST the system for normal operation.
J5 CHECK THE ABS MODULE OPERATION	
NOTE: Verify that the master cylinder reservoir is filled to the MAX line. • Ignition OFF. • Disconnect: Brake Fluid Level Switch C124. • Observe the brake warning indicator after the IC proves out. • Connect a fused jumper wire between the brake fluid level switch C124-3, circuit CMC19 (GY/VT), harness side and the brake fluid level switch C124-2, circuit RMC19 (YE/GY), harness side.  N0002771 • Ignition ON. • **Does the brake warning indicator turn off?**	**Yes** REMOVE the jumper wire. INSTALL a new brake master cylinder. REFER to Section 206-06 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to J6 .
J6 CHECK CIRCUIT CMC19 (GY/VT) FOR AN OPEN	

• Ignition OFF. • Disconnect: ABS Module C155. • Measure the resistance between the ABS module C155-39, circuit CMC19 (GY/VT), harness side and the brake fluid level switch C124-3, circuit CMC19 (GY/VT), harness side.  N0072704 • **Is the resistance less than 5 ohms?**	**Yes** GO to J7 . **No** REPAIR the circuit. TEST the system for normal operation.
J7 CHECK CIRCUIT RMC19 (YE/GY) FOR AN OPEN	
• Measure the resistance between the ABS module C155-7, circuit RMC19 (YE/GY), harness side and the brake fluid level switch C124-2, circuit RMC19 (YE/GY), harness side.  N0072705 • **Is the resistance less than 5 ohms?**	**Yes** GO to J8 . **No** REPAIR the circuit. TEST the system for normal operation.
J8 CHECK CIRCUITS CMC19 (GY/VT) AND RMC19 (YE/GY) FOR A SHORT TO GROUND	
• Measure the resistance between the ABS module C155-39, circuit CMC19 (GY/VT), harness side and ground; and between the ABS module C155-7, circuit RMC19 (YE/GY), harness side and ground.  N0027039 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to J9 . **No** REPAIR the circuit in question. TEST the system for normal operation.
J9 CHECK FOR CORRECT ABS MODULE OPERATION	

• Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Correct the ABS module connector and make sure it seats correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
J10 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify that the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: The ABS Warning Indicator Is Never/Always On

Normal Operation

The status of the ABS system is sent to the Instrument Cluster (IC) from the ABS module over the High Speed Controller Area Network (HS-CAN). The IC monitors the ABS input and illuminates the ABS warning indicator when a concern is present.

NOTE: When the ABS module detects an Electronic Brake Distribution (EBD) fault, the ABS module sends a message to the IC . Whenever the IC receives an EBD message from the ABS module, the IC turns on both the brake warning indicator and the ABS warning indicator simultaneously.

This pinpoint test is intended to diagnose the following:

- ABS module
- IC

PINPOINT TEST K: THE ABS WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
K1 RETRIEVE THE RECORDED DTCs FROM THE ABS MODULE SELF-TEST	
• Retrieve the recorded ABS module DTCs from the self-test. • **Are any ABS module DTCs retrieved?**	**Yes** REFER to Section 206-09 . **No** GO to K2 .

K2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to K3 .
K3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC ABS warning indicator (ABS_LAMP) active command. Command the ABS warning indicator on and off. Observe the ABS warning indicator. • **Does the ABS warning indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test L: The Safety Belt Warning Indicator Is Never/Always On

Normal Operation

The safety belt switch is hardwired to the Restraints Control Module (RCM). The RCM monitors the safety belt position through the safety belt buckle switch and communicates the safety belt status to the Instrument Cluster (IC) over the High Speed Controller Area Network (HS-CAN). When the safety belt is buckled, the RCM receives a ground signal and sends a message to the IC to turn off the safety belt warning indicator. When the safety belt is unbuckled, the ground to the RCM is removed and the RCM sends a message to the IC to illuminate the safety belt warning indicator.

This pinpoint test is intended to diagnose the following:

- RCM
- IC

PINPOINT TEST L: THE SAFETY BELT WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
L1 RETRIEVE THE RECORDED DTCs FROM THE RCM SELF-TEST	
• Retrieve the recorded RCM DTCs from the self-test. • **Are any RCM DTCs recorded?**	**Yes** REFER to Section 501-20B . **No**

	GO to L2 .
L2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to L3 .
L3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC safety belt warning indicator (SBLT_LMP) active command. Command the safety belt warning indicator on and off. Observe the safety belt warning indicator. • **Does the safety belt warning indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new RCM . REFER to Section 501-20B . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test M: The LH/RH Turn or High Beam Indicator Is Never/Always On

Normal Operation

When the multifunction switch is in the LH/RH TURN position or the headlamps are in the HIGH BEAM position, a message is sent to the Instrument Cluster (IC) from the Smart Junction Box (SJB) through the Medium Speed Controller Area Network (MS-CAN), to flash the LH/RH turn signal indicator on and off or to turn on the high beam indicator.

This pinpoint test is intended to diagnose the following:

- Exterior lighting concern
- SJB
- IC

PINPOINT TEST M: THE LH/RH TURN OR HIGH BEAM INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
M1 VERIFY THE LH/RH TURN SIGNAL OR HIGH BEAM OPERATION	
• Ignition ON. • Operate the LH/RH turn signals or the high beams. Observe the LH/RH turn signal or high beam lamps.	**Yes** GO to M2 . **No** REFER to Section 417-01 .

• **Do the LH/RH turn signal or high beam lamps operate correctly?**	
M2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U0140, GO to Pinpoint Test AQ . For all other DTCs, REFER to DTC Charts in this section. **No** GO to M3 .
M3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC left turn indicator (LHTURN), right turn indicator (RHTURN) or high beam indicator (HIGH_BEAM) active command. Command the LH/RH turn or high beam indicator on and off. Observe the LH/RH turn or high beam indicator. • **Does the LH or RH turn signal indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test N: The Low Oil Pressure Warning Indicator Is Never/Always On

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

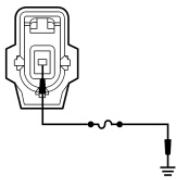
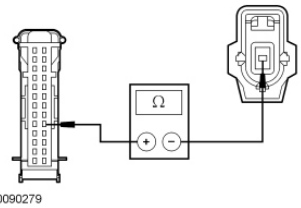
The engine oil pressure switch is hardwired to the Instrument Cluster (IC) through circuit CMC24 (GY). When the oil pressure is within normal ranges, the engine oil pressure switch closes and grounds circuit CMC24 (GY) to the IC , turning off the low oil pressure warning indicator. When engine oil pressure is low, the engine oil pressure switch opens, removing the ground to the IC , turning on the low oil pressure warning indicator.

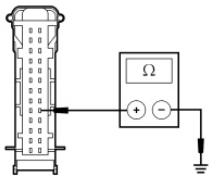
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Base engine concern
- Engine oil pressure switch
- IC

PINPOINT TEST N: THE LOW OIL PRESSURE INDICATOR IS NEVER/ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
N1 DETERMINE THE CONDITION	
• Start the engine. • Observe the low oil pressure indicator. • **Is the low oil pressure indicator illuminated?**	**Yes** GO to N2 . **No** GO to N5 .
N2 CHECK THE LOW OIL PRESSURE INDICATOR OPERATION	
NOTE: If the fused jumper wire fails, refer to the Wiring Diagrams Manual to identify the possible cause of the circuit short. • Ignition OFF. • Disconnect: Engine Oil Pressure Switch C103. • Connect a fused jumper wire between the engine oil pressure switch C103-1, circuit CMC24 (GY) (4.6L) or circuit CMC24 (WH/RD) (4.0L), harness side and ground.  A0089586 • Ignition ON. • **Does the low oil pressure indicator continue to illuminate?**	**Yes** REMOVE the jumper wire. GO to N3 . **No** REMOVE the jumper wire. GO to N4 .
N3 CHECK CIRCUIT CMC24 (GY) OR CIRCUIT CMC24 (WH/RD) (4.0L) FOR AN OPEN	
• Ignition OFF. • Disconnect: IC C220. • Measure the resistance between the IC C220-18, circuit CMC24 (GY), and the engine oil pressure switch C103-1, circuit CMC24 (GY) (4.6L) or circuit CMC24 (WH/RD) (4.0L), harness side and ground.  N0090279 • **Is the resistance less than 5 ohms?**	**Yes** GO to N7 . **No** REPAIR the circuit. TEST the system for normal operation.
N4 CARRY OUT THE ENGINE OIL PRESSURE TEST	

• Ignition OFF. • Carry out the engine oil pressure test. Refer to Section 303-00 . • **Is the engine oil pressure within specification?**	**Yes** INSTALL a new oil pressure switch. TEST the system for normal operation. **No** REFER to Section 303-00 .
N5 CARRY OUT THE IC PROVE OUT	
• Ignition OFF. • Disconnect: Engine Oil Pressure Switch C103. • Ignition ON. • Wait until the IC carries out the bulb prove out while observing the low oil pressure indicator. • **Does the low oil pressure indicator illuminate after the IC prove out?**	**Yes** INSTALL a new engine oil pressure switch. TEST the system for normal operation. **No** GO to N6 .
N6 CHECK CIRCUIT CMC24 (GY) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: IC C220. • Ignition ON. • Measure the resistance between the IC C220-18, circuit CMC24 (GY), harness side and ground.  N0057131 • **Is the resistance than greater than 10,000 ohms?**	**Yes** GO to N7 . **No** REPAIR the circuit. TEST the system for normal operation.
N7 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Malfunction Indicator Lamp (MIL) Is Never/Always On

Normal Operation

The Malfunction Indicator Lamp (MIL) informs the driver of a malfunction in the powertrain that affects the vehicle emissions system. When an emission related fault condition exists, the PCM sets a DTC and sends a command to the Instrument Cluster (IC) over the High Speed Controller Area Network (HS-CAN) to turn on the MIL.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST O: THE MIL IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
O1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Retrieve the recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to O2 .
O2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to O3 .
O3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC MIL indicator (MIL_IC) active command. Command the MIL on and off. Observe the MIL . • **Does the MIL illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test P: The Air Bag Warning Indicator Is Never/Always On

Normal Operation

The air bag warning indicator is used to provide a status of the Supplemental Restraint System (SRS). The Instrument Cluster (IC) receives a message from the Restraints Control Module (RCM) over the High Speed Controller Area Network (HS-CAN). If an air bag system concern is detected, a DTC is logged and the RCM sends a message to the IC to illuminate the air bag warning indicator. If the IC does not receive the restraints control command, the IC illuminates the air bag warning indicator.

This pinpoint test is intended to diagnose the following:

- RCM
- IC

PINPOINT TEST P: THE AIR BAG WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
P1 RETRIEVE THE RECORDED DTCs FROM THE RCM SELF-TEST	
• Retrieve the recorded RCM DTCs from the self-test. • **Are any RCM DTCs recorded?**	**Yes** REFER to Section 501-20B . **No** GO to P2 .
P2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to P3 .
P3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC air bag warning indicator (AIRBAG) active command. Command the air bag warning indicator on and off. Observe the air bag warning indicator. • **Does the air bag warning indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new RCM . REFER to Section 501-20B . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test Q: The Speed Control Indicator Is Never/Always On

Normal Operation

The speed control status information is sent to the Instrument Cluster (IC) from the PCM over the High Speed Controller Area Network (HS-CAN). When the speed control is engaged, the PCM provides a signal to the IC to illuminate the speed control indicator.

This pinpoint test is intended to diagnose the following:

- Speed control system concern
- PCM
- IC

PINPOINT TEST Q: THE SPEED CONTROL INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
Q1 CHECK THE SPEED CONTROL OPERATION	
• Verify the speed control operates correctly. • **Does the speed control operate correctly?**	**Yes** GO to Q2 . **No** REFER to Section 310-03 .
Q2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to Q3 .
Q3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC speed control indicator (CRUISE) active command. Command the speed control indicator on and off. Observe the speed control indicator. • **Does the speed control indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test R: The Powertrain Malfunction (Wrench) Warning Indicator is Never/Always On (Base IC)

Normal Operation

The Instrument Cluster (IC) receives the powertrain status from the PCM over the High Speed Controller Area Network (HS-CAN). When a system concern is detected, the PCM sends the IC a command signal to illuminate the powertrain malfunction (wrench) warning indicator. If the 4X4 control module detects a failure with the Four-Wheel Drive (4WD) system, the 4X4 control module sends a message to the IC over the HS-CAN to illuminate the powertrain malfunction (wrench) warning indicator. On 4.6L engines, if the Transmission Control Module (TCM), detects a failure with the transmission, the TCM sends a message to the IC over the HS-CAN to illuminate the powertrain malfunction (wrench) warning indicator.

This pinpoint test is intended to diagnose the following:

- 4WD system concern
- IC

PINPOINT TEST R: THE POWERTRAIN MALFUNCTION (WRENCH) WARNING INDICATOR IS NEVER/ALWAYS ON (BASE IC)

Test Step	Result / Action to Take
R1 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC all lamps active command (ALL_LAMP). Command all the lamps on and off while monitoring the powertrain malfunction (wrench) indicator. • **Does the powertrain malfunction (wrench) indicator turn on when commanded on and turn off when commanded off?**	**Yes** GO to R2 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
R2 VERIFY THE 4WD OPERATION	
• Verify that the vehicle is in 2-wheel drive when the 4x4 high is switched off, and that the 4WD high operates when switched to the 4x4. • **Does the 4x4 high operate correctly?**	**Yes** GO to R3 . **No** REFER to Section 308-07A .
R3 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Retrieve the recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to R4 .
R4 RETRIEVE THE RECORDED DTCs FROM THE TCM SELF-TEST	
• Retrieve the recorded TCM DTCs from the self-test.	**Yes** REFER to Section 307-01B .

• **Are any TCM DTCs recorded?**	**No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test S: The Door Ajar Warning Indicator Is Never/Always On

Normal Operation

The door ajar warning indicator informs the driver that one or more doors, the liftgate or the liftglass is open while the ignition key is in the RUN position. When a door, liftgate, or liftglass is ajar, the Smart Junction Box (SJB) sends a message to the Instrument Cluster (IC) over the Medium Speed Controller Area Network (MS-CAN) to illuminate the door ajar warning indicator.

This pinpoint test is intended to diagnose the following:

- SJB
- IC

PINPOINT TEST S: THE DOOR AJAR WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
S1 CHECK THE OPERATION OF THE INTERIOR LAMPS	
• Open and close each door, the liftgate, and the liftgate glass, while monitoring the interior lamps. • **Do the interior lamps operate correctly?**	**Yes** GO to S2 . **No** REFER to Section 417-02 .
S2 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U0140, GO to Pinpoint Test AQ . For all other DTCs, REFER to DTC Charts in this section. **No** GO to S3 .
S3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC door ajar warning lamp (DRAJLMP) active command. Command the door ajar warning indicator on and off. Observe the door ajar warning indicator.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section.

• **Does the door ajar warning indicator illuminate when commanded on, and turn off when commanded off?**	TEST the system for normal operation.

Pinpoint Test T: The O/D OFF Indicator Is Never/Always On

Normal Operation

The Overdrive (O/D) off function is controlled by the O/D off switch located on the shifter assembly. The O/D off status is transmitted to the Instrument Cluster (IC) from the PCM (4.0L engine), or the Transmission Control Module (TCM) (4.6L engine) over the High Speed Controller Area Network (HS-CAN).

This pinpoint test is intended to diagnose the following:

- TCM (4.6L engine)
- PCM (4.0L engine)
- IC

PINPOINT TEST T: THE O/D OFF INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
T1 RETRIEVE THE RECORDED DTCs FROM THE PCM AND TCM KOEO SELF-TEST	
• Retrieve the recorded PCM (4.0L engine) or TCM (4.6L engine) DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any DTCs recorded?**	**Yes** If equipped with a 4.0L engine, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If equipped with a 4.6L engine, REFER to Section 307-01B . **No** GO to T2 .
T2 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC O/D off indicator (OVERDRV) active command. Command the O/D OFF indicator on and off. Observe the O/D OFF indicator. • **Does the O/D OFF indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** If equipped with a 4.0L engine, INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. If equipped with a 4.6L engine, INSTALL a new TCM (mechatronic assembly). REFER to Section 307-01B . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test U: The Tire Pressure Monitoring System (TPMS) Warning Indicator is Never/Always On

Normal Operation

Each road tire is equipped with a tire pressure sensor fastened to the inside rim of the wheel. The tire-mounted pressure sensors transmit signals to the Smart Junction Box (SJB) by using the valve stem as an antenna. These signals are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The SJB compares each tire pressure sensor signal against low and high pressure limits. If the SJB determines that the tire pressure has exceeded the limit, the SJB communicates over the Medium Speed Controller Area Network (MS-CAN) to the Instrument Cluster (IC), which then illuminates the Tire Pressure Monitoring System (TPMS) warning indicator. If the TPMS status message is missing for more than 5 seconds, the IC sets DTC U0140 and flashes the TPMS indicator for approximately 70 seconds then turns on the TPMS indicator.

This pinpoint test is intended to diagnose the following:

- TPMS concern
- SJB
- IC

PINPOINT TEST U: THE TPMS WARNING INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
U1 CHECK THE TIRE PRESSURE	
• Verify that the tire pressure in all tires meets the recommended tire pressures on the vehicle certification label. Refer to Section 100-01 . • **Do all the tires meet the recommended tire pressures?**	**Yes** GO to U2 . **No** CORRECT the tire pressures. TEST the system for normal operation.
U2 CHECK FOR MESSAGE CENTER TPMS WARNING MESSAGES	
• Ignition ON. • Monitor the message center for TPMS related warning messages. • **Are any TPMS warning messages displayed in the message center?**	**Yes** REFER to Section 204-04 . **No** GO to U3 .
U3 RETRIEVE THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check for recorded SJB DTCs from the self-test. • **Are any TPMS related SJB DTCs recorded?**	**Yes** REFER to Section 419-10 . **No** GO to U4 .
U4 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON.	**Yes** INSTALL a new SJB . REFER to Section

• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC TPMS warning indicator (TIRE_PRES) active command. Command the TPMS warning indicator on and off. Observe the low tire pressure warning indicator. • **Does the TPMS warning indicator illuminate when commanded on, and turn off when commanded off?**	419-10 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test V: The 4X4 High Indicator Is Never/Always On

Normal Operation

The 4X4 control module sends the 4X4 high command, over the High Speed Controller Area Network (HS-CAN). The Instrument Cluster (IC) monitors the command from the 4X4 control module and illuminates the 4X4 high indicator when the vehicle is in 4X4 high.

This pinpoint test is intended to diagnose the following:

- Four-Wheel Drive (4WD) system concern
- 4X4 control module
- IC

PINPOINT TEST V: THE 4X4 HIGH INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
V1 RETRIEVE THE RECORDED DTCs FROM THE 4X4 CONTROL MODULE SELF-TEST	
• Check for recorded 4X4 control module DTCs from the self-test. • **Are any 4X4 control module DTCs recorded?**	**Yes** REFER to Section 308-07A . **No** GO to V2 .
V2 VERIFY THE 4WD OPERATION	
• Verify that the vehicle is in 2-wheel drive when the 4X4 high is switched off, and that the 4WD high operates when switched to the 4X4. • **Does the 4X4 high operate correctly?**	**Yes** GO to V3 . **No** REFER to Section 308-07A .
V3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC all warning lamps (ALL_LAMP) active command. Command all the warning lamps on and off. Observe the 4x4 high indicator.	**Yes** INSTALL a new 4X4 control module. REFER to Section 308-07A . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section.

• **Does the 4x4 high indicator illuminate when commanded on, and turn off when commanded off?**	TEST the system for normal operation.

Pinpoint Test W: The 4x4 Low Indicator Is Never/Always On

Normal Operation

The 4X4 control module sends the 4X4 low command, over the High Speed Controller Area Network (HS-CAN). The Instrument Cluster (IC) monitors the command from the 4X4 control module and illuminates the 4X4 LOW indicator when the vehicle is in 4X4 low.

This pinpoint test is intended to diagnose the following:

- Four-Wheel Drive (4WD) system concern
- 4X4 control module
- IC

PINPOINT TEST W: THE 4X4 LOW INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
W1 RETRIEVE THE RECORDED DTCs FROM THE 4X4 CONTROL MODULE SELF-TEST	
• Check for recorded 4X4 control module DTCs from the self-test. • **Are any 4X4 control module DTCs recorded?**	**Yes** REFER to Section 308-07A . **No** GO to W2 .
W2 VERIFY THE 4WD OPERATION	
• Verify that the vehicle is in 2-wheel drive when the 4X4 LOW is switched off, and that the 4WD low operates when switched to 4X4 LOW. • **Does the 4X4 low operate correctly?**	**Yes** GO to W3 . **No** REFER to Section 308-07A .
W3 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC all warning lamps (ALL_LAMP) active command. Command all the warning lamps on and off. Observe the 4x4 LOW indicator. • **Does the 4x4 LOW indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new 4X4 control module. REFER to Section 308-07A . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test X: The Engine Coolant Over-Temperature Warning Indicator Is Never/Always On (Base IC)

Normal Operation

The PCM receives the Engine Coolant Temperature (ECT) status through hardwired circuitry to the ECT sensor (4.0L engine), or from the Cylinder Head Temperature (CHT) sensor (4.6L engine). The Instrument Cluster (IC) receives the ECT data from the PCM over the High Speed Controller Area Network (HS-CAN). The IC monitors the ECT data received from the PCM and when the ECT is high, the engine over-temperature warning indicator illuminates.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST X: THE ENGINE COOLANT OVER-TEMPERATURE WARNING INDICATOR IS NEVER/ALWAYS ON (BASE IC)

Test Step	Result / Action to Take
X1 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any PCM DTCs recorded?**	**Yes** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. **No** GO to X2 .
X2 CARRY OUT THE IC INDICATOR LAMP ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC all lamps active command (ALL_LAMP). Command all the lamps on and off. Observe the engine coolant over-temperature warning indicator. • **Does the engine coolant over-temperature warning indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test Y: The Traction Control/Stability Assist Indicator Is Never/Always On

Normal Operation

The traction control/stability assist indicator informs the driver that a traction control or stability assist event is taking place, by flashing the traction control/stability assist indicator during the event. The traction control/stability assist indicator illuminates constantly (not flashing) when a malfunction is detected in the traction control or stability assist system, or if the traction control or stability assist system is disabled by the operator. The ABS module sends a message to the Instrument Cluster (IC) along the High Speed Controller Area Network (HS-CAN) bus to illuminate the traction control/stability assist indicator.

This pinpoint test is intended to diagnose the following:

- Traction control/stability assist system concern
- ABS module
- IC

PINPOINT TEST Y: THE TRACTION CONTROL/STABILITY ASSIST INDICATOR IS NEVER/ALWAYS ON

Test Step	Result / Action to Take
Y1 CHECK THE TRACTION CONTROL/STABILITY ASSIST INDICATOR OPERATION USING THE STABILITY/TRACTION CONTROL DISABLE SWITCH	
• Ignition ON. • Press the traction control/stability assist disable switch 1 time to disable the traction control/stability assist system then press the traction control/stability assist switch again while monitoring the traction control/stability assist indicator. • **Does the traction control/stability assist indicator illuminate with the first switch press and turn off with the second switch press?**	**Yes** If the traction control/stability assist indicator does not operate while in traction active mode, INSTALL a new ABS module. REFER to Section 206-09 . TEST the system for normal operation. If the traction control/stability assist indicator operates in traction active mode, the system is operating normally at this time. **No** GO to Y2 .
Y2 RETRIEVE THE RECORDED DTCs FROM THE ABS MODULE SELF-TEST	
• Check for recorded ABS module DTCs from the self-test. • **Are any ABS module DTCs recorded?**	**Yes** REFER to Section 206-09 . **No** GO to Y3 .
Y3 CARRY OUT THE IC INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the traction control/stability assist active indicator (ACTIVELMP) active command. Command the traction control/stability assist indicator on and off. Observe the stability/traction control indicator. • **Does the traction control/stability assist indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** REFER to Section 206-09 to diagnose the traction control/RSC system cannot be disabled. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test Z: The Charging System Warning Indicator Is Never/Always On (Base IC)

Normal Operation

The charging system warning indicator is controlled by the Instrument Cluster (IC) based upon data received from the PCM over the High Speed Controller Area Network (HS-CAN). When a generator malfunction occurs that prevents the generator from charging the battery, the generator regulator grounds the PCM input to ground. The PCM senses the ground state and sends a communication message over the HS-CAN to the IC to illuminate charging system warning indicator, which indicates a charging system fault has occurred.

This pinpoint test is intended to diagnose the following:

- Charging system concern
- PCM
- IC

PINPOINT TEST Z: THE CHARGING SYSTEM WARNING INDICATOR IS NEVER/ALWAYS ON (BASE IC)

Test Step	Result / Action to Take
Z1 CARRY OUT THE IC INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC charging system warning indicator (CHARGE _ LMP) active command. Command the charging system warning indicator on and off. Observe the charging system warning indicator. • **Does the charging system warning indicator illuminate when commanded on, and turn off when commanded off?**	**Yes** GO to Z2 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
Z2 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any charging system DTCs recorded?**	**Yes** REFER to Section 414-00 . **No** GO to Z3 .
Z3 CHECK THE CHARGING SYSTEM OPERATION	
• Check the charging system operation. REFER to Section 414-00 . • **Does the charging system operate correctly?**	**Yes** GO to Z4 . **No** REFER to Section 414-00 .
Z4 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC

	Charts in this section. **No** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.

Pinpoint Test AA: The Check Fuel Cap Indicator Is Never/Always On (Sport Trac Base IC Only)

Normal Operation

The PCM monitors the fuel tank evaporative emission system for significant leaks that occur following refueling of the vehicle. Once the PCM detects a fuel vapor leak, the PCM sends the Instrument Cluster (IC) a message over the communication network to turn on the check fuel cap indicator. DTC P0457 sets in the PCM following a successful cruise test, which is initiated when the vehicle is driven at a steady speed above 64 km/h (40 mph) for a duration of approximately 4-5 minutes. If the PCM is unable to successfully run the cruise test, the IC does not receive the check fuel cap message and the check fuel cap indicator remains off.

- DTC P0457 (Evaporative Emission System Leak Detected [Fuel Cap Loose/Off]) - sets in the PCM if a fuel tank pressure change greater than -23.7 kPa (-7 in-Hg) of vacuum within 30 seconds after refueling occurs, or there is an excessive purge (fuel vapor) flow of greater than 454 g (1.0 lb) per minute.

This pinpoint test is intended to diagnose the following:

- PCM
- IC

PINPOINT TEST AA: THE CHECK FUEL CAP INDICATOR IS NEVER/ALWAYS ON (SPORT TRAC BASE IC ONLY)

Test Step	Result / Action to Take
AA1 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to AA2 .
AA2 CARRY OUT THE IC INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger.	**Yes** GO to AA2 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this

• Select the IC all lamps (ALL_LAMPS) active command. Command all the lamps on and off while monitoring the check fuel cap indicator. • **Does the check fuel cap indicator turn on when commanded on and turn off when commanded off?**	section. TEST the system for normal operation.
AA3 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Is DTC P0457 recorded?**	**Yes** If the check fuel cap indicator is illuminated, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If the check fuel cap indicator is not illuminated, GO to AA3 **No** If the check fuel cap indicator is always on, INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. If the check fuel cap indicator is not illuminated, the system is operating normally at this time. If the fuel cap was left off and the check fuel cap warning indicator did not turn on, driving conditions may not have allowed for the PCM to run the cruise test and message the IC to turn on the check fuel cap warning indicator.

Pinpoint Test AB: The Compass Is Inoperative

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The compass sensor module (early build) or auto-dimming mirror (late build) receives voltage from the Smart Junction Box (SJB) through circuit CBP18 (GY/OG) (early build) or CBP05 (YE) (late build). The compass module (early build) or auto-dimming mirror (late build) is grounded through circuit GD143 (BK/VT). The compass sensor module (early build) or auto-dimming mirror (late-build) communicates the vehicle direction to the Instrument Cluster (IC), through a compass data plus circuit and compass data minus circuit.

- DTC B2097 (Compass Module Failure) - a continuous memory DTC that sets in the IC if the data received from the compass module (early build) or the auto-dimming mirror (late-build) is invalid.
- DTC U2013 (Compass Module is Not Responding) - a continuous and on-demand DTC that sets if the IC fails to receive a response from the compass module (early build) or the auto-dimming mirror (late-build) after 4 consecutive attempts.

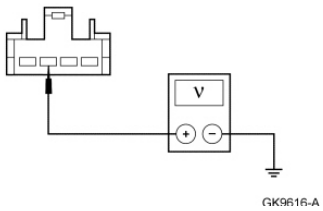
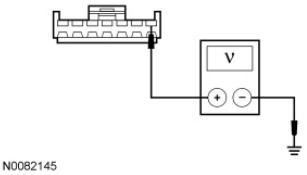
This pinpoint test is intended to diagnose the following:

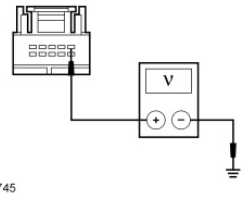
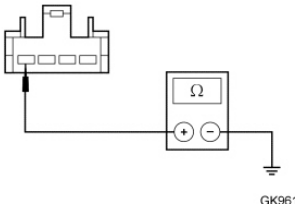
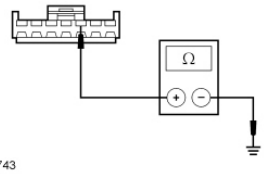
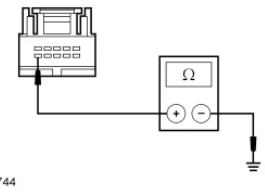
- Fuse
- Wiring, terminals or connectors
- Compass sensor module (early build)
- Auto-dimming mirror (late build)

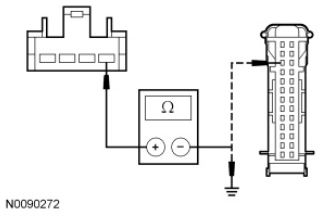
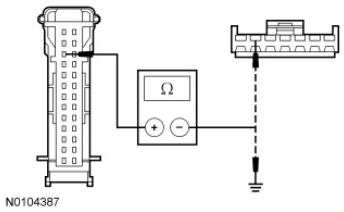
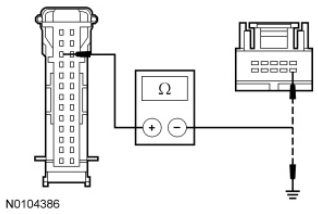
PINPOINT TEST AB: THE COMPASS IS INOPERATIVE

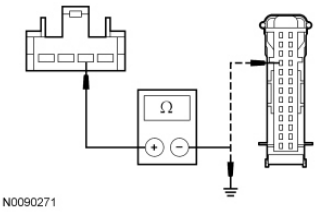
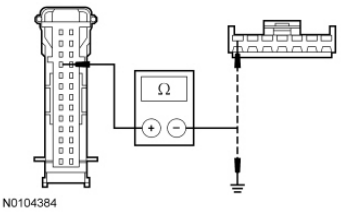
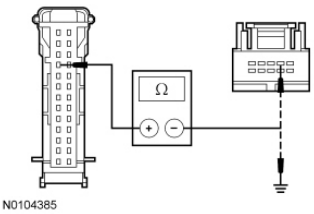
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AB1 CHECK THE COMPASS MODULE (EARLY BUILD) OR AUTO-DIMMING MIRROR (LATE BUILD) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Compass Sensor Module C909 (Early Build). • Disconnect: Auto-Dimming Mirror C911 (Without Microphone) (Late Build). • Disconnect: Auto-Dimming Mirror C9012 (With Microphone) (Late Build). • Ignition ON. • For early build vehicles, measure the voltage between the compass sensor module C909-3, circuit CBP18 (GY/OG), harness side and ground.  • For late build vehicles without a microphone, measure the voltage between the auto-dimming mirror C911-1, circuit CBP05 (YE), harness side and ground.  • For late build vehicles with a microphone, measure the voltage between the auto-dimming mirror C9012-1, circuit CBP05 (YE), harness side and ground.	**Yes** GO to AB2 . **No** VERIFY the SJB fuse 18 (10A) (early build) or fuse 5 (5A) (late build) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

 N0085745 • **Is the voltage greater than 10 volts?**	
AB2 CHECK THE COMPASS MODULE (EARLY BUILD) OR AUTO-DIMMING MIRROR (LATE BUILD) GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • For early build vehicles, measure the resistance between the compass sensor module C909-4, circuit GD143 (BK/VT), harness side and ground.  GK9617-A • For late build vehicles without a microphone, measure the resistance between the auto-dimming mirror C911-3, circuit GD143 (BK/VT), harness side and ground.  N0085743 • For late build vehicles with a microphone, measure the resistance between the auto-dimming mirror C9012-10, circuit GD143 (BK/VT), harness side and ground.  N0085744 • **Is the resistance less than 5 ohms?**	**Yes** GO to AB3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
AB3 CHECK THE COMPASS DATA PLUS CIRCUIT FOR AN OPEN AND A SHORT TO GROUND	

• Disconnect: IC C220. • On early build vehicles, measure the resistance between the compass sensor module C909-1, circuit VMC31 (YE/GN), harness side and the IC C220-11, circuit VMC31 (GY/BU), harness side; and between the compass sensor module C909-1, circuit VMC31 (YE/GN), harness side and ground.  N0090272 • On late build vehicles without a microphone, measure the resistance between the IC C220-11, circuit VMC31 (YE/GN), harness side and the auto-dimming mirror C911-6, circuit VMC31 (BU/OG), harness side; and between the IC C220-11, circuit VMC31 (YE/GN), harness side and ground.  N0104387 • On late build vehicles with a microphone, measure the resistance between the IC C220-11, circuit VMC31 (YE/GN), harness side and the auto-dimming mirror C9012-6, circuit VMC31 (BU/OG), harness side; and between the IC C220-11, circuit VMC31 (YE/GN), harness side and ground.  N0104386 • **Is the resistance less than 5 ohms between the compass sensor module and the IC (early build) or between the IC and the auto-dimming mirror (late build), and greater than 10,000 ohms between the compass module and ground (early build) or between the auto-dimming mirror and ground (late build)?**	**Yes** GO to AB4 . **No** REPAIR the circuit. TEST the system for normal operation.
AB4 CHECK THE COMPASS DATA MINUS CIRCUIT FOR AN OPEN AND A SHORT TO GROUND	

• On early build vehicles, measure the resistance between the compass sensor module C909-2, circuit VMC30 (BU/GY), harness side and the IC C220-10, circuit VMC30 (BU/GY), harness side; and between the compass sensor module C909-2, circuit VMC30 (BU/GY), harness side and ground.  N0090271 • On late build vehicles without a microphone, measure the resistance between the IC C220-10, circuit VMC30 (BU/GY), harness side and the auto-dimming mirror C911-7, circuit VMC30 (BU/GY), harness side; and between the IC C220-10, circuit VMC30 (BU/GY), harness side and ground.  N0104384 • On late build vehicles with a microphone, measure the resistance between the IC C220-10, circuit VMC30 (BU/GY), harness side and the auto-dimming mirror C9012-2, circuit VMC30 (BU/GY), harness side; and between the IC C220-10, circuit VMC30 (BU/GY), harness side and ground.  N0104385 • **Is the resistance less than 5 ohms between the compass sensor module and the IC (early build) or between the IC and the auto-dimming mirror (late build), and greater than 10,000 ohms between the compass module and ground (early build) or between the auto-dimming mirror and ground (late build)?**	**Yes** On early build vehicles, INSTALL a new compass sensor module. On late build vehicles, INSTALL a new auto-dimming mirror. REFER to Section 501-09 . SET the zone. REFER to Compass Zone Adjustment in this section. CALIBRATE the compass. REFER to Compass Calibration in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test AC: The Compass Is Inaccurate

Normal Operation

The compass sensor module (early build) or the auto-dimming mirror (late build) communicates the vehicle direction to the Instrument Cluster (IC) through the compass communication data plus and compass communication data minus circuits. The magnetic fields generated by the earths north and south poles are divided into zones that differ from each other with respect to how the magnetic fields appear. The magnetic north can change by up to 4 degrees between zones and become noticeable across multiple zones. The compass zone must be set to the correct zone for the compass to read accurately. Factors within the vehicle may affect the ability of the compass module to accurately read the magnetic north. Calibrating the compass allows the compass module to compensate for vehicle factors that influence the accuracy of the compass.

This pinpoint test is intended to diagnose the following:

- Calibration
- Zone setting
- Compass sensor module (early build)
- Auto-dimming mirror (late build)

PINPOINT TEST AC: THE COMPASS IS INACCURATE

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>AC1 CHECK THE COMPASS ACCURACY</td><td></td></tr>
<tr><td>• Position the vehicle and observe the compass display as follows:

<table><tr><th>Direction</th><th>Compass Display</th></tr><tr><td>North</td><td>N</td></tr><tr><td>Northeast</td><td>NE</td></tr><tr><td>East</td><td>E</td></tr><tr><td>Southeast</td><td>SE</td></tr><tr><td>South</td><td>S</td></tr><tr><td>Southwest</td><td>SW</td></tr><tr><td>West</td><td>W</td></tr><tr><td>Northwest</td><td>NW</td></tr></table>
• Does the compass display as indicated?</td><td>Yes
The compass is OK.

No
GO to AC2 .</td></tr>
<tr><td>AC2 CHECK THE COMPASS ZONE SETTING AND CALIBRATION</td><td></td></tr>
<tr><td>• Set the zone. Refer to Compass Zone Adjustment in this section.
• Calibrate the compass. Refer to Compass Zone Adjustment in this</td><td>Yes
The compass is OK. The concern may have been caused by an incorrect zone setting or the compass was out of calibration.</td></tr>
</table>

section. • **Does the compass calibrate correctly?**	**No** On early build vehicles, INSTALL a new compass sensor module. On late build vehicles, INSTALL a new auto-dimming mirror. REFER to Section 501-09 . SET the zone. REFER to Compass Zone Adjustment in this section. CALIBRATE the compass. REFER to Compass Calibration in this section. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AD: The Message Center Is Not Operating Correctly (High Series IC)

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The message center functionality is controlled through the message center switch, which is hardwired to the Instrument Cluster (IC) through circuits CMC29 (GN/VT) and RMC32 (GN/BU). The message center switch uses circuit CMC29 (GN/VT) to communicate the requested switch function to the IC message center. The message center switch is grounded through circuit RMC32 (GN/BU). Each message center switch uses a different resistance value allowing the IC to determine which switch is pressed.

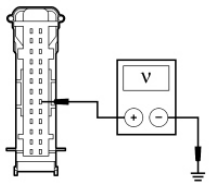
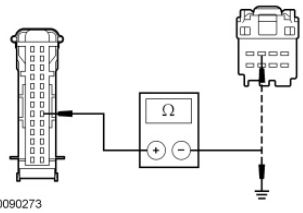
This pinpoint test is intended to diagnose the following:

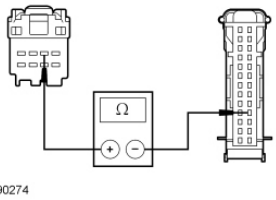
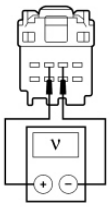
- Wiring, terminals or connectors
- Message center switch
- IC

PINPOINT TEST AD: THE MESSAGE CENTER IS NOT OPERATING CORRECTLY (HIGH SERIES IC)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AD1 CHECK THE MESSAGE CENTER DISPLAY ILLUMINATION	
• Ignition ON. • Observe the message center display segments illumination. • **Does the message center display illuminate all segments?**	**Yes** GO to AD2 . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.
AD2 CHECK THE IC PID FOR THE MESSAGE CENTER SWITCH	
• Ignition ON.	**Yes** INSTALL a new IC . REFER to

• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC message center switch PIDs (INFOSW, SETUPSW and RES_SW). Monitor the PIDs while pressing each message center switch (INFO, SETUP, and RESET). • **Do the PIDs agree with the switch position?**	Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** GO to AD3 .
AD3 CHECK CIRCUIT CMC29 (GN/VT) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: IC C220. • Ignition ON. • Measure the voltage between the IC C220-19, circuit CMC29 (GN/VT), harness side and ground.  N0075647 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to AD4 .
AD4 CHECK CIRCUIT CMC29 (GN/VT) FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Message Center Switch C253. • Measure the resistance between the IC C220-19, circuit CMC29 (GN/VT), harness side and the message center switch C253-3, circuit CMC29 (GN/VT), harness side; and between the IC C220-19, circuit CMC29 (GN/VT), harness side and ground.  N0090273 • **Is the resistance less than 5 ohms between the IC and the message center switch, and greater than 10,000 ohms between the IC and ground?**	**Yes** GO to AD5 . **No** REPAIR the circuit. TEST the system for normal operation.
AD5 CHECK CIRCUIT RMC32 (GN/BU) FOR AN OPEN	

• Ignition OFF. • Measure the resistance between the message center switch C253-2, circuit RMC32 (GN/BU), harness side and the IC C220-17, circuit RMC32 (GN/BU), harness side.  N0090274 • **Is the resistance less than 5 ohms?**	**Yes** GO to AD6 . **No** REPAIR the circuit. TEST the system for normal operation.
AD6 CHECK FOR VOLTAGE FROM THE IC	
• Connect: IC C220. • Ignition ON. • Measure the voltage between the message center switch C253-3, circuit CMC29 (GN/VT), harness side and the message center switch C253-2, circuit RMC32 (GN/BU), harness side.  N0064498 • **Is the voltage approximately 5 volts or greater?**	**Yes** INSTALL a new message center switch. REFER to Message Center Switch in this section. TEST the system for normal operation. **No** GO to AD7 .
AD7 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AE: The Outside Air Temperature Display Does Not Operate Correctly

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

NOTE: The outside air temperature display is only available in base Instrument Cluster (IC) without Electronic Automatic Temperature Control (EATC).

Normal Operation

The outside air temperature sensor is mounted on the radiator core support in front of the radiator and A/C condenser and is hardwired to the IC through input circuit VH407 (YE/GN) and return circuit RMC32 (GN/BU). The IC provides a reference voltage to the ambient air temperature sensor and monitors the change in voltage resulting from changes in resistance as determined by outside air temperature. When the engine has been off for an extended period of time, or the engine temperature is cold, the IC displays the current outside air temperature as measured by the ambient air temperature sensor. When the engine has only been turned off for a short time, or if the engine is not cold, the IC takes a reading of the current temperature and compares the current reading against the last reading at key off. If the temperature is less than the last key off temperature reading, the IC displays the current temperature. If the temperature is greater than the last key off temperature reading, the IC displays the last key off temperature reading until the ambient air temperature has had time to stabilize with vehicle movement.

- DTC B1255 (Air Temperature External Sensor Circuit Open) - a continuous and on-demand DTC that sets if the IC detects an open on the outside air temperature sensor input circuit VH407 (YE/GN). If the IC detects an open on the outside air temperature input, the IC defaults the display to 23.5° Celsius (75° F).
- DTC B1257 (Air Temperature External Sensor Circuit Short to Ground) - a continuous and on-demand DTC that sets if the IC detects a short to ground on the outside air temperature sensor input circuit VH407 (YE/GN). If the IC detects a short to ground on the outside air temperature input, the IC defaults the display to 23.5° Celsius (75° F).

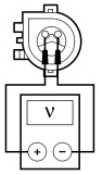
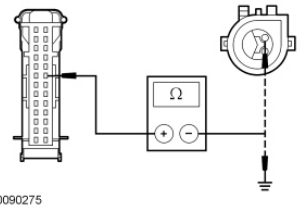
This pinpoint test is intended to diagnose the following:

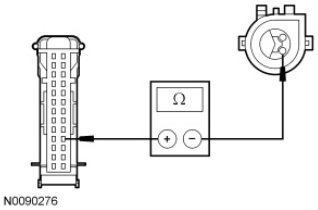
- Wiring, terminals or connectors
- Ambient air temperature sensor
- IC

PINPOINT TEST AE: THE OUTSIDE AIR TEMPERATURE DISPLAY DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AE1 RETRIEVE AND RECORD THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS	
• Check for recorded instrument cluster (IC) DTCs from the continuous and on-demand self-tests. • **Are DTCs B1255 or B1257 retrieved?**	**Yes** GO to AE2 . **No** If the outside air temperature display is inoperative, GO to AE7 . If the outside air temperature display is inaccurate, GO to AE5 .
AE2 CHECK THE AMBIENT AIR TEMPERATURE SENSOR FUNCTION	

• Ignition OFF. • Disconnect: Ambient Air Temperature Sensor C132. • Ignition ON. • Measure the voltage between the ambient air temperature sensor C132-1, circuit VH407 (YE/GN), harness side and the ambient air temperature sensor C132-2, circuit RMC32 (GN/BU), harness side.  N0084209 • **Is the voltage approximately 5 volts?**	**Yes** INSTALL a new ambient air temperature sensor. REFER to Section 412-01 . CLEAR the DTCs. REPEAT the self-test. **No** GO to AE3 .
AE3 CHECK CIRCUIT VH407 (YE/GN) FOR AN OPEN AND A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Instrument Cluster (IC) C220a. • Measure the resistance between the instrument cluster (IC) C220a-13, circuit VH407 (YE/GN), harness side and the ambient air temperature sensor C132-1, circuit VH407 (YE/GN), harness side; and between the instrument cluster (IC) C220a-13, circuit VH407 (YE/GN), harness side and ground.  N0090275 • **Is the resistance less than 5 ohms between the instrument cluster (IC) and the ambient air temperature sensor, and greater than 10,000 ohms between the instrument cluster (IC) and ground?**	**Yes** GO to AE4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
AE4 CHECK CIRCUIT RMC32 (GN/BU) FOR AN OPEN AND A SHORT TO GROUND	
• Measure the resistance between the instrument cluster (IC) C220a-14, circuit RMC32 (GN/BU), harness side and the ambient air temperature sensor C132-2, circuit RMC32 (GN/BU), harness side.	**Yes** GO to AE7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



- **Is the resistance less than 5 ohms between the instrument cluster (IC) and the ambient air temperature sensor, and greater than 10,000 ohms between the instrument cluster (IC) and ground?**

AE5 VERIFY THE SPEEDOMETER OPERATION

- Operate the vehicle and verify the speedometer operation.
- **Does the speedometer operate correctly?**

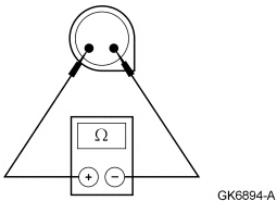
Yes
GO to AE6 .

No
GO to Pinpoint Test G .

AE6 CHECK THE AMBIENT AIR TEMPERATURE SENSOR FUNCTION

- Ignition OFF.
- Disconnect: Ambient Air Temperature Sensor C132.
- Measure the resistance between the ambient air temperature sensor C132 pin 1, component side and the ambient air temperature sensor C132 pin 2, component side according to the following table.

Ambient Air Temperature	Ambient Air Temperature Sensor Resistance
0-10°C (32-50°F)	91K-62K ohms
10-20°C (50-68°F)	56K-39K ohms
20-30°C (68-86°F)	35K-25K ohms
30-40°C (86-104°F)	23K-17K ohms



- **Does the ambient air temperature sensor resistance match the ambient air temperature according to the table?**

Yes
The system is operating normally at this time. Explain to the customer the normal operation of the system.

No
INSTALL a new ambient air temperature sensor. CLEAR the DTCs. REPEAT the self-test.

AE7 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect all the instrument cluster (IC) connectors.
- Check for:

Yes
INSTALL a new instrument cluster (IC). REFER to

♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the instrument cluster (IC) connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AF: The WASHER FLUID LOW LEVEL Warning Is Inoperative

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The Instrument Cluster (IC) is hardwired to the low washer fluid switch (part of the windshield washer reservoir) through circuit CMC20 (VT). The low washer fluid switch closes when the washer fluid level is approximately one-third full, providing a ground to the IC through circuit GD108 (BK/VT) and displaying the WASHER FLUID LOW LEVEL warning. When the washer fluid is above the low level, the low washer fluid switch opens, removing the ground to the IC , and the WASHER FLUID LOW LEVEL warning turns off.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Washer fluid level switch (part of the windshield washer reservoir)
- IC

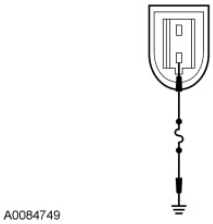
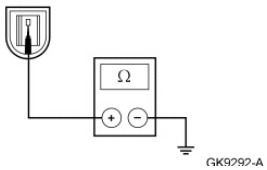
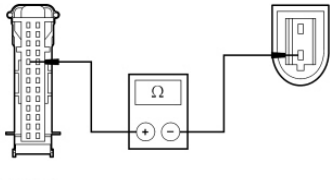
PINPOINT TEST AF: THE WASHER FLUID LOW LEVEL WARNING IS INOPERATIVE

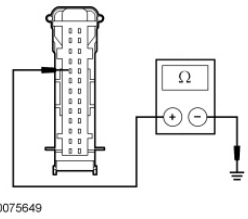
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Verify that the washer fluid reservoir is full and that the key has been cycled at least once prior to carrying out the pinpoint test.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AF1 DETERMINE THE CONDITION	
• Ignition ON. • **Does the WASHER FLUID LOW LEVEL warning display?**	**Yes** GO to AF5 . **No** GO to AF2 .
AF2 CHECK THE WASHER FLUID LEVEL SWITCH	

• Ignition OFF. • Disconnect: Washer Fluid Level Switch C138. • Connect a fused jumper wire between the washer fluid level switch C138-2, circuit CMC20 (VT), harness side and ground.  A0084749 • Ignition ON. • Wait one minute. • **Does the WASHER FLUID LOW LEVEL warning display?**	**Yes** REMOVE the jumper wire. GO to AF3 . **No** REMOVE the jumper wire. GO to AF4 .
AF3 CHECK CIRCUIT GD108 (BK/VT) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the washer fluid level switch C138-1, circuit GD108 (BK/VT), harness side and ground.  GK9292-A • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new windshield washer reservoir. REFER to Section 501-16 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
AF4 CHECK CIRCUIT CMC20 (VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: IC C220. • Measure the resistance between the IC C220-9, circuit CMC20 (VT), harness side and the washer fluid level switch C138-2, circuit CMC20 (VT), harness side.  N0090277 • **Is the resistance less than 5 ohms?**	**Yes** GO to AF7 . **No** REPAIR the circuit. TEST the system for normal operation.
AF5 CHECK THE WASHER FLUID LEVEL SWITCH OPERATION	

• Ignition OFF. • Disconnect: Washer Fluid Level Switch C138. • Ignition ON. • Wait one minute. • Monitor the WASHER FLUID LOW LEVEL warning. • **Does the WASHER FLUID LOW LEVEL warning turn off?**	**Yes** INSTALL a new windshield washer reservoir. REFER to Section 501-16 . TEST the system for normal operation. **No** GO to AF6 .
AF6 CHECK CIRCUIT CMC20 (VT) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: IC C220. • Measure the resistance between the IC C220-9, circuit CMC20 (VT), harness side and ground.  N0075649 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AF7 . **No** REPAIR the circuit. TEST the system for normal operation.
AF7 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AG: The CHECK CHARGING SYSTEM Warning Is Inoperative

Normal Operation

The charging system warning is controlled by the Instrument Cluster (IC) based upon the data received from the PCM over the High Speed Controller Area Network (HS-CAN).

This pinpoint test is intended to diagnose the following:

- Charging system
- IC

PINPOINT TEST AG: THE CHECK CHARGING SYSTEM WARNING IS INOPERATIVE

Test Step	Result / Action to Take
AG1 CHECK THE MESSAGE CENTER OPERATION	
• Start the engine. • Close all doors. • Open the driver door. • **Does the DOOR AJAR message display in the message center?**	**Yes** GO to AG2 . **No** INSTALL a new IC . REFER to Section 413-01 . TEST the system for normal operation.
AG2 RETRIEVE THE RECORDED DTCs FROM THE PCM KOEO SELF-TEST	
• Check for recorded PCM DTCs from the Key ON Engine OFF (KOEO) self-test. • **Are any charging system DTCs recorded?**	**Yes** REFER to Section 414-00 . **No** GO to AG3 .
AG3 CHECK THE CHARGING SYSTEM OPERATION	
• Check the charging system operation. REFER to Section 414-00 . • **Does the charging system operate correctly?**	**Yes** GO to AG4 . **No** REFER to Section 414-00 .
AG4 RETRIEVE THE RECORDED DTCs FROM THE IC SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Are any DTCs recorded?**	**Yes** For DTC U1900, REFER to Section 418-00 . For all other DTCs, REFER to DTC Charts in this section. **No** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation.

Pinpoint Test AH: The Key-In-Ignition Warning Chime Is Inoperative

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

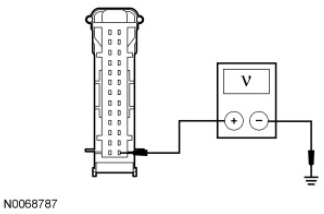
When the key is inserted into the ignition lock cylinder, the key-in-ignition switch (part of the ignition switch) closes, providing a voltage signal to the Instrument Cluster (IC) through circuit CDC30 (BU/GY). The door ajar status is communicated to the IC from the Smart Junction Box (SJB) through the Medium Speed Controller Area Network (MS-CAN). If the IC detects that the ignition switch is in the OFF or ACC position, the key is inserted in the ignition lock cylinder, and the SJB communicates to the IC that the driver door is ajar, the key-in-ignition warning chime sounds.

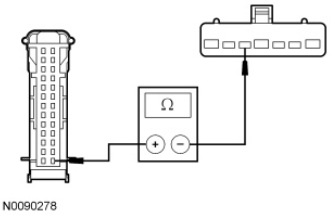
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Key-in-ignition switch (part of the ignition switch)
- IC

PINPOINT TEST AH: THE KEY-IN-IGNITION WARNING CHIME IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AH1 CHECK THE DOOR AJAR INDICATOR	
• Make sure all the doors are closed. • While observing the door ajar warning indicator, open the driver door. • **Is the door ajar warning indicator illuminated with the driver door open?**	**Yes** GO to AH2 . **No** GO to Pinpoint Test S .
AH2 CHECK CIRCUIT CDC30 (BU/GY) FOR VOLTAGE	
• Ignition OFF. • Disconnect: IC C220. • Place the key into the ignition cylinder. • Measure the voltage between the IC C220-14, circuit CDC30 (BU/GY), harness side and ground.  N0068787 • **Is the voltage greater than 10 volts?**	**Yes** GO to AH4 . **No** GO to AH3 .
AH3 CHECK CIRCUIT CDC30 (BU/GY) FOR AN OPEN	
• Disconnect: Ignition Switch C250. • Measure the resistance between the IC C220-14, circuit CDC30 (BU/GY), harness side and the ignition switch C250-5, circuit CDC30 (BU/GY), harness side.	**Yes** INSTALL a new ignition switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 • **Is the resistance less than 5 ohms?**	
AH4 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AI: The Headlamps On Warning Chime Is Inoperative

Normal Operation

The headlamps on warning chime sounds when the driver door is opened with the ignition switch in the OFF position, the key not in the ignition lock cylinder, and the headlamp switch is in the HEADLAMP or PARKING LAMP position. The Smart Junction Box (SJB) communicates to the Instrument Cluster (IC) when the headlamps or parking lamps are on and the driver door is opened. The autolamps feature must not be selected for the headlamps on warning chime to operate.

This pinpoint test is intended to diagnose the following:

- IC

PINPOINT TEST AI: THE HEADLAMPS ON WARNING CHIME IS INOPERATIVE

Test Step	Result / Action to Take
AI1 CHECK THE EXTERIOR LAMPS FOR OPERATION	
• Turn the headlamp switch to the HEADLAMP or PARKING LAMP position. • **Do the headlamps or parking lamps illuminate with the headlamp switch in the PARKING LAMP position?**	**Yes** GO to AI2 . **No** REFER to Section 417-01 .
AI2 CHECK THE DOOR AJAR INDICATOR	
• Ignition ON. • While observing the door ajar warning indicator,	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the

open the driver door. • **Is the door ajar warning indicator illuminated with the driver door open?**	system for normal operation. **No** GO to Pinpoint Test S .

Pinpoint Test AJ: The Turn Signal On Warning Chime Is Inoperative

Normal Operation

The turn signal on warning chime sounds when the vehicle travels more than 3.2 km (2 miles) with the turn signal on. The Smart Junction Box (SJB) communicates the turn signal switch status to the Instrument Cluster (IC) over the controller area network (CAN). The PCM communicates the odometer rolling count data to the IC over the CAN.

This pinpoint test is intended to diagnose the following:

- Turn signal indication concern
- Odometer rolling count input
- IC

PINPOINT TEST AJ: THE TURN SIGNAL ON WARNING CHIME IS INOPERATIVE

Test Step	Result / Action to Take
AJ1 CHECK THE TURN SIGNAL INDICATORS OPERATION	
• Ignition ON. • Verify the turn signal indicators operation. • **Do the turn signal indicators operate correctly?**	**Yes** GO to AJ2 . **No** GO to Pinpoint Test M .
AJ2 CHECK THE ODOMETER FOR CORRECT OPERATION	
• Drive the vehicle and observe the odometer for correct operation. • **Does the odometer operate correctly?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** GO to Pinpoint Test G .

Pinpoint Test AK: The Chime Sounds When The Driver Door Is Ajar (No Key In Ignition And Headlamps Off)

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

When the key is inserted into the ignition lock cylinder, the key-in-ignition switch (part of the ignition switch) closes, providing a voltage signal to the Instrument Cluster (IC) through circuit CDC30 (BU/GY). The door ajar status is communicated to the IC from the Smart Junction Box (SJB) through the controller area network

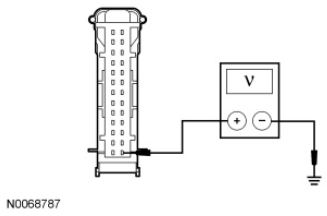
(CAN). If the IC detects that the ignition switch is in the OFF or ACC position, the key is inserted in the ignition lock cylinder, and the SJB communicates to the IC that the driver door is ajar, the key-in-ignition warning chime sounds. The SJB communicates to the IC that the headlamps or parking lamps are on and the driver door is opened. The headlamps on warning chime sounds when the driver door is opened with the ignition switch in the OFF position, the key is not in the ignition lock cylinder, and the headlamp switch is in the HEADLAMP or PARKING LAMP position.

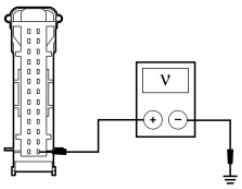
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Key-in-ignition warning switch (part of the ignition switch)
- IC

PINPOINT TEST AK: THE CHIME SOUNDS WHEN THE DRIVER DOOR IS AJAR (NO KEY IN IGNITION AND HEADLAMPS OFF)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
AK1 CHECK THE EXTERIOR LIGHTS FOR OPERATION	
• Turn the headlamp switch to the OFF position. • **Are the headlamps or parking lamps illuminated?**	**Yes** REFER to Section 417-01 . **No** GO to AK2 .
AK2 CHECK CIRCUIT CDC30 (BU/GY) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Remove the key from the ignition lock cylinder. • Disconnect: IC C220. • Measure the voltage between the IC C220-14, circuit CDC30 (BU/GY), harness side and ground.  N0068787 • **Is any voltage present?**	**Yes** GO to AK3 . **No** GO to AK4 .
AK3 CHECK THE IGNITION SWITCH	

• Disconnect: Ignition Switch C250. • Measure the voltage between the IC C220-14, circuit CDC30 (BU/GY), harness side and ground.  N0068787 • **Is any voltage present?**	**Yes** REPAIR circuit CDC30 (BU/GY) for a short to voltage. TEST the system for normal operation. **No** INSTALL a new ignition switch. REFER to Section 211-05 . TEST the system for normal operation.
AK4 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AL: The Safety Belt Warning Chime Does Not Operate Correctly

Normal Operation

The Restraints Control Module (RCM) monitors the operation of the driver safety belt buckle. When the safety belt is buckled and unbuckled, the RCM sends the Instrument Cluster (IC) a status message over the controller area network (CAN). The IC monitors these messages and operates the chime according to the data. The safety belt warning chime sounds when the driver safety belt is not fastened and the ignition key is turned from the OFF/LOCK or ACC to the ON or START position. The safety belt warning chime stops sounding when the safety belt is fastened, when the ignition key is turned from the ON or START position to the OFF/LOCK or ACC position, or when the chime has sounded for approximately 6 seconds.

This pinpoint test is intended to diagnose the following:

- RCM
- IC

PINPOINT TEST AL: THE SAFETY BELT WARNING CHIME DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AL1 RETRIEVE THE RECORDED DTCs FROM THE RCM SELF-TEST	

• Check for recorded RCM DTCs from the self-test. • **Are any RCM DTCs recorded?**	**Yes** REFER to Section 501-20B . **No** GO to AL2 .
AL2 CHECK THE IC SAFETY BELT WARNING INDICATOR OPERATION	
NOTE: The safety belt warning chime stops sounding when the safety belt is fastened , when the ignition key is turned from the ON or START position to the OFF/LOCK or ACC position, or when the chime has sounded for approximately 6 seconds. • Ignition ON. • Following the IC prove-out, observe the safety belt warning indicator with the safety belt buckled and unbuckled. • **Does the safety belt warning indicator operate correctly?**	**Yes** GO to AL3 . **No** GO to Pinpoint Test L .
AL3 CHECK THE IC CHIME FOR OPERATION	
• Enter the following diagnostic mode on the scan tool: IC Self-Test. • Carry out the IC on-demand self-test while listening for the IC chime. • **Does the IC chime operate?**	**Yes** INSTALL a new RCM . REFER to Section 501-20B . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test AM: The Belt-Minder® Feature Does Not Operate Correctly

Normal Operation

The Restraints Control Module (RCM) monitors the operation of the safety belt buckles. When the safety belts are buckled and unbuckled, the RCM sends the Instrument Cluster (IC) a status message over the High Speed Controller Area Network (HS-CAN). The Belt-Minder® reminds the driver that the driver or passenger safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the IC once the vehicle speed has exceeded 5 km/h (3 mph).

This pinpoint test is intended to diagnose the following:

- Belt-Minder® deactivated
- RCM
- IC

PINPOINT TEST AM: THE BELT-MINDER® FEATURE DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
AM1 CHECK THE BELT-MINDER® CONFIGURATION	

• Verify that the Belt-Minder® is activated or configured on for the seating position in question. Refer to Belt-Minder® Deactivating/Activating in this section to configure without a scan tool. • **Is the Belt-Minder® activated for the seating position in question?**	**Yes** GO to AM2 . **No** ACTIVATE the Belt-Minder® for the seating position in question. REFER to Belt-Minder® Deactivating/Activating in this section. TEST the system for normal operation.
AM2 CHECK THE SPEEDOMETER OPERATION	
• Start the engine. • Verify that the speedometer is operating correctly. • **Does the speedometer operate correctly?**	**Yes** GO to AM3 . **No** GO to Pinpoint Test G .
AM3 RETRIEVE THE RECORDED DTCs FROM THE RCM SELF-TEST	
• Check for recorded RCM DTCs from the self-test. • **Are any RCM DTCs recorded?**	**Yes** REFER to Section 501-20B . **No** GO to AM4 .
AM4 CHECK THE IC CHIME FOR OPERATION	
• Enter the following diagnostic mode on the scan tool: IC Self-Test. • Carry out the IC self-test while listening for the IC chime. • **Does the IC chime operate?**	**Yes** INSTALL a new RCM . REFER to Section 501-20B . TEST the system for normal operation. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test AN: The Parking Brake Warning Chime Is Inoperative

Normal Operation

The parking brake warning chime warns that the parking brake is engaged when the vehicle is in motion. The parking brake warning chime sounds if the ignition key is in the RUN position, the parking brake is engaged, and the vehicle speed is greater than 5 km/h (3 mph). The Smart Junction Box (SJB) monitors the parking brake status and when the parking brake is applied or released, the SJB sends the Instrument Cluster (IC) the parking brake status over the controller area network (CAN). The IC monitors these messages and operates the chime according to the data.

This pinpoint test is intended to diagnose the following:

- Brake warning indication
- Vehicle speed input
- IC

PINPOINT TEST AN: THE PARKING BRAKE WARNING CHIME IS INOPERATIVE

Test Step	Result / Action to Take
AN1 CHECK THE BRAKE WARNING INDICATOR OPERATION	
• Ignition ON. • Apply the parking brake. • Observe the brake warning indicator. • **Does the brake warning indicator turn on with the parking brake applied?**	**Yes** GO to AN2 . **No** GO to Pinpoint Test I .
AN2 CHECK THE SPEEDOMETER FOR CORRECT OPERATION	
• Verify the speedometer operates. • **Does the speedometer operate correctly?**	**Yes** GO to AN3 . **No** GO to Pinpoint Test G .
AN3 CHECK THE PARKING BRAKE WARNING CHIME OPERATION	
• Slightly apply the parking brake and drive the vehicle at a speed greater than 5 km/h (3 mph). Observe the parking brake warning chime. • **Does the parking brake warning chime operate correctly?**	**Yes** The system is operating correctly at this time. The vehicle must be moving at a speed greater than 5 km/h (3 mph) with the parking brake applied. **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test AO: DTC B1317

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

- DTC B1317 (Battery Voltage High) - a continuous memory and on-demand DTC that sets in the Instrument Cluster (IC) if the IC detects battery voltage above 16 volts on the B+ keep alive voltage input circuit SBP24 (VT/RD).

This pinpoint test is intended to diagnose the following:

- Charging system concern
- IC

PINPOINT TEST AO: DTC B1317

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: DTC B1317 may be stored in the module memory due to past battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
AO1 CHECK FOR DTC B1317, B1676 OR P0536 SET IN OTHER MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC B1317, B1676 or P0536 (PCM) set in more than one module?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AO2 .
AO2 CHECK THE BATTERY VOLTAGE	
• Turn off all interior/exterior lights and accessories. • Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage. • **Does the battery voltage rise to 15.5 volts or higher?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AO3 .
AO3 RECHECK FOR DTC B1317	
• Turn the engine off. • Ignition ON. • Enter the following diagnostic mode on the scan tool: IC Self-Test. • Clear the continuous memory DTCs. • Carry out the IC self-test. • **Is DTC B1317 present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test AP: DTC B1318

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

- DTC B1318 (Battery Voltage Low) - sets in continuous memory and on-demand if the Instrument Cluster (IC) voltage drops below 9 volts on the B+ keep alive voltage input circuit SBP24 (VT/RD).

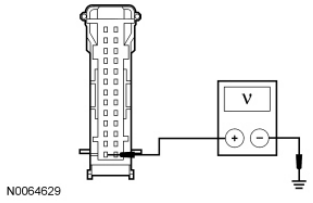
This pinpoint test is intended to diagnose the following:

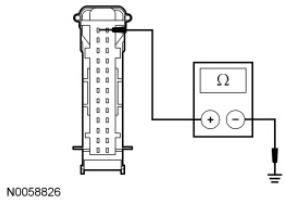
- Wiring, terminals or connectors
- High circuit resistance
- IC

PINPOINT TEST AP: DTC B1318

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AP1 RECHECK THE IC DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC Self-Test. • Clear the DTCs. Repeat the IC self-test. • **Is DTC B1318 still present?**	**Yes** GO to AP2 . **No** The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.
AP2 CHECK THE CHARGING SYSTEM DTCs IN THE PCM	
• Enter the following diagnostic mode on the scan tool: PCM Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC P0620, P0622, P0625, P0626 or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to AP3 .
AP3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Check the battery condition and verify that the battery is fully charged. Refer to Section 414-01 . • **Is the battery OK and fully charged?**	**Yes** GO to AP4 . **No** REFER to Section 414-01 .
AP4 CHECK THE IC VOLTAGE SUPPLY	
• Ignition OFF. • Measure and record the voltage at the battery. • Disconnect: IC C220. • Ignition ON. • Measure the voltage between the IC C220-1, circuit SBP24 (VT/RD), harness side and ground.  	**Yes** GO to AP5 . **No** REPAIR the circuit for high resistance. CLEAR the DTC. REPEAT the self-test.

• **Is the voltage within 0.2 volts of the recorded battery?**	
AP5 CHECK THE IC GROUND CIRCUITS	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the IC C220-13, circuit GD145 (BK/BU), harness side and ground.  N0058826 • **Is the resistance less than 5 ohms?**	**Yes** GO to AP6 . **No** REPAIR the circuit for high resistance. CLEAR the DTC. REPEAT the self-test.
AP6 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AQ: DTC U0140

Normal Operation

- DTC U0140 (Lost Communication With Body Control Module [GEM]) - sets in the Instrument Cluster (IC) if the data messages received from the Smart Junction Box (SJB) over the High Speed Controller Area Network (HS-CAN) are missing for 5 seconds or longer.

This pinpoint test is intended to diagnose the following:

- SJB
- IC

PINPOINT TEST AQ: DTC U0140

Test Step	Result / Action to Take
AQ1 VERIFY CUSTOMER CONCERN	
• Ignition ON.	**Yes** GO to AQ2 .

• Verify that there is an observable symptom present. • **Is an observable symptom present?**	**No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
AQ2 CHECK THE COMMUNICATION NETWORK	
• Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the SJB pass the network test?**	**Yes** GO to AQ3 . **No** REFER to Section 418-00 .
AQ3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Is DTC B1317 or B1318 recorded?**	**Yes** For DTC B1317, GO to Pinpoint Test AO . For DTC B1318, GO to Pinpoint Test AP . **No** GO to AQ4 .
AQ4 RECHECK THE IC DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the IC self-test. • **Is DTC U0140 still present?**	**Yes** GO to AQ5 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
AQ5 CHECK FOR DTC U0140 SET IN OTHER MODULES	
• Clear all DTCs. • Ignition OFF. • Ignition ON. • Wait 10 seconds. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC U0140 set in the Audio Control Module (ACM)?**	**Yes** REFER to Section 418-00 to diagnose no communication with the SJB . **No** INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

Pinpoint Test AR: DTC U0159

Normal Operation

- DTC U0159 (Lost Communication With Parking Assist Control Module [PAM]) - sets in the Instrument Cluster (IC) if data messages received from the Parking Aid Module (PAM) over the Medium Speed Controller Area Network (MS-CAN) are missing for 5 seconds or longer.

This pinpoint test is intended to diagnose the following:

- PAM
- IC

PINPOINT TEST AR: DTC U0159

Test Step	Result / Action to Take
AR1 VERIFY CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to AR2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
AR2 CHECK THE COMMUNICATION NETWORK	
• Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the PAM pass the network test?**	**Yes** GO to AR3 . **No** REFER to Section 418-00 .
AR3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Is DTC B1317 or B1318 recorded?**	**Yes** For DTC 1317, GO to Pinpoint Test AO . For DTC 1318, GO to Pinpoint Test AP . **No** GO to AR4 .
AR4 RECHECK THE IC DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the IC self-test. • **Is DTC U0159 still present?**	**Yes** INSTALL a new PAM . REFER to Section 413-13 . TEST the system for normal operation. REPEAT the IC self-test. If DTC U0159 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation.

	No The system is operating correctly at this time. The DTC may have been set due to high network traffic or intermittent fault condition.

Pinpoint Test AS: DTC U0208

Normal Operation

- DTC U0208 (Lost Communication With Seat Control Module [DSM]) - sets in the Instrument Cluster (IC) if data messages received from the Driver Seat Module (DSM) over the Medium Speed Controller Area Network (MS-CAN) are missing for 5 seconds or longer.

This pinpoint test is intended to diagnose the following:

- DSM
- IC

PINPOINT TEST AS: DTC U0208

Test Step	Result / Action to Take
AS1 VERIFY CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to AS2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
AS2 CHECK THE COMMUNICATION NETWORK	
• Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the DSM pass the network test?**	**Yes** GO to AS3 . **No** REFER to Section 418-00 .
AS3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded IC DTCs from the self-test. • **Is DTC B1317 or B1318 recorded?**	**Yes** For DTC 1317, GO to Pinpoint Test AO . For DTC 1318, GO to Pinpoint Test AP . **No** GO to AS4 .
AS4 RECHECK THE IC DTCs	

NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the IC self-test. • **Is DTC U0208 still present?**	**Yes** INSTALL a new DSM . REFER to Section 419-10 . TEST the system for normal operation. REPEAT the IC self-test. If DTC U0208 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or intermittent fault condition.

Pinpoint Test AT: DTC U0244

Normal Operation

- DTC U0244 (Lost Communication With Running Board Control Module [PRB]) - sets in the Instrument Cluster (IC) if data messages received from the Power Running Board (PRB) module over the Medium Speed Controller Area Network (MS-CAN) are missing for 5 seconds or longer.

This pinpoint test is intended to diagnose the following:

- Power Running Board (PRB) module
- IC

PINPOINT TEST AT: DTC U0244

Test Step	Result / Action to Take
AT1 VERIFY CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to AT2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
AT2 CHECK THE COMMUNICATION NETWORK	
• Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the PRB module pass the network test?**	**Yes** GO to AT3 . **No** REFER to Section 418-00 .
AT3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	

• Check for recorded IC DTCs from the self-test. • **Is DTC B1317 or B1318 recorded?**	**Yes** For DTC 1317, GO to Pinpoint Test AO . For DTC 1318, GO to Pinpoint Test AP . **No** GO to AT4 .
AT4 RECHECK THE IC DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the IC self-test. • **Is DTC U0244 still present?**	**Yes** INSTALL a new PRB module. REFER to Section 501-08 . TEST the system for normal operation. REPEAT the IC self-test. If DTC U0244 is still present, INSTALL a new IC . REFER to Instrument Cluster (IC) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or intermittent fault condition.

Message Center Configuration

Oil Life Reset And Start Value - With Message Center

NOTE: The oil life calculation is set at a maximum of approximately 12,000 km (7,500 miles) or 180 days.

1. From the setup menu, press and release the RESET button to display HOLD RESET IF NEW OIL.
2. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.
3. The message center displays OIL LIFE SET TO 100%.
4. Once the message center displays OIL LIFE SET TO 100%, release the RESET button then press and release the RESET button to reduce the start value (10% for each button press).

Oil Life Reset And Start Value - Without Message Center

NOTE: Oil life calculation is set at a maximum of approximately 12,000 km (7,500 miles) or 180 days.

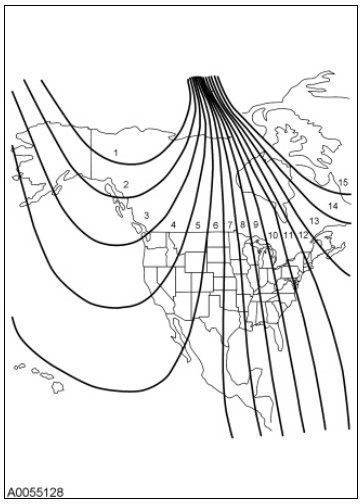
NOTE: All message center functions are carried out using the single stem reset button in the Instrument Cluster (IC).

1. Press and release the SELECT/RESET button to scroll through the information displays until the message center displays HOLD RESET IF NEW OIL.
2. Press and hold the SELECT/RESET button for approximately 2 seconds until the message center displays OIL LIFE SET TO 100%.
3. Once OIL LIFE SET TO 100% is displayed, press and hold the SELECT/RESET button for more than 2 seconds until the message center displays OIL LIFE SET TO XXX%.
4. Press and release the SELECT/RESET button to reduce the start value (10% for each button press).
5. Press and release the SELECT/RESET button to exit the procedure.

Compass Zone Adjustment

With Message Center

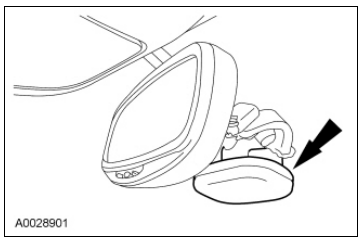
1. Turn the ignition switch to the ON position.
2. From the SETUP menu, select compass zone.
3. Determine which magnetic zone you are in for your geographic location.



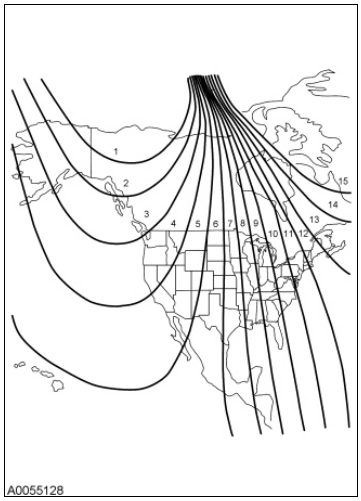
4. Press the RESET button until the message center display changes to show the current zone setting.
5. Press the RESET button repeatedly until the correct zone setting for your geographic location is displayed.
6. Wait 4 seconds when the correct zone is chosen.

Without Message Center - Early Build

1. Turn the ignition switch to the ON position.
2. Locate the reset button on top of the compass sensor located behind the mirror.



3. Determine which magnetic zone you are in for your geographic location.



4. Press and hold the reset button on the compass module for approximately 4 seconds until COMPASS ZONE XX appears in the instrument cluster display.

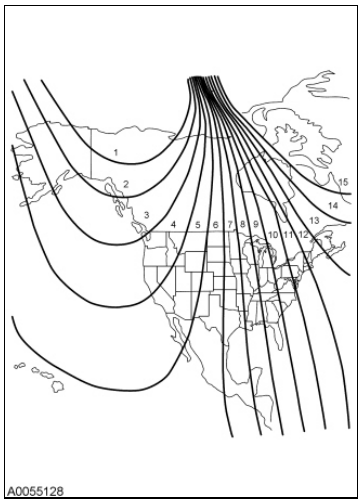
5. Continue to press the reset button until the correct zone setting for your geographic location appears in the instrument cluster display.

6. After 4 seconds, ZONE SET appears in the instrument cluster display. The zone is updated.

Without Message Center - Late Build

1. Turn the ignition switch to the ON position.

2. Determine which magnetic zone you are in for your geographic location.



3. Press and release the SELECT/RESET button until HOLD RESET FOR SYSTEM CHECK is displayed in the integrated circuit display.

4. Quickly release the SELECT/RESET button.

5. Press and release the SELECT/RESET button to scroll through the setup menu until COMPASS ZONE XX is displayed in the integrated circuit display.

6. Press and hold the SELECT/RESET button for approximately 2 seconds to enter the compass zone setting mode.

7. Press and release the SELECT/RESET button until the correct zone setting for your geographic location appears in the integrated circuit display.

8. Release the SELECT/RESET button and allow the setup timer to expire to exit the procedure.

Compass Calibration

With Message Center

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (rear window defrost, heater, A/C, map lamps, wipers, heated windshield, etc.) and make sure all doors are closed.

   Start the vehicle.

2. From the SETUP menu, press the SETUP button to select the compass calibration function.

3. Press the RESET button.

4. **NOTE:** It takes up to 5 circles to complete the calibration.

   NOTE: If not calibrated within 3 minutes or if the RESET button is pressed during CIRCLE SLOWLY TO CALIBRATE, CIRCLE SLOWLY TO CALIBRATE changes to CAL and the calibration process must start over.

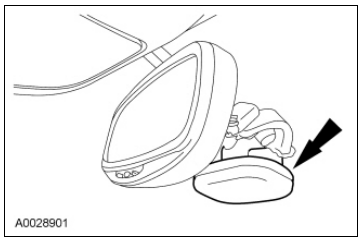
   Slowly drive the vehicle in a circle at no more than 5 km/h (3 mph) until CIRCLE SLOWLY TO CALIBRATE changes to CALIBRATION COMPLETED in the message center.

Without Message Center - Early Build

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (rear window defrost, heater A/C, map lamps, wipers, heated windshield, etc.) and make sure all doors are closed.

   Start the vehicle.

2. Locate the reset button on top of the compass sensor located behind the mirror.



3. Press and hold the reset button on the compass module for approximately 8 seconds until CIRCLE SLOWLY TO CALIBRATE is displayed and release.

4. **NOTE:** It takes up to 5 circles to complete the calibration.

   NOTE: If not calibrated within 3 minutes or if the reset button is pressed during CIRCLE SLOWLY TO CALIBRATE, CIRCLE SLOWLY TO CALIBRATE changes to CAL and the calibration process must start over.

Slowly drive the vehicle in a circle at no more than 5 km/h (3 mph) until CIRCLE SLOWLY TO CALIBRATE changes to CALIBRATION COMPLETE in the Instrument Cluster (IC) display.

Without Message Center - Late Build

1. **NOTE:** For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (rear window defrost, heater A/C, map lamps, wipers, heated windshield, etc.) and make sure all doors are closed.

   Start the vehicle.

2. Press and release the SELECT/RESET button to scroll through the information menu until HOLD RESET FOR SYSTEM CHECK is displayed.

3. Quickly release the SELECT/RESET button.

4. Press and release the SELECT/RESET button to scroll through the setup menu until COMPASS ZONE XX is displayed in the integrated circuit display.

5. Press and hold the SELECT/RESET button for approximately 2 seconds to enter the compass zone setting mode.

6. Release the SELECT/RESET button.

7. Press and hold the SELECT/RESET button until CIRCLE SLOWLY TO CALIBRATE appears in the integrated display.

8. **NOTE:** It can take up to 5 circles to complete the calibration.

   Slowly drive the vehicle in a circle at no more than 5 km/h (3 mph) until CIRCLE SLOWLY TO CALIBRATE changes to CALIBRATION COMPLETE in the IC display.

Belt-Minder® Deactivating/Activating

Preparation

NOTE: The Belt-Minder® Deactivating/Activating procedure can also be carried out using the scan tool.

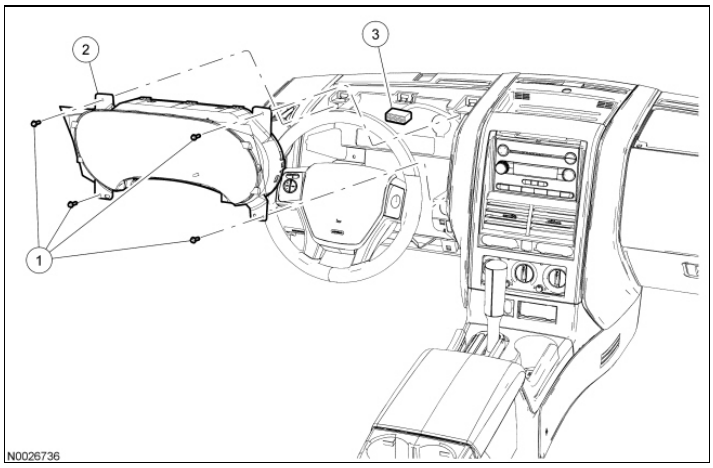
1. Apply the parking brake before deactivating/activating the Belt-Minder®.
2. Place the gear selector lever in PARK (P).
3. Place the ignition switch in the OFF position.
4. Close all the vehicle doors.
5. Unbuckle the driver and the front passenger safety belts.

Deactivating/Activating

1. Turn the ignition switch to the ON position (do not start the engine).
2. Wait until the safety belt warning indicator turns off (approximately 1 minute).
3. **NOTE:** Step 3 must be completed within 50 seconds after the safety belt warning indicator turns off.

   For the seating position being disabled, at a moderate speed, buckle then unbuckle the safety belt 9 times, ending with the safety belt in the unbuckled state. After this step the safety belt warning indicator illuminates for 3 seconds.
4. Within 5 seconds after the safety belt warning indicator turns off, at a moderate speed, buckle then unbuckle the safety belt.
   - This disables the Belt-Minder® feature for that seating position, if it is currently enabled. As confirmation, the safety belt warning indicator flashes 4 times per second for 3 seconds.
   - This enables the Belt-Minder® feature for that seating position, if it is currently disabled. As confirmation, the safety belt warning indicator flashes 4 times per second for 3 seconds followed by a second flash sequence after a brief pause.
5. After confirmation, the deactivation/activation procedure is complete.

Instrument Cluster (IC)



Item	Part Number	Description
1	W707628	Instrument Cluster (IC) screws (4 required)
2	10849	IC
3	-	Electrical connector (part of 14401)

Removal

NOTE: Prior to removal of the Instrument Cluster (IC), it is necessary to download the IC configuration information to the diagnostic tool. For additional information, refer to Section 418-01 .

NOTE: If installing a new IC , all vehicle keys are erased during the parameter reset procedure. Verify at least 2 of the vehicle keys are available prior to carrying out this procedure.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to Section 501-20B .
2. Lower the tilt steering column to the lowest position.
3. Remove the instrument cluster finish panel. For additional information, refer to Section 501-12 .
4. Remove the 4 screws and the IC .
    - Disconnect the electrical connector.

Installation

1. Position the IC in the instrument panel, connect the electrical connector and install the screws.
2. Install the instrument cluster finish panel. For additional information, refer to Section 501-12 .
3. Repower the SRS . For additional information, refer to Section 501-20B .
4. Following installation of the IC , download the module configuration information and the Vehicle Identification Number (VIN) from the scan tool into the new IC . For additional information, refer to Section 418-01 .

5. **NOTE:** If the IC is installed new, updated, or re-configured, the IC requires a parameter reset to allow the IC and the PCM to recognize the Passive Anti-Theft System (PATS) keys. Failure to carry out the parameter reset to the Instrument Cluster (IC) may result in a no start condition.

   Carry out the parameter reset and key programming procedure. For additional information, refer to Section 419-01 .

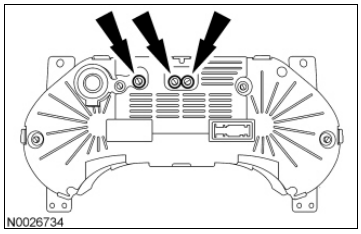
Warning Indicator Bulb

Removal and Installation

1. Remove the Instrument Cluster (IC). For additional information, refer to Instrument Cluster (IC) in this section.

2. **NOTE:** To remove a warning indicator bulb, rotate the bulb one quarter turn counterclockwise and lift it out from the IC .

   Remove the warning indicator bulb(s) in question.



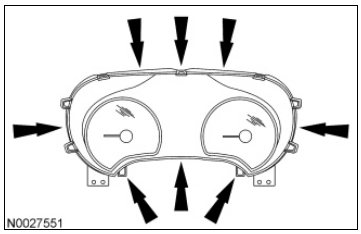
3. To install, reverse the removal procedure.

Instrument Cluster (IC) Lens

Removal and Installation

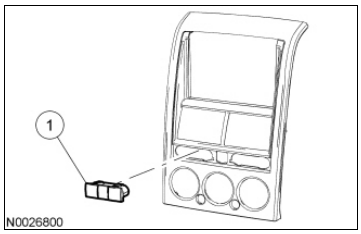
1. Remove the Instrument Cluster (IC). For additional information, refer to Instrument Cluster (IC) in this section.

2. Release the 8 tabs and remove the IC lens and mask assembly.



3. To install, reverse the removal procedure.

Message Center Switch

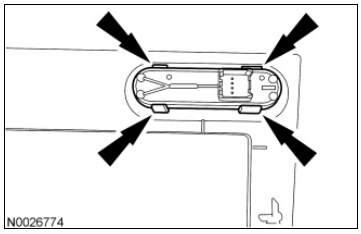


Item	Part Number	Description
1	10D996	Message center switch

Removal and Installation

1. Remove the instrument panel center finish panel. For additional information, refer to Section 501-12 .

2. Press the retaining tabs and remove the message center switch.



3. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Horn nut	10	89

SECTION 413-06: Horn

2009 Explorer/Mountaineer/Explorer Sport Trac Workshop Manual

DESCRIPTION AND OPERATION

Procedure revision date: 08/13/2008

Horn

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The horn system consists of the following components:

- Horn switch (part of the steering wheel)
- Clockspring
- Horn relay (part of the SJB)
- Horn
- SJB

Horn Location

The horn is mounted behind the LH front fender splash shield on the inner side of the fender well.

Horn

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The Battery Junction Box (BJB) supplies voltage to the horn relay (part of the SJB). When the horn switch (part of the steering wheel) is pressed, ground is supplied to the horn relay coil through the clockspring. The horn relay then energizes, sending voltage to the horn, enabling the horn to sound.

The SJB also provides ground to the horn relay coil to sound the horn when the anti-theft system is armed, an intrusion is detected or the panic button is pressed on the Remote Keyless Entry (RKE) transmitter, or to indicate a programming feature sequence.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Horn • Horn switch (part of the steering wheel)	• Smart Junction Box (SJB) fuse 14 (20A) • Wiring, terminals or connectors • Clockspring • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B1217	Horn Relay Coil Circuit Failure	If the horn is inoperative, GO to Pinpoint Test A . If the horn always sounds, GO to Pinpoint Test B .
B1218	Horn Relay Coil Circuit Short to Vbatt	GO to Pinpoint Test A .
All other DTCs	-	REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Horn Is Inoperative

Refer to Wiring Diagrams Cell 44 , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

The horn relay is part of the Smart Junction Box (SJB) and cannot be replaced independently. When the horn switch (part of the steering wheel) is pressed, the switch closes and ground is applied from the steering wheel harness through the clockspring to the horn relay through circuit CRH02 (BU/WH). The horn relay is then energized, applying voltage to the horn through circuit CBP14 (VT/OG), enabling the horn to sound. Ground for the horn is supplied through circuit GD120 (BK/GN).

- DTC B1217 (Horn Relay Coil Circuit Failure) - a continuous and on-demand DTC that sets when the SJB detects an open on the horn relay coil circuit.
- DTC B1218 (Horn Relay Coil Circuit Short to Vbatt) - a continuous and on-demand DTC that sets when the SJB detects a short to voltage on the horn relay coil circuit.

This pinpoint test is intended to diagnose the following:

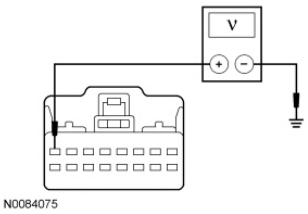
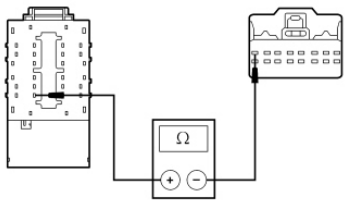
- Fuse
- Wiring, terminals or connectors
- Steering wheel harness
- Horn
- Clockspring
- Horn switch (part of the steering wheel)
- SJB

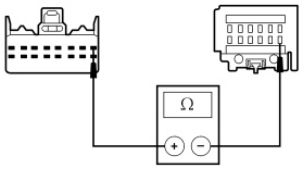
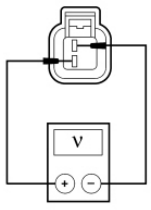
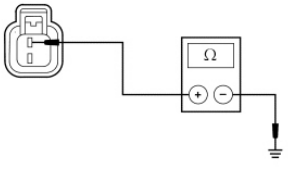
PINPOINT TEST A: THE HORN IS INOPERATIVE

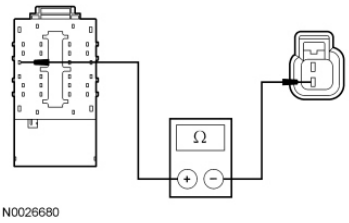
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
A1 CHECK THE SJB OUTPUT	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Select the SJB horn PID (HORNRLY). Active command the horn on and then off. • **Does the horn sound when commanded on?**	**Yes** GO to A2 . **No** GO to A6 .
A2 CHECK CIRCUIT CRH02 (BU/WH) FOR VOLTAGE	

• Ignition OFF. • Depower the Supplemental Restraint System (SRS). Refer to Section 501-20B . • Disconnect: Clockspring C218a. • Connect: Negative Battery Cable. • Measure the voltage between the clockspring C218a-8, circuit CRH02 (BU/WH), harness side and ground.  N0084075 • **Is the voltage greater than 10 volts?**	**Yes** GO to A4 . **No** GO to A3 .
A3 CHECK CIRCUIT CRH02 (BU/WH) FOR AN OPEN	
• Disconnect: SJB C2280c. • Measure the resistance between the clockspring C218a-8, circuit CRH02 (BU/WH), harness side and the SJB C2280c-6, circuit CRH02 (BU/WH), harness side.  N0026512 • **Is the resistance less than 5 ohms?**	**Yes** GO to A9 . **No** REPAIR the circuit. REPOWER the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
A4 CHECK THE CLOCKSPRING FOR AN OPEN	
• Remove the driver air bag module. Refer to Section 501-20B . • Disconnect: Upper Clockspring. • Measure the resistance between the clockspring C218a pin 8, component side and the upper clockspring C218b pin 1, component side.	**Yes** GO to A5 . **No** INSTALL a new clockspring. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

 N0027244 • **Is the resistance less than 5 ohms?**	
A5 CHECK THE STEERING WHEEL HARNESS FOR DAMAGE OR OPENS	
• Inspect the steering wheel harness for damage or opens. • **Is the steering wheel harness OK?**	**Yes** INSTALL a new steering wheel. REFER to Section 211-04 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR or INSTALL a new steering wheel harness. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
A6 CHECK CIRCUIT CBP14 (VT/OG) FOR VOLTAGE	
• Disconnect: Horn C1101. • While pressing the horn switch, measure the voltage between the horn C1101-2, circuit CBP14 (VT/OG), harness side and the horn C1101-1, circuit GD120 (BK/GN), harness side.  N0013171 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new horn. REFER to Horn in this section. CLEAR the DTCs. REPEAT the self-test. **No** VERIFY the SJB fuse 14 (20A) is OK. If OK, GO to A7 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
A7 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the horn C1101-1, circuit GD120 (BK/GN), harness side and ground.  A0032815	**Yes** GO to A8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

• **Is the resistance less than 5 ohms?**	
A8 CHECK CIRCUIT CBP14 (VT/OG) FOR AN OPEN	
• Measure the resistance between the SJB C2280e-17, circuit CBP14 (VT/OG), harness side and the horn C1101-2, circuit CBP14 (VT/OG), harness side.  N0026680 • **Is the resistance less than 5 ohms?**	**Yes** GO to A9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
A9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Horn Is Always On

Refer to Wiring Diagrams Cell 44 , Horn/Cigar Lighter for schematic and connector information.

Normal Operation

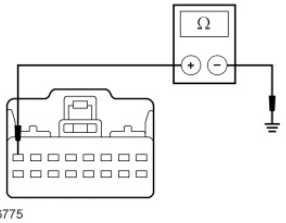
The horn relay is part of the Smart Junction Box (SJB) and cannot be replaced independently. When the horn switch (part of the steering wheel) is pressed, the switch closes and ground is applied from the steering wheel harness through the clockspring to the horn relay through circuit CRH02 (BU/WH). The horn relay is then energized, applying voltage to the horn through circuit CBP14 (VT/OG), enabling the horn to sound.

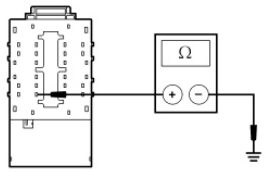
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Steering wheel harness
- Clockspring
- Horn switch (part of the steering wheel)
- SJB

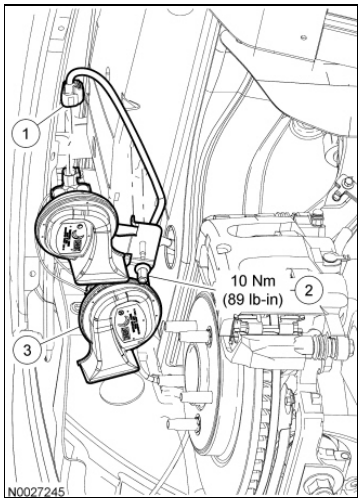
PINPOINT TEST B: THE HORN IS ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 CHECK CIRCUIT CBP14 (VT/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280e. • **Does the horn continue to sound?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to B2 .
B2 CHECK THE HORN SWITCH INPUT	
• Connect: SJB C2280e. • Disconnect: SJB C2280c. • **Does the horn continue to sound?**	**Yes** GO to B6 . **No** GO to B3 .
B3 CHECK CIRCUIT CRH02 (BU/WH) FOR A SHORT TO GROUND	
• Depower the Supplemental Restraint System (SRS). Refer to Section 501-20B . • Disconnect: Clockspring C218a. • Measure the resistance between the clockspring C218a-8, circuit CRH02 (BU/WH), harness side and ground.  N0026775 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to B4 . **No** REPAIR the circuit. REPOWER the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
B4 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	
• Remove the driver air bag module. REFER to Section 501-20B . • Connect: Clockspring C218a. • Measure the resistance between the SJB C2280c-6, circuit CRH02 (BU/WH), harness side and ground.	**Yes** GO to B5 . **No** INSTALL a new clockspring. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.

 N0026515 • **Is the resistance greater than 10,000 ohms?**	
B5 CHECK THE STEERING WHEEL HARNESS FOR DAMAGE OR SHORTS	
• Inspect the steering wheel harness for damage or shorts. • **Is the steering wheel harness OK?**	**Yes** INSTALL a new steering wheel. REFER to Section 211-04 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR or INSTALL a new steering wheel harness. INSTALL the driver air bag module. REFER to Section 501-20B . CLEAR the DTCs. REPEAT the self-test.
B6 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Horn



Item	Part Number	Description
1	-	Electrical connector (part of 14398)
2	-	Horn nut
3	13832	Horn

Removal and Installation

1. Remove the LH front fender splash shield. For additional information, refer to Section 501-02 .

2. Disconnect the electrical connector.

3. Remove the nut and the horn.
   - To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.

General Specifications

Item	Specification
Explorer	
Azimuth system check object position 1 (P1) and position 5 (P5), distance from sensor	46 cm (18 in) rear 50 cm (20 in) side
Azimuth system check object position 2 (P2), 3 (P3) and 4 (P4), distance from sensor	274 cm (9 ft)
Mountaineer, Explorer Sport Trac	
Azimuth system check object position 1 (P1) and position 5 (P5), distance from sensor	30 cm (12 in) rear
Azimuth system check object position 2 (P2) and position 4 (P4), distance from sensor	91 cm (36 in) rear
Azimuth system check object position 3 (P3), distance from sensor	152 cm (60 in) rear

Parking Aid

Explorer

The parking aid system utilizes radar technology only. The parking aid radar sensor is integral to the Parking Aid Module (PAM) and is located in the center of the rear bumper between the bumper isolator and the bumper cover. The parking aid speaker is located in the RH D-pillar area.

The parking aid system consists of the following:

- Radar sensor
- PAM
- Parking aid speaker (audible warning tone)
- Parking aid disable feature (integral to theInstrument Cluster (IC) message center)

Mountaineer, Explorer Sport Trac

The parking aid system utilizes ultrasonic technology only. The 4 parking aid ultrasonic sensors are located in the rear bumper cover.

The parking aid system consists of the:

- Parking aid sensors
- PAM and speaker assembly (located in the passenger lower D-pillar (Mountaineer) or behind the passenger rear seat (Explorer Sport Trac))
- Parking aid disable feature (integral to the IC message center)

Parking Aid - Explorer

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The liftgate must be closed for correct operation of the parking aid system.

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

With the ignition switch in the RUN position, the Parking Aid Module (PAM) detects objects behind the vehicle when the REVERSE (R) gear is selected. The PAM calculates the distance to an object by the use of a radar sensor mounted in the rear bumper. The radar does this by calculating the distance to an object with in a 170 degree semicircular area emitted around the rear of the vehicle.

- At speeds under 4 km/h (2.5 mph), the system reports multiple beeps at ranges of up to 2.6 m (9 ft). A solid tone is reported if an object is within approximately 0.5m (1.5ft).
- At speeds between (2.5-5 mph), the system reports objects up to 5 m (16 ft).
- At speeds above 8 km/h (5 mph), the system reports objects up to 5 m (16 ft) and reports a fast beep alarm indicating time to collision is less than 1.5 seconds.
- The system is not effective at speeds greater than 10 km/h (6 mph) and may not detect certain angular or moving objects.
- Audio system volume is reduced when the PAM speaker is sounding (beeping).

The parking aid system is disabled if any fault is detected, and the message center indicates the parking aid is disabled. The parking aid system is also disabled when the operator selects parking aid disable through the message center. The parking aid system remains disabled until either the ignition key is cycled from OFF to RUN, or parking aid enable is selected through the message center.

The PAM communicates with the scan tool, the Smart Junction Box (SJB) and the Instrument Cluster (IC). The following chart describes network messages used by the PAM .

NOTE: Both the Medium Speed Controller Area Network (MS-CAN) and High Speed Controller Area Network (HS-CAN) are used for intermodule communication. A gateway message is transferred from one network to another network through the Instrument Cluster (IC). Refer to Section 418-00 .

Parking Aid Module (PAM) Network Communication Messages

Broadcast Message	Originating Module	Network Type	Receiving Module
Ignition switch position	Smart Junction Box (SJB)	MS-CAN	Parking Aid Module (PAM)
Parking aid disable switch status	Instrument Cluster (IC)	MS-CAN	PAM
Parking aid system status	PAM	MS-CAN	IC
Transmission selector range (PRNDL)	Transmission Control Module (TCM) (6R60 transmission)	HS-CAN	IC
Transmission selector range (PRNDL)	PCM (5R55S transmission)	HS-CAN	IC
Transmission selector range (PRNDL) (gateway)	IC	MS-CAN	PAM
Vehicle speed	PCM	HS-CAN	IC
Vehicle speed (gateway)	IC	MS-CAN	PAM
Audio system volume cutback request	PAM	MS-CAN	Audio Control Module (ACM)

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Rear bumper height and alignment	• Smart Junction Box (SJB) fuse 18 (10A) • Wiring, terminals or connectors • Parking Aid Module (PAM) • Parking aid speaker • Reversing lamps system

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).
5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM .
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the PAM .

9. **NOTE:** Follow the non-network DTC diagnostics (B-codes, C-codes, P-codes) prior to the network DTC diagnostics (U-codes).

   If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Parking Aid Module (PAM) DTC Chart

DTC	Description	Action
B1317	Battery Voltage High	GO to Pinpoint Test I .
B1318	Battery Voltage Low	GO to Pinpoint Test B .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the Parking Aid Module (PAM) self-test. If DTC B1342 is retrieved again, INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. CLEAR all DTCs. REPEAT the self-test.
C1742	Rear Sounder Circuit Failure	GO to Pinpoint Test C .
C1743	Rear Sounder Circuit Short To Vbatt	GO to Pinpoint Test C .
U0140	Lost Communication with Body Control Module (GEM)	GO to Pinpoint Test J .
U0155	Lost Communication with Instrument Panel Cluster (IPC) Control Module	GO to Pinpoint Test K .
U2023	Fault Received From External Node	DISREGARD this DTC. RETRIEVE and FOLLOW other PAM DTCs.
U2471	Unexpected PRNDL State	GO to Pinpoint Test D .
U2472	Unexpected Ignition State	GO to Pinpoint Test E .
U2473	Unexpected Vehicle Speed (VSS)	GO to Pinpoint Test F .
	-	

All other DTCs		REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: Parking Aid Is Inoperative

Normal Operation

The parking aid system is disabled if any fault is detected, and the message center indicates the parking aid is disabled. The parking aid system may also be disabled when the operator selects parking aid disable through the message center. The parking aid system remains disabled until the fault is corrected, the ignition key is cycled from OFF to RUN (if previously disabled through the message center) or parking aid enable is selected through the message center. The Parking Aid Module (PAM) communicates with the scan tool, the Smart Junction Box (SJB) and the Instrument Cluster (IC) on the Medium Speed Controller Area Network (MS-CAN).

This pinpoint test is intended to diagnose the following:

- PAM

PINPOINT TEST A: PARKING AID IS INOPERATIVE

Test Step	Result / Action to Take
A1 VERIFY THE PAM COMMUNICATES WITH THE SCAN TOOL	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the PAM communicate with the scan tool?**	**Yes** GO to A2 . **No** REFER to Section 418-00 .
A2 CHECK THE DTCs FROM THE PAM ON-DEMAND SELF-TEST	
• Enter the following diagnostic mode on the scan tool: PAM Self-Test. • Retrieve the DTCs from the PAM on-demand self-test. • **Are any DTCs recorded?**	**Yes** REFER to DTC Charts in this section. **No** GO to A3 .

A3 CHECK THE MESSAGE CENTER DISPLAY	
• Observe the message center. • **Does the message center display PARK AID OFF?**	**Yes** ENABLE parking aid in the message center. TEST the system for normal operation. **No** GO to A4 .
A4 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC B1318

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the Parking Aid Module (PAM) on circuit CBP18 (GY/OG) while circuit GD145 (BK/BU) provides ground.

- DTC B1318 (Battery Voltage Low) - a continuous and on-demand DTC that sets if available voltage to the PAM drops below 8 volts for 3 or more seconds.

This pinpoint test is intended to diagnose the following:

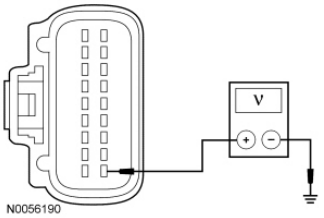
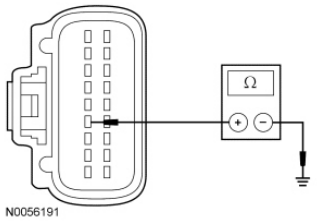
- Wiring, terminals or connectors
- Charging system concern

PINPOINT TEST B: DTC B1318

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
B1 CHECK THE PAM VOLTAGE SUPPLY CIRCUIT	

• Ignition OFF. • Disconnect: PAM C4226. • Ignition ON. • Measure the voltage between the PAM C4226-18, circuit CBP18 (GY/OG), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to B2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
B2 CHECK THE PAM GROUND CIRCUIT	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the PAM C4226-6, circuit GD145 (BK/BU), harness side and ground.  • **Is resistance less than 5 ohms?**	**Yes** REFER to Section 414-00 to diagnose the low battery voltage concern. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTC C1742 Or DTC C1743

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

With the ignition switch in the RUN position and the REVERSE (R) gear selected, the parking aid system calculates the distance to an object by the use of a radar sensor. A variable rate warning tone is generated by the parking aid speaker.

The parking aid speaker tone is controlled by the Parking Aid Module (PAM) through circuit CMP09 (BN/BU) and is grounded through circuit RMP09 (BU/GN). The parking aid speaker is located in the driver D-pillar area.

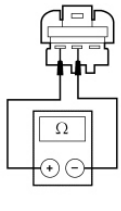
- DTC C1742 (Rear Sounder Circuit Failure) - a continuous and on-demand DTC that sets if the PAM detects a short to ground or open on the rear speaker circuit CMP09 (BN/BU) when the vehicle is in REVERSE (R) and a detectable object is within the azimuth field.
- DTC C1743 (Rear Sounder Circuit Short To Vbatt) - a continuous and on-demand DTC that sets if the PAM detects a short to voltage on the rear speaker circuit CMP09 (BN/BU) when the vehicle is in REVERSE (R) and a detectable object is within the azimuth field.

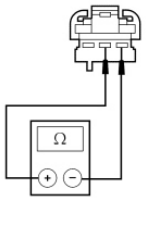
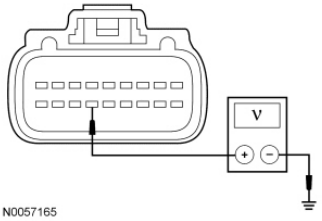
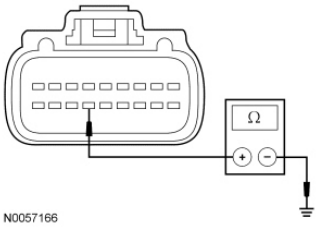
This pinpoint test is intended to diagnose the following:

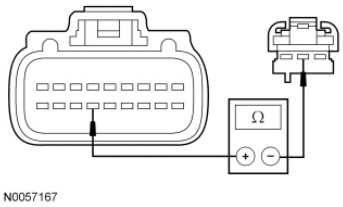
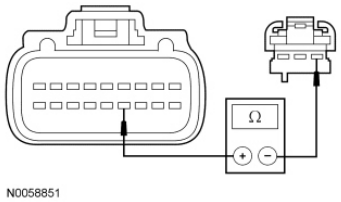
- Wiring, terminals or connectors
- Parking aid speaker
- PAM

PINPOINT TEST C: DTC C1742 OR DTC C1743

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
C1 CHECK THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Enter the following diagnostic mode on the scan tool: PAM Self-Test. • Check the recorded PAM DTCs from the continuous and on-demand and self-test. • **Is DTC C1742 or C1743 recorded?**	**Yes** GO to C2 . **No** REFER to DTC Charts in this section.
C2 MEASURE THE PARKING AID SPEAKER RESISTANCE	
• Ignition OFF. • Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the parking aid speaker pin 1, component side, and the parking aid speaker pin 2, component side.  N0068957 • **Is the speaker resistance between 45 and 57 ohms?**	**Yes** If DTC C1742 was recorded, GO to C3 . If DTC C1743 was recorded, GO to C4 . **No** INSTALL a new parking aid speaker. REFER to Parking Aid Speaker in this section. CLEAR the DTCs. REPEAT the self-test.
C3 CHECK THE PARKING AID SPEAKERS FOR A SHORT TOGETHER	
• Disconnect: PAM C4226. • Measure the resistance between the parking aid speaker C4015-2, circuit CMP09 (BN/BU), harness side, and the parking aid speaker C4015-1, circuit RMP09 (BU/GN), harness side.	**Yes** GO to C5 . **No** REPAIR the circuits. CLEAR the DTCs. REPEAT the self-test.

 N0094173 • **Is the resistance greater than 10,000 ohms?**	
C4 CHECK THE PARKING AID SPEAKER (+) CIRCUIT FOR A SHORT TO VOLTAGE	
• Disconnect: PAM C4226. • Ignition ON. • Measure the voltage between the PAM C4226-15, circuit CMP09 (BN/BU), harness side and ground.  N0057165 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C8 .
C5 CHECK THE PARKING AID SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND	
• Measure the resistance between the PAM C4226-15, circuit CMP09 (BN/BU), harness side and ground.  N0057166 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C6 CHECK THE PARKING AID SPEAKER (+) CIRCUIT FOR AN OPEN	
• Measure the resistance between the PAM C4226-15, circuit CMP09 (BN/BU), harness side and the parking aid speaker C4015-2, circuit CMP09 (BN/BU), harness side.	**Yes** GO to C7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0057167 • **Is the resistance less than 5 ohms?**	
C7 CHECK THE PARKING AID SPEAKER (-) CIRCUIT FOR AN OPEN	
• Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the PAM C4226-13, circuit RMP09 (BU/GN), harness side and the parking aid speaker C4015-1, circuit RMP09 (BU/GN), harness side.  N0058851 • **Is the resistance less than 5 ohms?**	**Yes** GO to C8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C8 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC U2471

Normal Operation

The Parking Aid Module (PAM) receives the PRNDL state from the Instrument Cluster (IC) as a gateway message from the PCM or the Transmission Control Module (TCM).

- DTC U2471 (Unexpected PRNDL State) - a continuous and on-demand DTC that sets when the PAM receives an unknown PRNDL state message from the IC .

This pinpoint test is intended to diagnose the following:

- IC

- Network data fault

PINPOINT TEST D: DTC U2471

Test Step	Result / Action to Take
D1 CHECK THE DTCs FROM THE ON-DEMAND SELF-TEST	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: PAM Self-Test. • Clear the DTCs. Repeat the PAM on-demand self-test. • **Are any DTCs present?**	**Yes** If DTCs U2471 and U0155 are both present, REFER to Section 418-00 to diagnose no communication with the IC . For DTC U2471 only, GO to D2 . **No** System is operating normally at this time.
D2 VERIFY THE REVERSING LAMPS FUNCTION CORRECTLY	
• Move the gearshift lever through the range of positions. • **Do the reversing lamps operate with the gearshift lever in REVERSE (R)?**	**Yes** GO to D3 . **No** REFER to Section 417-01 .
D3 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTC U2472

Refer to Wiring Diagrams Cell 149 , Component Testing for component testing.

Normal Operation

The Parking Aid Module (PAM) receives the PRNDL state from the Smart Junction Box (SJB) as a network message.

- DTC U2472 (Unexpected Ignition State) - a continuous and on-demand DTC that sets when the PAM receives an unknown ignition switch state message.

This pinpoint test is intended to diagnose the following:

- SJB
- Network data fault

PINPOINT TEST E: DTC U2472

Test Step	Result / Action to Take
E1 CHECK THE DTCs FROM THE PAM ON-DEMAND SELF-TEST	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: PAM Self-Test. • Clear the DTCs. Repeat the PAM on-demand self-test. • **Is DTC U2472 present?**	**Yes** GO to E2 . **No** System is operating normally at this time.
E2 CHECK THE DTCs FROM THE SJB SELF-TEST	
• Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Carry out the SJB self-test. • **Is DTC B1359, B1363 and/or B1555 recorded?**	**Yes** REFER to Section 211-05 . **No** GO to E3 .
E3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC U2473

Normal Operation

The Parking Aid Module (PAM) receives the vehicle speed from the Instrument Cluster (IC) as a gateway message from the PCM.

- DTC U2473 (Unexpected Vehicle Speed (VSS)) - a continuous and on-demand DTC that sets when the PAM receives an unknown vehicle speed message.

This pinpoint test is intended to diagnose the following:

- IC fault
- Network data fault

PINPOINT TEST F: DTC U2473

Test Step	Result / Action to Take
F1 CHECK THE DTCs FROM THE PAM ON-DEMAND SELF-TEST	
• Enter the following diagnostic mode on the scan tool: PAM Self-Test. • Check the recorded results from the PAM self-test. • **Is DTC U0155 recorded?**	**Yes** REFER to Section 418-00 . **No** GO to F2 .
F2 CHECK THE SPEEDOMETER OPERATION	
• Observe the speedometer operation while test driving the vehicle. • **Does the speedometer operate correctly?**	**Yes** GO to F3 . **No** REFER to Section 413-01 .
F3 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: Continuous or Intermittent Tone When No Obstacles or Fault Codes Are Present

Normal Operation

With the ignition switch in the RUN position and the REVERSE (R) gear selected, the parking aid system calculates the distance to an object by the use of a radar sensor. The speaker increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 46 cm (18 in) of the vehicle, the warning tone becomes continuous. A dirty, damaged or obstructed rear bumper results in the parking aid system not operating correctly.

This pinpoint test is intended to diagnose the following:

- Rear bumper cover impact damage, alignment or obstruction concerns
- Parking Aid Module (PAM)

PINPOINT TEST G: CONTINUOUS OR INTERMITTENT TONE WHEN NO OBSTACLES OR FAULT CODES ARE PRESENT

Test Step	Result / Action to Take
G1 CARRY OUT REAR BUMPER COVER VISUAL INSPECTION	
• Visually inspect the rear bumper or bumper cover for any of the following conditions: ♦ Dirty or iced over rear bumper cover ♦ Rear bumper cover impact damage ♦ Rear bumper height or alignment incorrect ♦ Rear bumper cover aftermarket add-ons present including but not limited to trailer hitches, emblems, and metallic stickers • **Are any of the above conditions present?**	**Yes** REMOVE the aftermarket equipment or REPAIR the rear bumper cover damage as necessary. **No** GO to G2 .
G2 CARRY OUT THE AZIMUTH AND ELEVATION SYSTEM CHECKS	
• Carry out the azimuth and elevation checks. Refer to Azimuth System Check and Elevation System Check in this section. • **Does the parking aid system pass both system checks?**	**Yes** The system is operating correctly at this time. **No** GO to G3 .
G3 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly.	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

• Operate the system and determine if the concern is still present. • **Is the concern still present?**	

Pinpoint Test H: The Volume Cutback Is Inoperative

Normal Operation

With the ignition switch in the RUN position and the gear selector in REVERSE (R), the parking aid system calculates the distance to an object by the use of a radar sensor. A volume cutback request message is sent to the Audio Control Module (ACM) from the Parking Aid Module (PAM) over the Medium Speed Controller Area Network (MS-CAN) to decrease the volume of the ACM . The sounder increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 46 cm (18 in) of the vehicle, the warning tone becomes continuous.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAM
- ACM

PINPOINT TEST H: THE VOLUME CUTBACK IS INOPERATIVE

Test Step	Result / Action to Take
H1 VERIFY THE PAM COMMUNICATES WITH THE IC MESSAGE CENTER DISPLAY	
• Apply the park brake. • Ignition ON. • Apply the brake pedal and place the gear selector in REVERSE (R). • Disable/enable the parking aid system by pressing the reset button on the message center switch. • **Can the PAM be disabled/enabled in the Instrument Cluster (IC) message center display?**	**Yes** GO to H3 . **No** GO to H2 .
H2 VERIFY THE CORRECT PAM IS INSTALLED	
• Check to make sure the correct PAM is installed. • **Has the PAM been replaced prior?**	**Yes** VERIFY the correct PAM is installed. If correct, GO to H3 . If incorrect, INSTALL the correct PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation. **No** GO to H3

H3 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation. **No** The system is operating correctly at this time.

Pinpoint Test I: DTC B1317

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

The Parking Aid Module (PAM) sets DTC B1317 in continuous memory and on-demand if the PAM detects high battery voltage above 15 volts on circuit CBP18 (GY/OG).

This pinpoint test is intended to diagnose the following:

- Charging system concern
- PAM

PINPOINT TEST I: DTC B1317

NOTE: DTC B1317 may be stored in the module memory due to past battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
I1 CHECK FOR DTC B1317, B1676 OR P0563 SET IN OTHER MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC B1317, B1676 or P0563 (PCM) set in more than 1 module?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to I2 .
I2 CHECK THE BATTERY VOLTAGE	
• Turn off all interior/exterior lights and accessories. • Start and run the engine at approximately 2,000 rpm for 3	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No**

minutes while monitoring the battery voltage. • **Does the battery voltage rise to 15 volts or higher?**	GO to I3 .
I3 RECHECK FOR DTC B1317	
• Turn the engine off. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test. • Clear the continuous memory DTCs. • Carry out the PAM self-test. • **Is DTC B1317 present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation. **No** The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test J: DTC U0140

Normal Operation

Several modules receive network messages from the Smart Junction Box (SJB) via the Medium Speed Controller Area Network (MS-CAN). The information is included in the message is ignition switch position.

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0140 (Lost Communication With Body Control Module (GEM)) - set by the Parking Aid Module (PAM) when network messages are missing from the SJB for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Module communication
- PAM
- SJB

PINPOINT TEST J: DTC U0140

Test Step	Result / Action to Take
J1 VERIFY THE CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to J2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
J2 CHECK THE COMMUNICATION NETWORK	

• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the SJB pass the network test?**	**Yes** GO to J3 . **No** REFER to Section 418-00 .
J3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded PAM DTCs from the self-test. • **Is DTC B1317 or DTC B1318 recorded?**	**Yes** For DTC B1317, GO to Pinpoint Test I . For DTC B1318, GO to Pinpoint Test B . **No** GO to J4 .
J4 RECHECK THE PAM DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the PAM self-test. • **Is DTC U0140 still present?**	**Yes** GO to J5 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
J5 CHECK FOR DTC U0140 SET IN OTHER MODULES	
• Clear all DTCs. • Ignition OFF. • Ignition ON. • Wait 10 seconds. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC U0140 set in any module?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation.

Pinpoint Test K: DTC U0155

Normal Operation

Several modules receive network messages from the Instrument Cluster (IC) via the Medium Speed Controller Area Network (MS-CAN). The following information is included in the messages:

- ♦ Transmission gear selected
- ♦ Vehicle speed
- ♦ Parking aid disable switch status

As more than one module receives these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0155 (Lost Communication With Instrument Panel Cluster (IC) Control Panel) - set by the Parking Aid Module (PAM) when network messages are missing from the IC for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Module communication
- PAM
- IC

PINPOINT TEST K: DTC U0155

Test Step	Result / Action to Take
K1 VERIFY THE CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to K2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
K2 CHECK THE COMMUNICATION NETWORK	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the IC pass the network test?**	**Yes** GO to K3 . **No** REFER to Section 418-00 .
K3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded PAM DTCs from the self-test. • **Is DTC B1317 or DTC B1318 recorded?**	**Yes** For DTC B1317, GO to Pinpoint Test I . For DTC B1318, GO to Pinpoint Test B . **No** GO to K4 .
K4 RECHECK THE PAM DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the PAM self-test. • **Is DTC U0155 still present?**	**Yes** GO to K5 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.

K5 CHECK FOR DTC U0155 SET IN OTHER MODULES	
• Clear all DTCs. • Ignition OFF. • Ignition ON. • Wait 10 seconds. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC U0155 set in any module?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . TEST the system for normal operation. **No** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Explorer in this section. TEST the system for normal operation.

Parking Aid - Mountaineer, Explorer Sport Trac

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The parking aid system detects objects behind the vehicle when the REVERSE (R) gear is selected. The Parking Aid Module (PAM) calculates the distance to an object by the use of 4 ultrasonic sensors mounted in the rear bumper. The PAM does this by calculating the distance to an object within the 170 degree semicircular area around the rear of the vehicle.

The parking aid sensors detect objects approximately 1.8 m (5.9 ft) from the rear of the vehicle, 50 cm (1.6 ft) from the rear side of the vehicle, and 16 cm (6 in) above the ground. A variable rate warning tone is generated from a parking aid speaker attached to the PAM . The parking aid speaker increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 25 cm (10 in) of the sensors, the warning tone becomes continuous.

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The parking aid system is disabled if a fault is detected in 1 of the 4 sensors, the parking aid speaker, or the PAM . This is indicated by the parking aid disabled warning message in the message center. The PAM is on the Medium Speed Controller Area Network (MS-CAN) and can be diagnosed with a scan tool.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical

- Smart Junction Box (SJB) fuse 18 (10A)
- Wiring, terminals or connectors
- Parking Aid Module (PAM)
- Parking aid sensors
- Parking aid speaker

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the PAM .

9. **NOTE:** Follow the non-network DTC diagnostics (B-codes, C-codes, P-codes) prior to the network DTC diagnostics (U-codes).

   If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Parking Aid Module (PAM) DTC Chart

DTC	Description	Action
B1299	Power Supply Sensor Circuit Short to Ground	GO to Pinpoint Test P .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the PAM self-test. If DTC B1342 is retrieved again, INSTALL a new PAM . REFER to Parking Aid

		Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. CLEAR all DTCs. REPEAT the self-test.
B2477	Module Configuration Failure	REFER to Section 418-01 .
C1699	Left Rear Sensor Circuit Short to Vbat	GO to Pinpoint Test N .
C1700	Left Rear Sensor Circuit Failure or Blockage	GO to Pinpoint Test M .
C1701	Left Rear Sensor Circuit Fault	GO to Pinpoint Test O .
C1702	Right Rear Sensor Circuit Short to Vbat	GO to Pinpoint Test N .
C1703	Right Rear Sensor Circuit Failure or Blockage	GO to Pinpoint Test M .
C1704	Right Rear Sensor Circuit Fault	GO to Pinpoint Test O .
C1705	Left Rear Center Sensor Circuit Short to Vbat	GO to Pinpoint Test N .
C1706	Left Rear Center Sensor Circuit Failure	GO to Pinpoint Test M .
C1707	Left Rear Center Sensor Circuit Fault	GO to Pinpoint Test O .
C1708	Right Rear Center Sensor Circuit Short to Vbat	GO to Pinpoint Test N .
C1709	Right Rear Center Sensor Circuit Failure	GO to Pinpoint Test M .
C1710	Right Rear Center Sensor Circuit Fault	GO to Pinpoint Test L .
C1742	Rear Sounder Circuit Failure	GO to Pinpoint Test Q .
C1743	Rear Sounder Circuit Short to Vbat	GO to Pinpoint Test Q .
U0140	Lost Communication With Body Control Module (GEM)	GO to Pinpoint Test R .
U0155	Lost Communication With Instrument Panel Cluster (IC)	GO to Pinpoint Test S .
U2051	One or More Calibration Files Missing/Corrupt	REFER to Section 418-01 .
All other DTCs	-	REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

PID Chart

PID	Description
LRI_DIST	Left rear inner sensor distance to object
LRO_DIST	Left rear outer sensor distance to object
RRI_DIST	Right rear inner sensor distance to object
RRO_DIST	Right rear outer sensor distance to object
LRI_ATTEN	Left rear inner sensor attenuation
LRO_ATTEN	Left rear outer sensor attenuation
RRI_ATTEN	Right rear inner sensor attenuation
RRO_ATTEN	Right rear outer sensor attenuation
TRANSGR	Transmission gear position

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test L: The Parking Aid Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The Parking Aid Module (PAM) receives reverse gear input from the Instrument Cluster (IC) through the Medium Speed Controller Area Network (MS-CAN). Voltage is supplied to the parking aid sensors from the PAM on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG). The system can be disabled through the message center which is part of the IC .

This pinpoint test is intended to diagnose the following:

- Rear bumper cover
- Parking aid sensors alignment
- PAM

PINPOINT TEST L: THE PARKING AID IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
L1 VERIFY THE PAM COMMUNICATES WITH THE SCAN TOOL	

• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the PAM communicate with the scan tool?**	**Yes** GO to L2 . **No** REFER to Section 418-00 .
L2 CHECK THE DTCs FROM THE PAM SELF-TEST	
• Enter the following diagnostic mode on the scan tool: PAM Self-Test. • Retrieve the DTCs from the PAM on-demand self-test. • **Are any PAM DTCs recorded?**	**Yes** REFER to DTC Charts in this section. **No** GO to L3 .
L3 CHECK THE PARKING AID SENSORS FOR CORRECT ALIGNMENT	
NOTE: If the vehicle was in a rear end collision, the parking aid sensors may not be aligned correctly. • Check the bumper for correct alignment. • Carry out the azimuth system check. Refer to Azimuth System Check in this section. • Carry out the elevation system check. Refer to Elevation System Check in this section. • **Does the parking aid system pass both system checks?**	**Yes** GO to L4 . **No** REALIGN or INSTALL a new bumper cover. REFER to Section 501-19 . If the vehicle was in a rear end collision, further body work may be required to bring the parking aid sensors into correct alignment.
L4 CHECK THE PAM REVERSE INDICATION PID	
• Apply the parking brake. • Ignition ON. • Select REVERSE. • Enter the following diagnostic mode on the scan tool: PAM DataLogger. • Monitor the PAM PID (TRANSGR). • **Does the PID indicate YES (transmission in reverse)?**	**Yes** GO to L5 . **No** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section.
L5 CHECK THE MESSAGE CENTER FOR PARKING AID DISABLE SWITCH OPERATION	
• While observing the IC message center, disable and enable the parking aid system. • **Does the message center display PARKING AID OFF when the parking aid system is disabled, and display PARKING AID ON when the parking aid system is activated?**	**Yes** GO to L6 . **No** REFER to Section 413-01 .
L6 CHECK FOR CORRECT PAM OPERATION	

• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: DTCs C1700, C1703, C1706 And C1709

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the Parking Aid Module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

DTC Description	Fault Trigger Conditions
• C1700 - Left Rear Sensor Circuit Failure or Blockage	Sets when any of the left rear parking aid sensor circuits are open or the sensor signal line is shorted to ground.
• C1703 - Right Rear Sensor Circuit Failure or Blockage	Sets when any of the right rear parking aid sensor circuits are open or the sensor signal line is shorted to ground.
• C1706 - Left Rear Center Sensor Circuit Failure	Sets when any of the left rear center parking aid sensor circuits are open or the sensor signal line is shorted to ground.
• C1709 - Right Rear Center Sensor Circuit Failure	Sets when any of the right rear center parking aid sensor circuits are open or the sensor signal line is shorted to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST M: DTCs C1700, C1703, C1706 AND C1709

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>M1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS</td><td></td></tr>
<tr><td>• Check the PAM DTCs from the continuous and on-demand self-tests.
• Are multiple DTCs recorded?</td><td>Yes
GO to M2 .

No
For DTCs C1700, C1703, C1706 or C1709, GO to M3 .

For all other DTCs, REFER to DTC Charts in this section.</td></tr>
<tr><td>M2 CHECK THE BUMPER WIRING HARNESS</td><td></td></tr>
<tr><td>• Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
• Is the bumper wiring harness OK?</td><td>Yes
GO to M3 .

No
REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.</td></tr>
<tr><td>M3 CHECK THE SENSOR CIRCUITRY FOR OPENS</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: Suspect Parking Aid Sensor C4009, C4010, C4011 and C4012.
• Disconnect: PAM C4014 (Mountaineer) or C3267 (Explorer Sport Trac).
• Measure the resistance between the PAM C4014 (Mountaineer) or C3267 (Explorer Sport Trac), harness side and the suspect parking aid sensor, harness side as follows:

Mountaineer

<table>
<tr><th>DTC</th><th>Rear Sensor</th><th>PAM Connector-Pin</th><th>Sensor Connector-Pin</th><th>Circuit</th></tr>
<tr><td>C1700</td><td>LH outer</td><td>C4014-9</td><td>C4009-1</td><td>LMP07 (BU/WH)</td></tr>
<tr><td>C1700</td><td>LH outer</td><td>C4014-15</td><td>C4009-2</td><td>VMP15 (YE/GN)</td></tr>
<tr><td>C1700</td><td>LH outer</td><td>C4014-12</td><td>C4009-3</td><td>RMP07 (GN/WH)</td></tr>
<tr><td>C1703</td><td></td><td>C4014-9</td><td>C4011-1</td><td></td></tr>
</table>
</td><td>Yes
GO to M4 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.</td></tr>
</table>

	RH outer			LMP07 (BU/WH)
C1703	RH outer	C4014-16	C4011-2	VMP17 (YE/OG)
C1703	RH outer	C4014-12	C4011-3	RMP07 (GN/WH)
C1706	LH inner	C4014-9	C4010-1	LMP07 (BU/WH)
C1706	LH inner	C4014-14	C4010-2	VMP14 (WH/OG)
C1706	LH inner	C4014-12	C4010-3	RMP07 (GN/WH)
C1709	RH inner	C4014-9	C4012-1	LMP07 (BU/WH)
C1709	RH inner	C4014-13	C4012-2	VMP16 (YE/GY)
C1709	RH inner	C4014-12	C4012-3	RMP07 (GN/WH)

Explorer Sport Trac

DTC	Rear Sensor	PAM Connector-Pin	Sensor Connector-Pin	Circuit
C1700	LH outer	C3267-9	C4009-1	LMP07 (BU/WH)
C1700	LH outer	C3267-15	C4009-2	VMP15 (YE/GN)
C1700	LH outer	C3267-12	C4009-3	RMP07 (GN/WH)
C1703	RH outer	C3267-9	C4011-1	LMP07 (BU/WH)
C1703	RH outer	C3267-16	C4011-2	VMP17 (YE/OG)
C1703	RH outer	C3267-12	C4011-3	RMP07 (GN/WH)
C1706	LH inner	C3267-9	C4010-1	LMP07 (BU/WH)
C1706	LH inner	C3267-14	C4010-2	VMP14 (WH/OG)
C1706	LH inner	C3267-12	C4010-3	RMP07 (GN/WH)
C1709	RH inner	C3267-9	C4012-1	LMP07 (BU/WH)
C1709	RH inner	C3267-13	C4012-2	VMP16 (YE/GY)

C1709	RH inner	C3267-12	C4012-3	RMP07 (GN/WH)

- **Are the resistances less than 5 ohms?**

M4 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO GROUND

- Measure the resistance between the suspect parking aid sensor, harness side and ground as follows:

DTC	Rear Sensor	Connector-Pin	Circuit
C1700	LH outer	C4009-2	VMP15 (YE/GN)
C1703	RH outer	C4011-2	VMP17 (YE/OG)
C1706	LH inner	C4010-2	VMP14 (WH/OG)
C1709	RH inner	C4012-2	VMP16 (YE/GY)

- **Is the resistance greater than 10,000 ohms?**

Yes
If all of the parking aid sensors recorded DTCs, GO to M5 .

If one or more parking aid sensor(s) recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test.

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

M5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

Yes
INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system for normal operation.

No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: DTCs C1699, C1702, C1705 And C1708

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the Parking Aid Module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

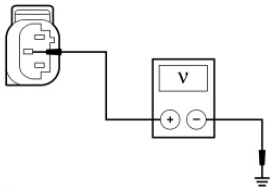
DTC Description	Fault Trigger Conditions
• C1699 - Left Rear Sensor Circuit Short to Vbat	Sets when the left rear parking aid sensor signal line is shorted to voltage.
• C1702 - Right Rear Sensor Circuit Short to Vbat	Sets when the right rear parking aid sensor signal line is shorted to voltage.
• C1705 - Left Rear Center Sensor Circuit Short to Vbat	Sets when the left rear center parking aid sensor signal line is shorted to voltage.
• C1708 - Right Rear Center Sensor Circuit Short to Vbat	Sets when the right rear center parking aid sensor signal line is shorted to voltage.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST N: DTCs C1699, C1702, C1705 AND C1708

Test Step	Result / Action to Take
N1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS	
• Check the PAM DTCs from the continuous and on-demand self-tests. • **Are multiple DTCs recorded?**	**Yes** GO to N2 . **No** For DTC C1699, C1702, C1705 or C1708, GO to N3 . For all other DTCs, REFER to DTC Charts in this section.
N2 CHECK THE BUMPER WIRING HARNESS	
• Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion. • **Is bumper wiring harness OK?**	**Yes** GO to N3 . **No** REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.
N3 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO VOLTAGE	

• Ignition OFF. • Disconnect: Suspect Parking Aid Sensors C4009, C4010, C4011 and C4012. • Disconnect: PAM C4014. • Ignition ON. • Measure the voltage between the suspect parking aid sensor, harness side and ground as follows: **DTC / Rear Sensor / Connector-Pin / Circuit** C1699 / LH outer / C4009-2 / VMP15 (YE/GN) C1702 / RH outer / C4011-2 / VMP17 (YE/OG) C1705 / LH inner / C4010-2 / VMP14 (WH/OG) C1708 / RH inner / C4012-2 / VMP16 (YE/GY)  A0085471 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to N4 .
N4 CHECK THE PARKING AID SENSORS	
• Install a known good parking aid sensor(s) for each of the suspect parking aid sensor(s). • Clear the DTCs. Repeat the self-test. • Test the system for normal operation. • **Is the concern still present?**	**Yes** If all of the parking aid sensors recorded DTCs prior, GO to N5 . If one or more parking aid sensor(s) recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
N5 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system

♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test O: DTCs C1701, C1704, C1707 And C1710

Normal Operation

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The Parking Aid Module (PAM) calculates the distance to an object by the use of 4 ultrasonic sensors mounted in the rear bumper. The parking aid sensors can detect obstructions in the path behind the vehicle.

DTC Description	Fault Trigger Conditions
• C1701 - Left Rear Sensor Circuit Fault	Sets when the left rear parking aid sensor has internally failed or has an incorrect attenuation time.
• C1704 - Right Rear Sensor Circuit Fault	Sets when the right rear parking aid sensor has internally failed or has an incorrect attenuation time.
• C1707 - Left Rear Center Sensor Circuit Fault	Sets when the left rear center parking aid sensor has internally failed or has an incorrect attenuation time.
• C1710 - Right Rear Center Sensor Circuit Fault	Sets when the right rear center parking aid sensor has internally failed or has an incorrect attenuation time.

This pinpoint test is intended to diagnose the following:

- Dirty or obstructed parking aid sensor
- Wiring, terminals or connectors
- Parking aid sensor
- Parking aid bumper harness
- PAM

PINPOINT TEST O: DTCs C1701, C1704, C1707 AND C1710

Test Step	Result / Action to Take
O1 CHECK THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS	

• Check the PAM DTCs from the continuous and on-demand self-tests. • **Are parking aid DTCs other than C1701, C1704, C1707 or C1710 recorded?**	**Yes** DIAGNOSE the other DTCs first. REFER to DTC Charts in this section. **No** GO to O2 .
O2 CHECK THE PARKING AID SENSOR OPERATION	
NOTE: Make sure the area around the vehicle is clear of anything that might activate the parking aid system. • Clean the rear bumper and sensors with high-pressure water. • Carry out the azimuth system check. Refer to Azimuth System Check in this section. • Carry out the elevation system check. Refer to Elevation System Check in this section. • **Does the parking aid system pass both system checks?**	**Yes** The system is operating correctly at this time. The concern may have been caused by a dirty or blocked parking aid sensor. CLEAR the DTCs. REPEAT the self-test. **No** GO to O3 .
O3 CHECK THE PARKING AID SENSOR DISTANCE PIDs	
• Make sure the suspect parking aid sensor(s) is flush-mounted in the bezel. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Parking Aid DataLogger. • **NOTE:** Make sure that no objects are present behind the vehicle. • With the brake pedal applied, shift the transmission into REVERSE (R) and monitor the parking aid sensor distance PID. The PID reads 255 cm (100 in) on a correctly functioning sensor. • **Does the PID read 255 cm (100 in)?**	**Yes** GO to O4 . **No** GO to O5 .
O4 CHECK THE PARKING AID SENSOR ATTENUATION PIDs	
• Check the parking aid sensor attenuation PIDs. • **Do the attenuation PIDs read between 0 and 16?**	**Yes** GO to O6 . **No** GO to O5 .
O5 INSTALL A KNOWN GOOD SENSOR	
• Install a known good sensor for the suspect parking aid sensor. • Ignition ON. • Clear the DTCs. Repeat the self-test. Operate the system and verify the concern is still present.	**Yes** GO to O6 . **No** INSTALL a new parking aid sensor. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs.

• **Is the concern still present?**	REPEAT the self-test.
O6 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: DTC B1299

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the Parking Aid Module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH).

- DTC B1299 (Power Supply Sensor Circuit Short To Ground) - sets when the sensor power supply circuit is shorted to ground or to circuit RMP07 (GN/WH).

This pinpoint test is intended to diagnose the following:

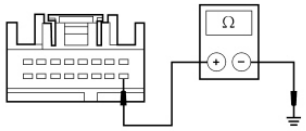
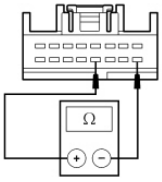
- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST P: DTC B1299

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
P1 CHECK THE BUMPER WIRING HARNESS	
• Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion. • **Is the bumper wiring harness OK?**	**Yes** GO to P2 . **No** REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.
P2 CHECK THE LH OUTER SENSOR FOR AN INTERNAL SHORT	

• Ignition OFF. • Disconnect: Parking Aid Sensor C4009. • Ignition ON. • Clear the DTCs. Repeat the on-demand self-test. • **Is DTC B1299 still present?**	**Yes** GO to P3 . **No** INSTALL a new LH outer parking aid sensor. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test.
P3 CHECK THE RH OUTER SENSOR FOR AN INTERNAL SHORT	
• Ignition OFF. • Disconnect: Parking Aid Sensor C4011. • Ignition ON. • Clear the DTCs. Repeat the on-demand self-test. • **Is DTC B1299 still present?**	**Yes** GO to P4 . **No** INSTALL a new RH outer parking aid sensor. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test.
P4 CHECK THE LH INNER SENSOR FOR AN INTERNAL SHORT	
• Ignition OFF. • Disconnect: Parking Aid Sensor C4010. • Ignition ON. • Clear the DTCs. Repeat the on-demand self-test. • **Is DTC B1299 still present?**	**Yes** GO to P5 . **No** INSTALL a new LH inner parking aid sensor. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test.
P5 CHECK THE RH INNER SENSOR FOR AN INTERNAL SHORT	
• Ignition OFF. • Disconnect: Parking Aid Sensor C4012. • Ignition ON. • Clear the DTCs. Repeat the on-demand self-test. • **Is DTC B1299 still present?**	**Yes** GO to P6 . **No** INSTALL a new RH inner parking aid sensor. REFER to Parking Aid Sensor - Mountaineer, Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test.
P6 CHECK THE PARKING AID SENSOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND	

• Ignition OFF. • Disconnect: PAM C4014 (Mountaineer) or C3267 (Explorer Sport Trac). • Measure the resistance between the PAM C4014-9 (Mountaineer) or C3267-9 (Explorer Sport Trac), circuit LMP07 (BU/WH), harness side and ground.  N0057381 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to P7 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
P7 CHECK THE PARKING AID SENSOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO THE PARKING AID SENSOR GROUND CIRCUIT	
• Ignition OFF. • Measure the resistance between the PAM C4014-9 (Mountaineer) or C3267-9 (Explorer Sport Trac), circuit LMP07 (BU/WH), harness side and the PAM C4014-12 (Mountaineer) or C3267-12 (Explorer Sport Trac), circuit RMP07 (GN/WH).  N0058809 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to P8 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
P8 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Q: DTC C1742 Or DTC C1743

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

A variable rate warning tone is generated from a parking aid speaker. The parking aid speaker increases the warning tone rate as the vehicle gets closer to an obstacle.

- DTC C1742 (Rear Sounder Circuit Failure) - sets when the sounder circuit is open or shorted to ground.
- DTC C1743 (Rear Sounder Circuit Short to VBATT) - sets when the sounder circuit is shorted to voltage.

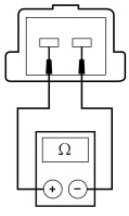
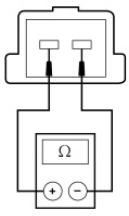
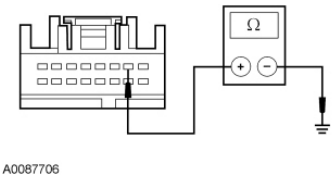
This pinpoint test is intended to diagnose the following:

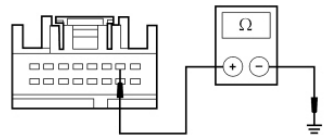
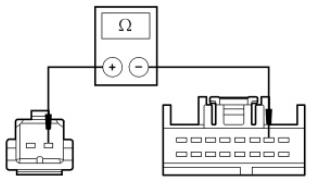
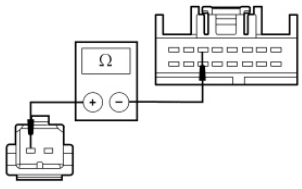
- Wiring, terminals or connectors
- Parking Aid Module (PAM)
- Parking aid speaker

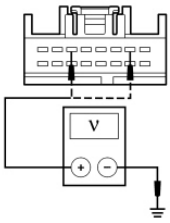
PINPOINT TEST Q: DTC C1742 OR DTC C1743

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
Q1 USE THE RECORDED DTCs FROM THE PAM SELF-TEST	
• Use the recorded results from the PAM self-test. • **Is DTC C1742 or C1743 recorded?**	**Yes** GO to Q2 . **No** All other DTCs, GO to DTC Charts. If no DTCs are recorded, GO to Pinpoint Test L .
Q2 MEASURE THE PARKING AID SPEAKER RESISTANCE	
• Ignition OFF. • Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the parking aid speaker pin 1, component side, and the parking aid speaker pin 2, component side.	**Yes** If DTC C1742 was recorded, GO to Q3 . If DTC C1743 was recorded, GO to Q8 . **No** INSTALL a new parking aid speaker. REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. CLEAR the DTCs. REPEAT the self-test.

 N0062395 • **Is the resistance between 40 and 60 ohms?**	
Q3 MEASURE THE PARKING AID SPEAKER CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between the parking aid speaker C4015-2, circuit CMP09 (BN/BU), harness side and the parking aid speaker C4015-1, circuit RMP09 (BU/GN), harness side.  N0062395 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Q4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
Q4 CHECK THE PARKING AID SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND	
• Connect: Parking Aid Speaker C4015. • Disconnect: PAM C4014 (Mountaineer) or C3267 (Explorer Sport Trac). • Measure the resistance between the PAM , C4014-2 (Mountaineer) or C3267-2 (Explorer Sport Trac), circuit CMP09 (BN/BU), harness side and ground.  A0087706 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Q6 . **No** GO to Q5 .
Q5 CHECK THE PARKING AID SPEAKER (+) CIRCUIT FOR A SHORT TO GROUND WITH THE PARKING AID SPEAKER DISCONNECTED	

• Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the PAM C4014-2 (Mountaineer) or C3267-2 (Explorer Sport Trac), circuit CMP09 (BN/BU), harness side and ground.  A0087706 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR circuit RMP09 (BU/GN). CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit CMP09 (BN/BU). CLEAR the DTCs. REPEAT the self-test.
Q6 CHECK THE PARKING AID SPEAKER (+) CIRCUIT FOR AN OPEN	
• Disconnect: Parking Aid Speaker C4015. • Measure the resistance between the parking aid speaker C4015-2, circuit CMP09 (BN/BU), harness side and the PAM C4014-2 (Mountaineer) or C3267-2 (Explorer Sport Trac), circuit CMP09 (BN/BU), harness side.  A0087707 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
Q7 CHECK THE PARKING AID SPEAKER (-) CIRCUIT FOR AN OPEN	
• Measure the resistance between the parking aid speaker C4015-1, circuit RMP09 (BU/GN), harness side and the PAM C4014-6 (Mountaineer) or C3267-6 (Explorer Sport Trac), circuit RMP09 (BU/GN), harness side.  A0087708 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
Q8 CHECK THE PARKING AID SPEAKER CIRCUITRY FOR A SHORT TO VOLTAGE	

• Disconnect: PAM C4014 (Mountaineer) or C3267 (Explorer Sport Trac). • Ignition ON. • Measure the voltage between the PAM , C4014-2 (Mountaineer) or C3267-2 (Explorer Sport Trac), circuit CMP09 (BN/BU), harness side and ground; and between the PAM , C4014-6 (Mountaineer) or C3267-6 (Explorer Sport Trac), circuit RMP09 (BU/GN), harness side and ground.  A0087727 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to Q8 .
Q9 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test R: DTC U0140

Normal Operation

Several modules receive network messages from the Smart Junction Box (SJB) via the Medium Speed Controller Area Network (MS-CAN). The information is included in the message is ignition switch position.

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0140 (Lost Communication With Body Control Module (GEM)) - set by the Parking Aid Module (PAM) when network messages are missing from the SJB for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Module communication
- PAM

- SJB

PINPOINT TEST R: DTC U0140

Test Step	Result / Action to Take
R1 VERIFY THE CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to R2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
R2 CHECK THE COMMUNICATION NETWORK	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the SJB pass the network test?**	**Yes** GO to R3 . **No** REFER to Section 418-00 .
R3 RECHECK THE PAM DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the PAM self-test. • **Is DTC U0140 still present?**	**Yes** GO to R4 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
R4 CHECK FOR DTC U0140 SET IN OTHER MODULES	
• Clear all DTCs. • Ignition OFF. • Ignition ON. • Wait 10 seconds. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC U0140 set in any module?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system for normal operation.

Pinpoint Test S: DTC U0155

Normal Operation

Several modules receive network messages from the Instrument Cluster (IC) via the Medium Speed Controller Area Network (MS-CAN). The following information is included in the messages:

- ♦ Transmission gear selected
- ♦ Vehicle speed
- ♦ Parking aid disable switch status

As more than one module receives these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0155 (Lost Communication With Instrument Panel Cluster (IC) Control Panel) - set by the Parking Aid Module (PAM) when network messages are missing from the IC for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Module communication
- PAM
- IC

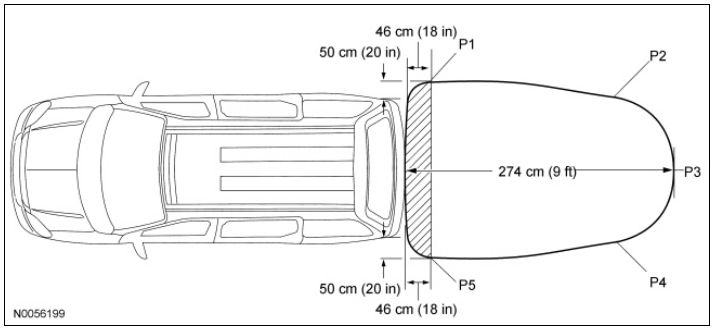
PINPOINT TEST S: DTC U0155

Test Step	Result / Action to Take
S1 VERIFY THE CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to S2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
S2 CHECK THE COMMUNICATION NETWORK	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the IC pass the network test?**	**Yes** GO to S3 . **No** REFER to Section 418-00 .
S3 RECHECK THE PAM DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the PAM self-test. • **Is DTC U0155 still present?**	**Yes** GO to S4 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic.
S4 CHECK FOR DTC U0155 SET IN OTHER MODULES	

• Clear all DTCs. • Ignition OFF. • Ignition ON. • Wait 10 seconds. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC U0155 set in any module?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . TEST the system for normal operation. **No** INSTALL a new PAM . REFER to Parking Aid Module (PAM) - Mountaineer or Parking Aid Module (PAM) - Explorer Sport Trac in this section. TEST the system for normal operation.

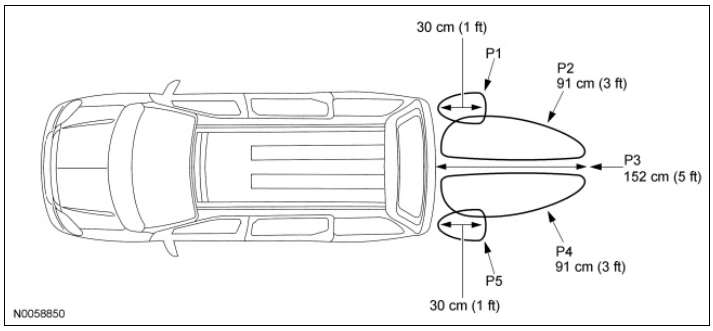
Azimuth System Check

Minimum Detectable Object Locations - Explorer



Minimum Detectable Object Locations - Mountaineer, Explorer Sport Trac

NOTE: Mountaineer shown, Explorer Sport Trac similar.



NOTE: The object used in this system check can be fabricated from 9 cm O.D. (3 in I.D) plastic pipe 100 cm (39 in) in length (available as Polyvinyl Chloride (PVC) pipe, or similar from a hardware or plumbing supply).

NOTE: The following system check should be carried out with the vehicle on a level surface. The specified object locations are approximate, not absolute

NOTE: The parking aid system will default to on when the ignition key is cycled from OFF to ON.

NOTE: For Explorer Sport Trac and Mountaineer only, the scan tool may be used to monitor distance PIDs. The distance PIDs read between 0 and 255 cm (0 and 8 ft) on a correctly functioning system.

1. Turn the ignition to the ON position, engine off.

2. Set the parking brake on.

3. Place the gear shift in REVERSE (R).

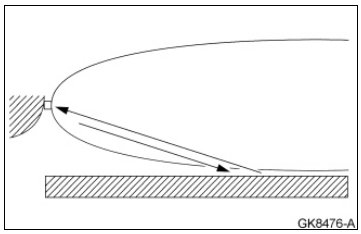
4. Verify that the parking aid system detects the specified object when placed within the 5 specified locations (P1, P2, P3, P4, P5). The pipe should be inside of these locations.
   - The speaker should beep slowly when objects are detected on the outer edges of the detection zone, and increase as the object is moved closer to the vehicle.

- When the object is within 46 cm (18 in) of the rear bumper, the sounder should be on continuously.
- If the Parking Aid Module (PAM) does not detect the object above, refer to Parking Aid - Explorer or Parking Aid - Mountaineer, Explorer Sport Trac in the Diagnosis and Testing portion of in this section.

Elevation System Check

1. **NOTE:** The following system check should be carried out with the vehicle on a 3.0 m wide by 4.5 m deep (10 ft wide by 15 ft deep) smooth concrete surface, free of all obstacles and noise from fan and pneumatic tools.

   Turn the ignition to the ON position, engine off.

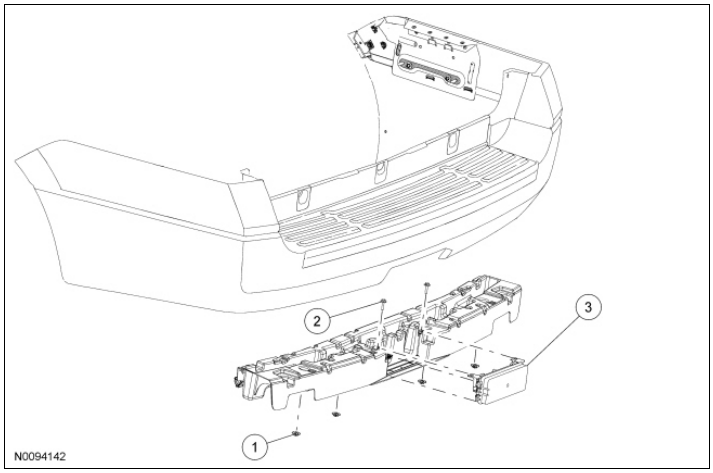


2. Set the parking brake.

3. Place the gear shift in REVERSE (R).

4. Verify that no audible alerts are heard. If audible alerts are heard, check to make sure the bumper is correctly installed and is not tilted downward so that the sensor is pointing at the ground.
   - If the audible warning tone is heard, refer to Parking Aid - Explorer or Parking Aid - Mountaineer, Explorer Sport Trac in the Diagnosis and Testing portion of in this section.

Parking Aid Module (PAM) - Explorer

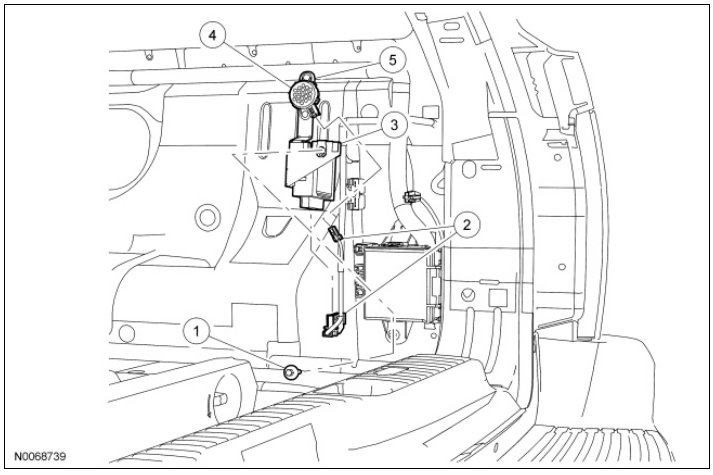


Item	Part Number	Description
1	-	Insulator-to-bumper cover nuts (4 required)
2	W505425-S	Parking Aid Module (PAM) bolts (2 required)
3	15K859	PAM

Removal and Installation

1. Disconnect the Parking Aid Module (PAM) bumper harness from the body harness.
2. Remove the rear bumper cover. For additional information, refer to Section 501-19 .
3. Remove the 4 insulator-to-bumper cover nuts and the insulator from the bumper cover.
4. Disconnect the PAM bumper harness from the PAM .
5. Remove the 2 PAM bolts.
6. Remove the PAM assembly.
7. To install, reverse the removal procedure.

Parking Aid Module (PAM) - Mountaineer



Item	Part Number	Description
1	W505413-S309	Parking Aid Module (PAM) bracket screw
2	-	PAM and parking aid speaker wiring harness connectors (part of 15K866)
3	15K866	PAM and bracket assembly
4	15A866	Parking aid speaker
5	-	Parking aid speaker push pins (2 required)

Removal and Installation

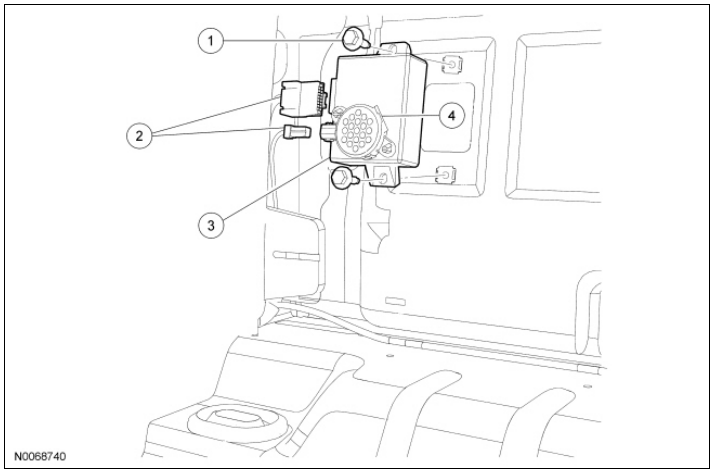
1. Remove the RH quarter trim panel. For additional information, refer to Section 501-05 .

2. If replacing the parking aid speaker only, proceed as follows:
   - Disconnect the parking aid speaker electrical connector.
   - Remove the parking aid speaker push pins.
   - Remove the parking aid speaker.

3. If replacing the Parking Aid Module (PAM), proceed as follows:
   - Disconnect the electrical connectors.
   - Remove the PAM screw.
   - Remove the PAM .

4. To install, reverse the removal procedure.

Parking Aid Module (PAM) - Explorer Sport Trac



Item	Part Number	Description
1	W702434-S439	Parking Aid Module (PAM) bracket screw
2	-	PAM and parking aid speaker wiring harness connectors (part of 13A409)
3	15K866	PAM and bracket assembly
4	15A866	Parking aid speaker

Removal and Installation

1. Remove the cab rear trim panel. For additional information, refer to Section 501-05 .

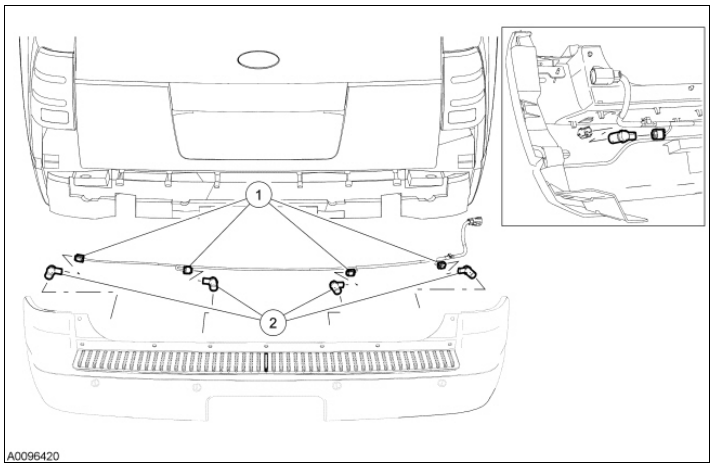
2. If replacing the parking aid speaker only, proceed as follows:
   - Disconnect the parking aid speaker electrical connector.
   - Disengage the parking aid speaker clips.
   - Remove the parking aid speaker.

3. If replacing the Parking Aid Module (PAM), proceed as follows:
   - Disconnect the electrical connectors.
   - Remove the PAM screw.
   - Remove the PAM .

4. To install, reverse the removal procedure.

Parking Aid Sensor - Mountaineer, Explorer Sport Trac

NOTE: Mountaineer shown, Explorer Sport Trac similar.

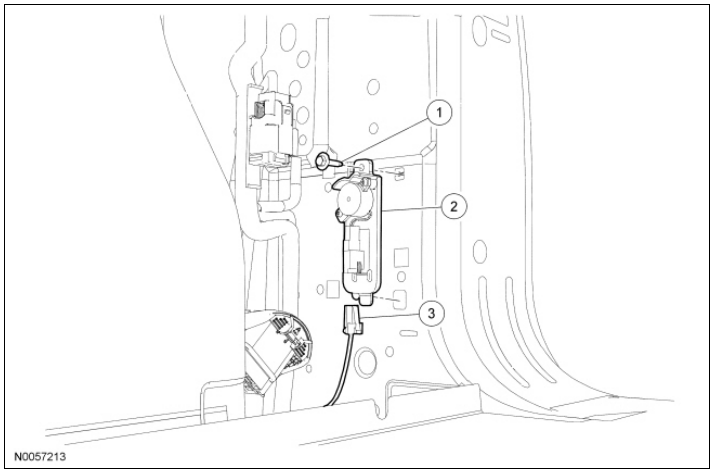


Item	Part Number	Description
1	-	Parking aid sensor electrical connectors (part of 15K868)
2	14489	Parking aid sensors

Removal and Installation

1. Remove the rear bumper cover. For additional information, refer to Section 501-19 .
2. Disconnect the parking aid sensor(s) electrical connector(s).
3. Press the retaining tabs and remove the parking aid sensor(s).
4. To install, reverse the removal procedure.

Parking Aid Speaker



Item	Part Number	Description
1	-	Parking aid speaker bracket bolt
2	-	Parking aid speaker and bracket assembly
3	-	Parking aid speaker electrical connector

Removal and Installation

1. Remove the LH C-pillar trim panel. For additional information, refer to Section 501-05 .

2. Remove the bolt and the speaker and bracket assembly.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

General Specifications

Item	Specification
Generator - 4.0L	
Generator pulley ratio	2.63:1
Rating	70 amps @ 500 rpm (min) to 105 amps @ 2,000 rpm (max)
Voltage regulator type	Electronic internal with generator
Generator - 4.6L	
Generator pulley ratio	2.72:1
Rating	82 amps @ 500 rpm (min) to 155 amp @ 2,000 rpm (max)
Voltage regulator type	Electronic internal with generator

Torque Specifications

Description	Nm	lb-ft	lb-in
Generator B+ terminal nut	17	-	150
Generator bolts (4.0L)	47	35	-
Generator bolts (4.6L)	25	18	-
Generator bracket bolts (4.6L)	10	-	89
Generator pulley nut	109	80	-
Radial arm adapter nut	9	-	80

Charging System

The charging system is a negative ground system consisting of:

- a generator with an internal voltage regulator.
- a charging system warning indicator.
- a battery.
- circuitry and cables.
- a PCM.
- a radial arm adapter (serviceable separately from the generator)

The generator is driven by the accessory drive belt. When the engine is started, the generator begins to generate AC which is internally converted to DC. The DC is controlled by the voltage regulator (located on the rear of the generator) and supplied to the battery. The PCM controls the voltage regulation set point, working with the generator internal voltage regulator over 2 control and communication circuits.

Principles of Operation

The PCM-controlled charging system, or "Smart Charge" charging system, determines the optimal voltage set point for the charging system and communicates this information to the voltage regulator. The "Smart Charge" charging system is designed to set 1 of 6 DTCs any time a charging system fault is present. All of the DTCs can set continuous faults, but not all DTCs will set as on-demand faults.

DTC	KOEO	KOER	Continuous
P0562	X	X	X
P0563	X	X	X
P0620			X
P0625		X	X
P0626		X	X
P065B			X

This system uses 2 communication lines between the PCM and the generator/voltage regulator. Both of these communication lines use Pulse-Width Modulation (PWM). The generator communication (GENCOM) line communicates the desired set point from the PCM to the voltage regulator. The generator monitor (GENMON) line communicates the generator load and error conditions to the PCM. The GENCOM command is only sent by the PCM when it is necessary to adjust the voltage set point. If the set point does not need to be changed, several seconds may elapse between PCM GENCOM commands. This normal operation will appear in the PID as occasional "bursts" of pulse-width commands. The third pin on the voltage regulator, the A circuit pin, is a circuit dedicated to monitor or sense battery voltage.

The PCM simultaneously controls and monitors the output of the generator. When the current consumption is high or the battery is discharged, the PCM will raise engine speed as needed to increase generator output. The generator charges the battery and at the same time supplies power for all of the electrical loads that are required. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm. The PCM is able to adjust the charging voltage according to the battery temperature by using a signal from the Intake Air Temperature (IAT) sensor. The PCM also uses other inputs to control charging system voltage such as the Vehicle Speed Sensor (VSS) and Engine Coolant Temperature (ECT). The voltage set point is calculated by the PCM and communicated to the voltage regulator by the GENCOM circuit based on the needs of the vehicle and the conditions.

The PCM turns off the generator during cranking to reduce the generator load and improve cranking speed. Once the engine starts, the PCM slowly increases generator output to desired voltage.

The PCM controls the charging system warning indicator by sending a message over the High Speed Controller Area Network (HS-CAN) to the Instrument Cluster (IC) module. The IC module will then control charging system warning indication based on the message from the PCM. The status of the PCM charging system warning indicator and/or message can be confirmed by viewing PCM PID generator fault indicator lamp (GENFIL). Any charging system fault detected by the PCM will result in 1 or more DTCs being set and the PID GENFIL having a status of On. If equipped with a charging system warning indicator, the IC module will turn the indicator ON or OFF. If equipped with a message center, the IC module will display a CHECK

CHARGING SYSTEM message. When the ignition is ON and the engine is OFF on vehicles equipped with a message center, the CHECK CHARGING SYSTEM message may not be displayed. For information regarding the IC module and message center, refer to Section 413-01 .

Under certain circumstances, the charging system may have a concern, but will still keep the battery charged and the vehicle running. GENCOM is normally used to initiate charging, but the generator may charge with a fault in this circuit. If the engine is operated at greater than 2,000 rpm momentarily, the generator may "self-excite" or start charging on its own. The charging system warning indicator is illuminated and/or CHECK CHARGING SYSTEM message is displayed, and the generator operates in a default mode (approximately 13.5 volts) until the engine is turned off. When the engine is restarted and the engine is operated at greater than 2,000 rpm momentarily, the generator may again self-excite and again the charging system warning indicator is illuminated and/or CHECK CHARGING SYSTEM message is displayed.

The PIDs and their associated descriptions used in the charging system diagnosis are listed below:

PID Chart

PID	Description	Normal Display	Associated Circuit Name	Connector, Circuit
GENMON	Generator Monitor	Constant fluctuating percentage 3%-98%	Generator monitor (GENMON)	C102A-1, CDC15 (VT)
GENCMD	Generator Command	Fluctuating percentage or small intermittent bursts 3%-98%	Generator communication (GENCOM)	C102A-2, CDC10 (BU/OG)
GENVDSD	Generator Voltage Desired	Voltage varies by vehicle needs - May be controlled by an output state control	-	-
GENFIL	Generator Fault Indicator Lamp	OFF if charging system is OK	-	-
GENCMD_LF	Generator Command Line Fault	NO FAULT if GENCOM circuit (GENCMD PID) is OK	-	-
GENMON_HZ	Generator Monitor Frequency	Frequency value	-	-
VPWR	Module Supply Voltage	Within 0.5 volt of battery voltage	-	-
RPM	Engine Revolutions Per Minute	Engine rpm - May be controlled by an output state control	-	-

Inspection And Verification

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

⚠ WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

NOTICE: **Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses or fusible links.**

NOTICE: **Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.**

NOTE: While carrying out any pinpoint test, disregard any DTCs set while following a specific pinpoint test. After the completion of a test, be sure to clear all DTCs in the PCM.

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Battery • Front End Accessory Drive (FEAD) belt • Generator pulley	• Wiring, terminals or connectors • Cables • Battery • Generator • Fusible links

	• Fuses • Radial arm adapter

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. Verify the battery condition. Refer to Section 414-01 .

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

6. **NOTE:** The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM .
   - refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition is ON.
     - The air bag warning indicator prove-out (other indicators may NOT prove ignition is ON) confirms ignition ON. If ignition does not turn ON, refer to Section 211-05 to diagnose no power in RUN.
   - refer to Section 418-00 Inspection and Verification to establish a scan tool session (without the ignition ON).
   - verify the scan tool operation with a known good vehicle.

8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .

NOTE: Use the Integrated Diagnostic System (IDS) feature that retrieves all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules at one time.

9. Retrieve CMDTCs from all modules.

10. **NOTE:** If no charging system DTCs are present, the charging system is operating correctly. If the charging system has a concern, it will usually set a charging system DTC.

    If the DTCs retrieved are related to the concern, go to the Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Master DTC Chart in Section 419-10 or Powertrain Control/Emissions Diagnosis (PC/ED) manual.

11. If no DTCs related to the concern are retrieved, go to the Symptom Chart in this section.

Diagnostic Trouble Code (DTC) Chart

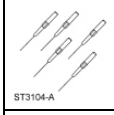
DTCs	Description	Source	Action
P0563	System Voltage High	PCM	GO to Pinpoint Test A .
P0563	System Voltage High	Various Modules	GO to Pinpoint Test A
P0620	Generator Control Circuit	PCM	GO to Pinpoint Test C .
P0625	Generator Field Terminal Circuit Low	PCM	GO to Pinpoint Test D .
P0626	Generator Field Terminal Circuit High	PCM	GO to Pinpoint Test D .
P065B	Generator Control Circuit Range/Performance	PCM	GO to Pinpoint Test E .
All other DTCs	-	Various Modules	REFER to the Master DTC Chart in Section 419-10 or the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If directed to this section from another section, GO to Symptom Chart in this section.

Symptom Chart

Symptom Chart

Pinpoint Test

Special Tool(s)

 ST3104-A	Backprobe Pins POM 6411
 ST2574-A	Flex Probe Kit 300-NUD105-R025DE or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST3094-A	Test Light SGT27000 or equivalent 250-350 mA incandescent bulb test lamp SGT27000
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Pinpoint Test A: System Voltage High

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

NOTE: DTC P0563, B1317 or B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if vehicle accessories have been operating for an extended period of time without the engine running.

Normal Operation

With the engine running, the charging system supplies voltage to the battery and the vehicle electrical system through the battery B+ cable. The voltage that is supplied to the vehicle electrical system is used for the operation of the various vehicle systems and modules. Many modules monitor this voltage and if it rises above their calibrated set point, a DTC will be set.

- DTC P0563 (System Voltage High) - If the PCM detects a voltage from the charging system higher than 15.2 volts with vehicle speed above 8 km/h (5 mph), this DTC will be set.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Engine, generator and battery grounds
- Battery
- Generator

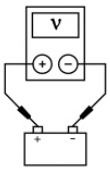
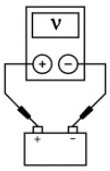
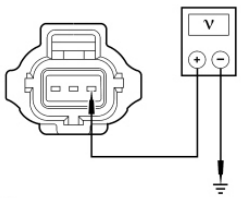
- PCM

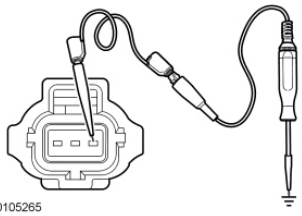
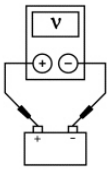
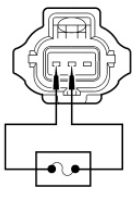
PINPOINT TEST A: SYSTEM VOLTAGE HIGH

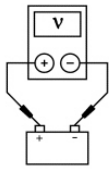
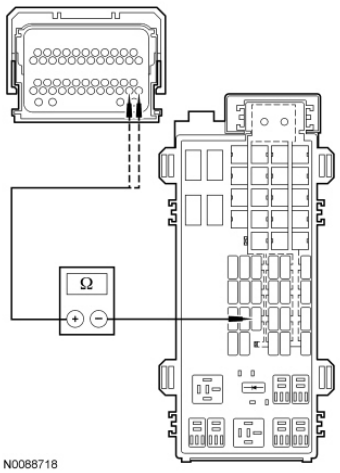
NOTE: Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

Test Step	Result / Action to Take
A1 CHECK BATTERY CONDITION	
• Refer to Section 414-01 and carry out Pinpoint Test A: Battery Condition Test to determine if the battery can hold a charge and is OK for use. • **Does the battery pass the condition test?**	**Yes** GO to A2 . **No** INSTALL a new battery. REFER to Section 414-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A2 CHECK FOR DTCs IN THE PCM	
• Enter the following diagnostic mode on the scan tool: Self Test - PCM. • **Is DTC P0620, P0625, P0626 or P065B present?**	**Yes** REFER to the DTC Chart in this section for the correct pinpoint test and DIAGNOSE those DTCs first. **No** GO to A3 .
A3 MONITOR PCM PID GENERATOR VOLTAGE DESIRED (GENVDSD)	
• Start the engine. • **NOTE:** Many of the PCM PIDs selected will be monitored later in this pinpoint test. • Select and monitor the following PCM PIDs: ♦ Generator Monitor (GENMON) ♦ Generator Command (GENCMD) ♦ Generator Voltage Desired (GENVDSD) ♦ Module Supply Voltage (VPWR) • Monitor the GENVDSD PID. • **Does the GENVDSD PID indicate 15.1 volts or less?**	**Yes** GO to A4 . **No** GO to A11 .
A4 MONITOR PCM PID GENERATOR VOLTAGE DESIRED (GENVDSD)	
• With the engine still running at idle, measure battery voltage and record.	**Yes** The fault is not present at this time. This may indicate an intermittent fault. CARRY OUT a wiggle test on the charging system circuits to try and RECREATE the concern. CHECK generator connections for corrosion, loose connections and/or bent terminals. REPAIR as necessary. CLEAR

 AJ0210-A • Monitor the GENVDSD PID. • **Is battery voltage within ±0.6 volt of the PID GENVDSD?**	the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to A5 .
A5 MEASURE THE A SENSE VOLTAGE	
• Ignition OFF. • Disconnect: Generator C1104A. • Ignition ON. • Measure battery voltage and record.  AJ0210-A • Measure the voltage between generator C1104A-3, circuit SDC02 (RD), harness side and ground.  N0105264 • **Is the A sense voltage equal to battery voltage?**	**Yes** GO to A6 . **No** VERIFY fusible links are OK. If OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A6 A SENSE CIRCUIT LOAD TEST	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** **NOTE:** This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault. A 250-350 mA incandescent 12-volt test lamp is required for this step. This circuit will not be	**Yes** GO to A7 . **No** REPAIR resistance due to corroded or loose connection on circuit SDC02 (RD). INSPECT generator C1104A-3, circuit SDC02 (RD) for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

loaded properly using an LED-style test lamp. • Using a 12-volt test lamp connected to ground, check for voltage at generator C1104A-3, circuit SDC02 (RD), harness side.  N0105265 • **Does the test lamp illuminate?**	
A7 CHECK THE GENERATOR OUTPUT	
• Start the engine. • Increase engine rpm until generator starts to generate output. • With the engine running, measure battery voltage and record.  AJ0210-A • **Is the voltage above 14.5 volts?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to A8 .
A8 MONITOR PCM PIDs GENERATOR COMMAND (GENCMD), GENERATOR MONITOR (GENMON) AND GENERATOR VOLTAGE DESIRED (GENVDSD)	
• Ignition OFF. • Connect a fused jumper wire between generator C1104A-1, CDC15 (VT), harness side and generator C1104A-2, circuit CDC10 (BU/OG), harness side.  N0074142 • Start the engine.	**Yes** GO to A9 . **No** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

• Monitor the GENVDSD, GENMON and GENCMD PIDs. • Using the active command, set GENVDSD PID to 14 volts. • **Does the GENCMD PID read within 5% of GENMON PID?**	
A9 COMPARE PCM SUPPLY VOLTAGE (VPWR) PID TO BATTERY VOLTAGE	
• With the engine still running at idle, measure the battery voltage at the battery and monitor the PCM VPWR PID.  AJ0210-A • **Does PCM VPWR PID accurately display battery voltage within ±0.5 volt?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to A10 .
A10 CHECK PCM SUPPLY VOLTAGE CIRCUITS	
• Ignition OFF. • Disconnect: Fused Jumper Wire. • Disconnect: PCM C175B. • Inspect the connector pins for damage. Measure resistance between BJB fuse 39 (15A), output side and: ♦ PCM C175B-35, circuit CBB39 (VT/WH), harness side. ♦ PCM C175B-36, circuit CBB39 (VT/WH), harness side.  N0088718 • **Are the resistances less than 0.5 ohm?**	**Yes** GO to A11 . **No** REPAIR high resistance or loose connections in the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A11 CHECK FOR CORRECT PCM OPERATION	

• Ignition OFF. • Check the PCM harness and component side connectors for: ♦ corrosion. ♦ pushed-out/bent pins. • Connect the PCM and generator, make sure the connectors seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test B: System Voltage Low or Battery is Discharged

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

With the engine running, the charging system supplies voltage to the battery and the vehicle electrical system through the battery B+ cable. The PCM monitors this voltage through the battery positive post through the Battery Junction Box (BJB). If this voltage drops 1.5 volts or more below the generator voltage desired, this DTC will be set after 30 seconds.

- DTC P0562 (System Voltage Low) - If the PCM detects a voltage from the charging system that is 1.5 volts lower than the generator voltage desired, this DTC will be set.

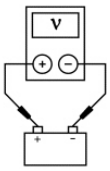
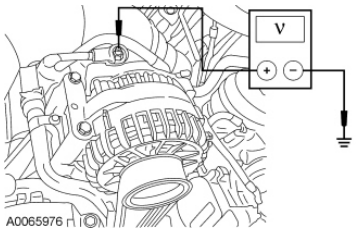
This pinpoint test is intended to diagnose the following:
- Fusible link
- Wiring, terminals or connectors
- Radial arm adapter
- Battery
- Generator
- PCM

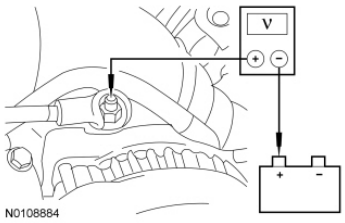
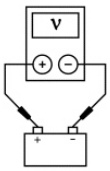
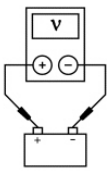
PINPOINT TEST B: SYSTEM VOLTAGE LOW OR BATTERY IS DISCHARGED

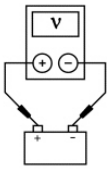
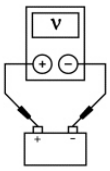
NOTE: Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

Test Step	Result / Action to Take
B1 CHECK FOR OTHER PCM DTCs	
• Enter the following diagnostic mode on the scan tool: Self Test - PCM. • **Is DTC P0620, P0625, P0626 or P065B present?**	**Yes** REFER to the DTC Chart in this section for the correct pinpoint test and DIAGNOSE those DTCs first. **No** GO to B2 .
B2 CHECK BATTERY CONDITION	

• Refer to Section 414-01 and carry out Pinpoint Test A: Battery Condition Test to determine if the battery can hold a charge and is OK for use. • **Does the battery pass the condition test?**	**Yes** GO to B3 . **No** INSTALL a new battery. REFER to Section 414-01 . TEST the system for normal operation.
B3 CHECK THE GENERATOR CONNECTIONS	
• Ignition OFF. • Inspect generator C1104A connection. Connector should be installed correctly and tight. • Disconnect: Generator C1104A. • Inspect generator C102A for bent and/or pushed-out pins. • Inspect generator C102B, B+ circuit SDC02 (RD) and radial arm adapter connection(s). Connection should be tight. • Measure the battery voltage.  AJ0210-A • Measure the voltage between generator C1104B, B+ circuit SDC02 (RD) and ground.  • **Are the generator C102B and radial arm adapter connections tight and does the generator B+ measure battery voltage?**	**Yes** GO to B4 . **No** TIGHTEN or INSTALL a new C1104B (B+ nut) and/or radial arm adapter as needed. REFER to Specifications in this section. VERIFY the fusible link is OK. If the fusible link is OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B4 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT	
• Connect: Generator C1104A. • Start the engine. • With the engine running at idle, headlamps on and blower on high, measure the voltage drop between generator B+ C1104B, circuit SDC02 (RD) and the positive battery	**Yes** GO to B5 . **No** INSPECT circuit SDC02 (RD), radial arm adapter and the positive battery cable for loose connections, physical damage or wire corrosion.

terminal.  • Carry out a wiggle test of the generator wiring and connections while measuring voltage drop. • **Is the voltage drop less than 0.5 volt?**	REPAIR as required. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B5 COMPARE PCM MODULE SUPPLY VOLTAGE (VPWR) PID	
• With the engine still running at idle, headlamps on and blower on high, measure the battery voltage at the battery and monitor the PCM VPWR PID.  • **Does PCM VPWR PID display battery voltage within ±0.5 volt?**	**Yes** GO to B6 . **No** REPAIR high resistance or loose connections in the affected PCM power circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B6 CHECK PCM GROUND FOR HIGH RESISTANCE	
• Monitor PCM VPWR PID. • With the engine still running at idle, turn off all accessory loads, measure the battery voltage at the battery and note the PCM VPWR PID.  • With the engine still running at idle, turn headlamps on and blower on high, measure the battery voltage at the battery and monitor	**Yes** GO to B7 . **No** REPAIR the affected PCM ground circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

the PCM VPWR PID.  AJ0210-A • **Does the VPWR PID read within ±0.5 volt with accessory loads on as compared to accessory loads off?**	
B7 MONITOR PID VPWR AT WOT	
• With the engine still running at idle, turn off all accessory loads, measure the battery voltage at the battery and monitor the PCM VPWR PID.  AJ0210-A • Monitor the VPWR PID and momentarily accelerate the engine to Wide Open Throttle (WOT) and release. Repeat this step 4-5 times while continuing to monitor the VPWR PID. • **Does the VPWR PID stay within 0.5 volt of battery voltage when the engine rpms are increased?**	**Yes** GO to B8 . **No** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
B8 CHECK FOR DISCHARGED BATTERY	
• With the engine still running at idle, measure the battery voltage at the battery. • Monitor PCM PIDs generator voltage desired (GENVDSD) and generator monitor (GENMON). • **Does GENMON PID frequently rise above 90% and battery voltage drop below GENVDSD PID by 0.5 volt or more?**	**Yes** CARRY OUT the Component Test, Battery - Drain Test. REFER to Section 414-01 . **No** VERIFY fusible links are OK. If OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test C: DTC P0620

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

The PCM monitors the generator output via the GENMON circuit. The PCM uses the GENCOM circuit to command the generator to either increase or decrease output. If the GENCOM circuit (generator control circuit) or the A sense circuit are open or shorted to ground, the PCM will be unable to control the generator output. When the engine speed rises above approximately 2,000 rpm, the generator will default to a steady voltage output of approximately 13.5 volts and the PCM will send a request to the Instrument Cluster (IC) to illuminate the charging system warning indicator. A GENCOM circuit fault can be confirmed by viewing the PCM PID generator command line fault (GENCMD_LF) (YES status indicator fault).

- DTC P0620 (Generator Control Circuit) - If the GENCOM circuit or A sense circuit are open or shorted to ground, the PCM will set this DTC.

This pinpoint test is intended to diagnose the following:

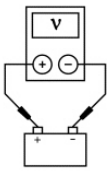
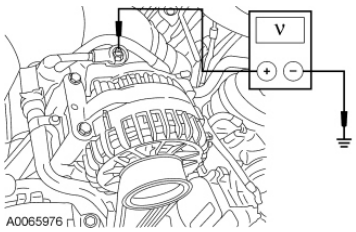
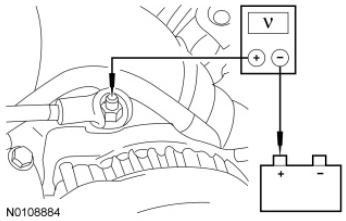
- Fuse
- Wiring, terminals or connectors
- Radial arm adapter
- Generator
- PCM

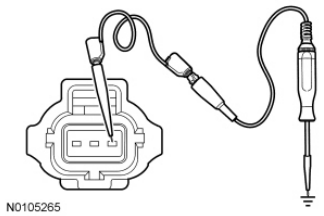
PINPOINT TEST C: DTC P0620

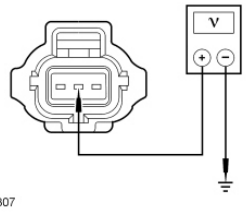
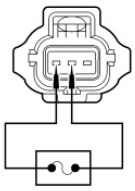
NOTE: Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.

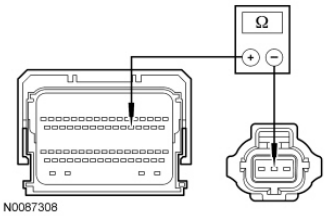
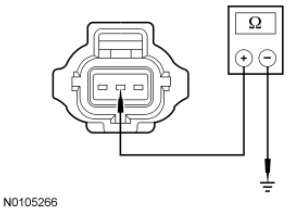
NOTE: Do not have a battery charger attached during vehicle testing.

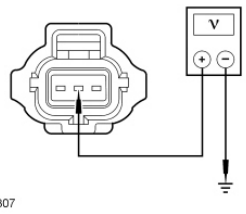
Test Step	Result / Action to Take
C1 CHECK THE BATTERY CONDITION	
• Refer to Section 414-01 and carry out Pinpoint Test A: Battery Condition Test to determine if the battery can hold a charge and is OK for use. • **Does the battery pass the condition test?**	**Yes** GO to C2 . **No** INSTALL a new battery. REFER to Section 414-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C2 CHECK THE GENERATOR CONNECTIONS	
• Ignition OFF. • Inspect generator C1104A connection. Connector should be installed correctly and tight. • Disconnect: Generator C1104A. • Inspect generator C1104A for bent and/or pushed-out pins. • Inspect generator C1104B, B+ circuit SDC02 (RD) and radial arm connection(s). Connection should be tight. • Measure the battery voltage.	**Yes** GO to C3 . **No** TIGHTEN or INSTALL a new C1104B (B+ nut) and/or radial arm adapter as needed. REFER to Specifications in this section. VERIFY the fusible link is OK. If the fusible link is OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal

 AJ0210-A • Measure the voltage between generator C1104B, B+ circuit SDC02 (RD) and ground.  A0065976 • **Are the generator C1104B and radial arm adapter connections tight and does the generator B+ measure battery voltage?**	operation.
C3 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT	
• Connect: Generator C1104A. • Start the engine. • With the engine running at idle, headlamps on and blower on high, measure the voltage drop between generator B+ C1104B, circuit SDC02 (RD) and the positive battery terminal.  N0108884 • Carry out a wiggle test of the generator wiring and connections while measuring voltage drop. • **Is the voltage drop less than 0.5 volt?**	**Yes** GO to C4 . **No** INSPECT circuit SDC02 (RD), radial arm adapter and the positive battery cable for loose connections, physical damage or wire corrosion. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C4 A SENSE CIRCUIT LOAD TEST	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe**	**Yes** GO to C5 . **No** VERIFY fusible links are OK. If OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR

directly on any connector. **NOTE:** This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault. A 250-350 mA incandescent 12-volt test lamp is required for this step. This circuit will not be loaded properly using an LED-style test lamp. • Ignition OFF. • Disconnect: Generator C1104A. • Ignition ON. • Using a 12-volt test lamp connected to ground, check for voltage at generator C1104A-3, circuit SDC02 (RD), harness side.  N0105265 • **Does the test lamp illuminate?**	the DTCs. REPEAT the self-test. TEST the system for normal operation.
C5 CHECK THE GENERATOR COMMAND LINE FAULT (GENCMD_LF) PID	
• Ignition OFF. • Connect: Generator C1104A. • Start the engine. • **NOTE:** Many of the PCM PIDs selected will be monitored later in this pinpoint test. • Select and monitor the following PCM PIDs: ♦ Generator Monitor (GENMON) ♦ Generator Command (GENCMD) ♦ Generator Command Line Fault (GENCMD_LF) • With the engine running at idle, monitor the GENCMD_LF PID. • **Does the GENMON_LF PID indicate FAULT?**	**Yes** GO to C6 . **No** GO to C9 .
C6 CHECK THE GENERATOR COMMAND CIRCUIT FOR A SHORT TO POWER	
• Ignition OFF. • Disconnect: Generator C1104A. • Ignition ON. • Measure the voltage between generator C1104A-2, circuit CDC10 (BU/OG), harness side and ground.	**Yes** GO to C7 . **No** GO to C11 .

 N0087307 • **Does voltage read 1 volt or less?**	
C7 COMPARE THE PCM PIDs GENERATOR MONITOR (GENMON) AND GENERATOR COMMAND (GENCMD)	
• Ignition OFF. • Connect a fused jumper wire between generator C1104A-1, circuit CDC15 (VT), harness side and generator C1104A-2, circuit CDC10 (BU/OG), harness side.  N0074142 • Start the engine. • Monitor the GENMON and GENCMD PIDs while performing a wiggle test on the generator harness. • **Does the GENMON PID read within 5% of the GENCMD PID?**	**Yes** GO to C8 . **No** GO to C12 .
C8 CHECK THE GENERATOR COMMAND CIRCUIT FOR DAMAGE OR AN OPEN	
• Ignition OFF. • Disconnect: Fused Jumper Wire. • Disconnect: PCM C175B. • Inspect the following harness connectors for damaged or pushed-out pins: ♦ PCM C175B-22, circuit CDC10 (BU/OG) ♦ Generator C1104A-2, circuit CDC10 (BU/OG) • Measure the resistance between PCM C175B-22, circuit CDC10 (BU/OG), harness side and generator C1104A-2, circuit CDC10 (BU/OG, harness side.	**Yes** GO to C9 . **No** REPAIR circuit CDC10 (BU/OG). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 • **Are the connectors and pins free of damage and is the resistance less than 5 ohms?**	
C9 CHECK THE GENERATOR COMMAND CIRCUIT FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Generator C1104A (if not previously disconnected). • Disconnect: PCM C175B. • Measure the resistance between the generator C1104A-2, circuit CDC10 (BU/OG), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to C10 . **No** REPAIR circuit CDC10 (BU/OG). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C10 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS	
• Connect: Generator C102A. • Connect: PCM C175B. • Ignition ON. • Clear all DTCs. • Start the engine and let the engine run for 5 minutes. • Retrieve Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules. • **Did any charging system DTC get stored into memory?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** The fault is not present at this time. This may indicate an intermittent fault. CARRY OUT a wiggle test on the charging system circuits to try and RECREATE the concern. CHECK generator connections for corrosion, loose connections and/or bent terminals. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C11 CHECK THE GENERATOR COMMAND AND PCM FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Disconnect: PCM C175B. • Ignition ON. • Measure the voltage between generator C1104A-2, circuit CDC10 (BU/OG), harness side and ground.  • **Does voltage read 0 volt?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR circuit CDC10 (BU/OG). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
C12 INSPECT GENERATOR CONNECTORS AND CIRCUITS	
• Ignition OFF. • Disconnect: PCM C175B. • Inspect the following connector pins for damage and/or corrosion: ♦ PCM C175B-50, circuit GD113 (BK/YE) ♦ Generator C1104A-1, circuit CDC15 (VT) ♦ Generator C1104A-2, circuit CDC10 (BU/OG) • **Are the connectors and circuits OK?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** REPAIR high resistance or loose connections in the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: DTC P0625 or P0626

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

The PCM monitors the generator output via the GENMON circuit (generator field terminal circuit). If the PCM cannot read the GENMON circuit due to an open or short to ground, when the engine rises above approximately 2,000 rpm, the generator will default to a steady voltage of approximately 13.5 volts and the PCM will send a request to the Instrument Cluster (IC) to illuminate the charging system warning indicator. A GENMON duty cycle of 3% or less indicates a short to ground fault is present and will result in DTC P0625 setting in the PCM. A GENMON duty cycle of 98% or more indicates an open or short to voltage fault is present and will result in DTC P0626 setting in the PCM.

- DTC P0625 (Generator Field Terminal Circuit Low) - If the GENMON circuit is shorted to ground, the A sense circuit is open or the B+ circuit is open, the PCM will set this DTC. This DTC can also be set by a faulted PCM or generator.
- DTC P0626 (Generator Field Terminal Circuit High) - If the GENMON circuit is open or shorted to power, the PCM will set this DTC. This DTC can also be set by a faulted PCM or generator.

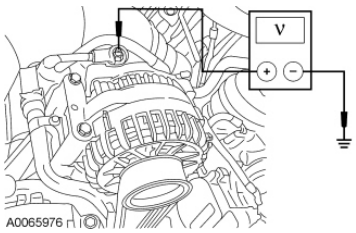
This pinpoint test is intended to diagnose the following:

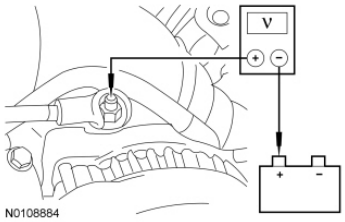
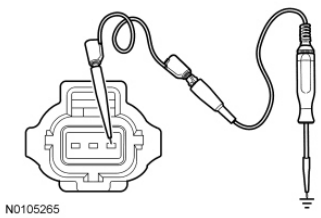
- Fuse
- Wiring, terminals or connectors
- Radial arm adapter
- Engine, generator and battery grounds
- Battery
- Generator
- PCM

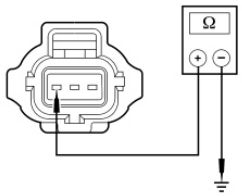
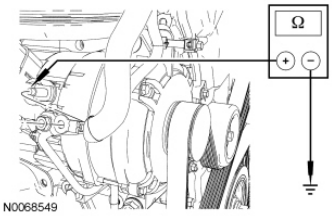
PINPOINT TEST D: DTC P0625 OR P0626

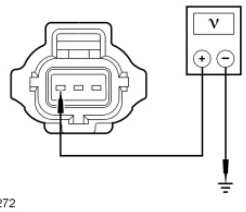
NOTE: Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.

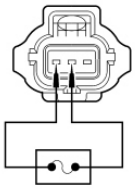
NOTE: Do not have a battery charger attached during vehicle testing.

Test Step	Result / Action to Take
D1 CHECK THE BATTERY CONDITION	
• Refer to Section 414-01 and carry out Pinpoint Test A: Battery Condition Test to determine if the battery can hold a charge and is OK for use. • **Does the battery pass the condition test?**	**Yes** GO to D2 . **No** INSTALL a new battery. REFER to Section 414-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D2 CHECK THE GENERATOR B+ CONNECTION	
• Ignition OFF. • Inspect generator C1104B, circuit SDC14 (RD), harness side. Connection should be tight. • Inspect generator radial adapter connection on rear of generator. Connection should be tight. • Measure the voltage between generator C1104B, circuit SDC02 (RD) and ground.  • **Are the generator C1104B and radial arm adapter connections tight and does the generator B+ measure battery voltage?**	**Yes** GO to D3 . **No** TIGHTEN or INSTALL a new C1104B (B+ nut) and/or radial arm adapter as needed. REFER to Specifications in this section. VERIFY the fusible link is OK. If the fusible link is OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D3 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT	

• Start the engine. • With the engine running at idle, headlamps on and blower on high, measure the voltage drop between generator B+ C1104B, circuit SDC02 (RD) and the positive battery terminal.  • Carry out a wiggle test of the generator wiring and connections while measuring voltage drop. • **Is the voltage drop less than 0.5 volt?**	**Yes** For DTC P0625, GO to D4 . For DTC P0626, GO to D6 . **No** INSPECT circuit SDC02 (RD), radial arm adapter and the positive battery cable for loose connections, physical damage or wire corrosion. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D4 A SENSE CIRCUIT LOAD TEST	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** **NOTE:** This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault. A 250-350 mA incandescent 12-volt test lamp is required for this step. This circuit will not be loaded properly using an LED-style test lamp. • Ignition OFF. • Disconnect: Generator C1104A . • Ignition ON. • Using a 12-volt test lamp connected to ground, check for voltage at C1104A-3, circuit SDC02 (RD), harness side.  • **Does the test lamp illuminate?**	**Yes** GO to D5 . **No** VERIFY fusible links are OK. If OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D5 CHECK CIRCUIT CDC15 (VT) FOR DAMAGE OR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: PCM C175B. • Inspect the following harness connectors for damaged or pushed-out pins: ♦ PCM C175B-26, circuit CDC15 (VT) ♦ Generator C1104A-1, circuit CDC15 (VT) • Measure the resistance between generator C1104A-1, circuit CDC15 (VT), harness side and ground.  N0105271 • **Are the connectors and pins free of damage and is the resistance greater than 10,000 ohms?**	**Yes** GO to D10 . **No** REPAIR the connector(s) and/or circuit CDC15 (VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D6 CHECK THE GENERATOR B+ RESISTANCE	
• Ignition OFF. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. • Disconnect the battery. Refer to Section 414-01 . • Disconnect: Generator C102B. • Measure the resistance between generator C102B, component side and the generator housing.  N0068549 • **Is the resistance greater than 25K ohms?**	**Yes** GO to D7 . **No** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D7 CHECK THE RESISTANCE OF THE VOLTAGE REGULATOR INTERNAL CIRCUITS TO GROUND	
• Disconnect: Generator C1104A. • Measure the resistance between generator C1104A, component side and ground. Refer to	**Yes** GO to D8 . **No**

the following table. | Pin	Expected Resistance | |---|---| | 1 | Greater than 10K ohms | | 2 | Greater than 10K ohms | | 3 | Greater than 10K ohms | • **Are the resistance values as indicated?**	INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D8 CHECK CIRCUIT CDC15 (VT) FOR DAMAGE OR AN OPEN	
• Disconnect: PCM C175B. • Inspect the following harness connectors for damaged or pushed-out pins: ♦ PCM C175B-26, circuit CDC15 (VT) ♦ Generator C1104A-1, circuit CDC15 (VT) • Measure the resistance between PCM C175B-26, circuit CDC15 (VT), harness side and generator C1104A-1, circuit CDC15 (VT), harness side. • **Are the connectors and pins free of damage and is the resistance less than 5 ohms?**	**Yes** GO to D9 . **No** REPAIR the connector(s) and/or circuit CDC15 (VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
D9 CHECK CIRCUIT CDC15 (VT) FOR A SHORT TO POWER	
• Connect the battery. Refer to Section 414-01 . • Ignition ON. • Measure the voltage between generator C1104A-1, circuit CDC15 (VT), harness side and ground.  N0105272 • **Is there any voltage present?**	**Yes** REPAIR the connector(s) and/or circuit CDC15 (VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to D10 .
D10 COMPARE THE PCM PIDs GENERATOR MONITOR (GENMON) AND GENERATOR COMMAND (GENCMD)	

• Ignition OFF. • Connect: PCM C175B. • Connect a fused jumper wire between generator C1104A-1, circuit CDC15 (VT), harness side and generator C1104A-2, circuit CDC10 (BU/OG), harness side.  N0074142 • Start the engine. • Using the active command, set the GENVDSD PID to 14.0 volts. • Monitor the GENMON and GENCMD PIDs while carrying out a wiggle test on the generator wiring harness. • **Does the GENMON PID read within 2% of the GENCMD PID?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** GO to D11 .
D11 CHECK FOR CORRECT PCM OPERATION	
• Ignition OFF. • Disconnect: Fused Jumper Wire. • Check the PCM harness, generator harness, PCM component side and generator component side connectors for: ♦ corrosion. ♦ pushed-out/bent pins. • Connect the PCM and/or generator connectors. Make sure the connectors seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test E: DTC P065B

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

With the engine running, the PCM expects to receive a valid generator monitor (GENMON) signal with a duty cycle greater than 5% and less than 98%. The PCM also monitors the state of the generator command (GENCMD) signal line to make sure it is not stuck high or stuck low. If the GENMON or GENCMD signal fluctuates between out-of-valid range, or stuck high, or stuck low, or some combination and normal, a DTC will be set. When engine speed rises above approximately 2,000 rpm, the generator will default to a steady voltage of approximately 13.5 volts and the PCM will send a request to the Instrument Cluster (IC) to illuminate the charging system warning indicator lamp.

- DTC P065B (Generator Control Circuit Range/Performance) - If the input frequency was continuously less than 80 Hz or more than 200 Hz the PCM will set this DTC. Additionally, if the signal shows a faulted condition that is happening in a fluctuating manner, the PCM will track the fluctuations between faulted and normal conditions. If the fluctuations occur frequently within a short amount of time, this DTC will also be set.

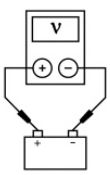
This pinpoint test is intended to diagnose the following:

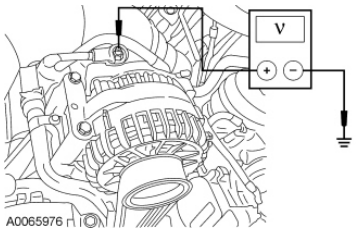
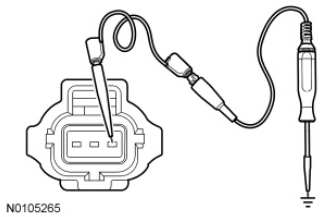
- Wiring, terminals or connectors
- Radial arm adapter
- Generator
- PCM

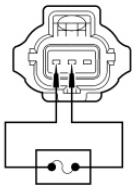
PINPOINT TEST E: DTC P065B

NOTE: Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

Test Step	Result / Action to Take
E1 CHECK THE BATTERY CONDITION	
• Refer to Section 414-01 and carry out Pinpoint Test A: Battery Condition Test to determine if the battery can hold a charge and is OK for use. • **Does the battery pass the condition test?**	**Yes** GO to E2 . **No** INSTALL a new battery. REFER to Section 414-01 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E2 CHECK THE GENERATOR CONNECTIONS	
• Ignition OFF. • Inspect generator C1104A connection. Connector should be installed correctly and tight. • Disconnect: Generator C1104A. • Inspect generator C102A for bent and/or pushed-out pins. • Inspect generator C1104B, B+ circuit SDC02 (RD) and radial arm connection(s). Connection should be tight. • Measure the battery voltage.  AJ0210-A • Measure the voltage between generator C1104B, B+ circuit SDC02 (RD) and ground.	**Yes** GO to E3 . **No** TIGHTEN or INSTALL a new C1104B (B+ nut) and/or radial arm adapter as needed. REFER to Specifications in this section. VERIFY the fusible link is OK. If the fusible link is OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

 • **Are the generator C1104B and radial arm adapter connections tight and does the generator B+ measure battery voltage?**	
E3 A SENSE CIRCUIT LOAD TEST	
NOTICE: **The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.** **NOTE:** This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault. A 250-350 mA incandescent 12-volt test lamp is required for this step. This circuit will not be loaded properly using an LED-style test lamp. • Ignition ON. • Using a 12-volt test lamp connected to ground, check for voltage at C1104A-3, circuit SDC02 (RD), harness side.  • **Does the test lamp illuminate?**	**Yes** GO to E4 . **No** VERIFY fusible links are OK. If OK, REPAIR circuit SDC02 (RD). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E4 CHECK THE PCM GENERATOR MONITOR FREQUENCY (GENMON_HZ) PID	
• Ignition OFF. • Connect: Generator C1104A. • Start the engine. • **NOTE:** Many of the PCM PIDs selected will be monitored later in this pinpoint test. • Select and monitor the following PCM PIDs: ♦ Generator Voltage Desired (GENVDSD) ♦ Generator Monitor Frequency (GENMON_HZ) • Monitor the GENMON_HZ PID. • **Does the PID read between 80-200 Hz?**	**Yes** GO to E8 . **No** GO to E5 .

E5 CHECK THE PCM GENERATOR MONITOR FREQUENCY (GENMON_HZ) PID WITH GENERATOR C1104A DISCONNECTED	
• Ignition OFF. • Disconnect: Generator C1104A. • Start the engine. • Monitor the GENMON_HZ PID. • **Does the PID read between 0-2 Hz?**	**Yes** GO to E7 . **No** GO to E6 .
E6 CHECK GENERATOR CIRCUITRY	
• Ignition OFF. • ***NOTICE:*** **This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool specified in the tool list in this section. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage while making sure that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors and subsequent electrical faults.** • With PCM C175B connected, connect a fused jumper wire between PCM C175B-26, circuit CDC15 (VT) and ground by carefully back probing the connector. • Start the engine. • Monitor the GENMON_HZ PID. • **Does the PID read 0 Hz?**	**Yes** INSPECT the harness for wire to wire shorts or insulation chaffing, mis-pinned connectors and correct wire colors and REPAIR generator circuit CDC15 (VT) as needed. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E7 MONITOR THE PCM PID GENERATOR MONITOR FREQUENCY (GENMON_HZ) WHILE ACTIVATING THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID	
• Ignition OFF. • Connect a fused jumper wire between generator C1104A-1, circuit CDC15 (VT), harness side and generator C1104A-2, circuit CDC10 (BU/OG), harness side.  N0074142 • Start the engine. • With the engine running at idle, set the active command GENVDSD PID to 14 volts. • Monitor the GENMON_HZ PID. • **Does the GENMON_HZ PID read between 120-130 Hz?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
E8 CHECK THE PCM GENERATOR COMMAND LINE FAULT (GENCMD_LF) PID	

• With the engine running and all selectable loads OFF, monitor the PCM PID GENCMD_LF. • **Does the PCM PID GENCMD_LF fluctuate from YES FAULT to NO FAULT?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. **No** The fault is not present at this time. This may indicate an intermittent fault. CARRY OUT a wiggle test on the charging system circuits to try and RECREATE the concern. CHECK generator connections for corrosion, loose connections and/or bent terminals. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test F: The Generator is Noisy

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

The generator is belt-driven by the engine accessory drive system. There are several sources of generator noise which include: bearing noise, electrical fault noise, generator or belt pulley misalignment. A generator with certain types of diode or stator failures may also produce an audible noise.

This pinpoint test is intended to diagnose the following:

- Accessory drive belt
- Loose bolts/brackets
- Generator/pulley

PINPOINT TEST F: THE GENERATOR IS NOISY

Test Step	Result / Action to Take
F1 CHECK FOR ACCESSORY DRIVE BELT NOISE AND LOOSE MOUNTING BRACKETS	
• Ignition OFF. • Check the accessory drive belt and tensioner for damage and correct installation. Refer to Section 303-05 . • Check the accessory mounting brackets and generator pulley for looseness or misalignment. • **Is the accessory drive OK?**	**Yes** GO to F2 . **No** REPAIR as necessary. REFER to Section 303-05 for diagnosis and testing of the accessory drive system. TEST the system for normal operation.

F2 CHECK THE GENERATOR MOUNTING	
• Check the generator mounting for loose bolts or misalignment. • **Is the generator mounted correctly?**	**Yes** GO to F3 . **No** REPAIR as necessary. TEST the system for normal operation.
F3 CHECK THE GENERATOR FOR NOISE	
• With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise. • **Is the generator the noise source?**	**Yes** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. **No** REFER to Section 303-00 to diagnose the source of the engine noise.

Pinpoint Test G: Radio Interference

Refer to Wiring Diagrams Cell 12 , Charging System for schematic and connector information.

Normal Operation

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

This pinpoint test is intended to diagnose the following:
- Generator
- Wiring, terminals or connectors
- In-vehicle entertainment system

PINPOINT TEST G: RADIO INTERFERENCE

NOTE: If the OEM audio unit has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to OEM condition before following this pinpoint test.

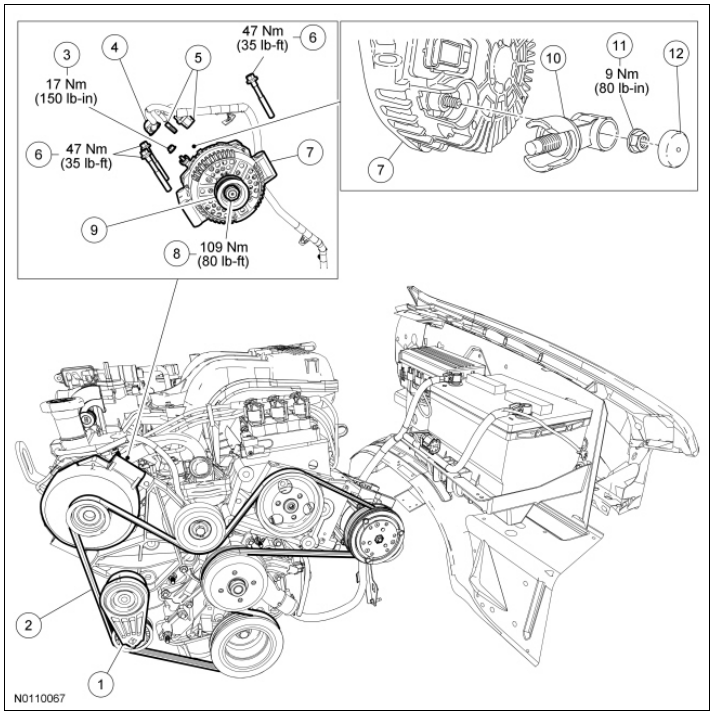
NOTE: If the engine is operated at greater than 2,000 rpm momentarily, the generator will self-excite. Make sure when the generator is disconnected the engine rpm stays below 2,000 rpm. If it does rise above 2,000 rpm, turn the ignition to the off position and start the test over again.

NOTE: Inspect for any after market accessories that have been added to the vehicle. Check the wiring for these accessories and be sure they have not been attached to the generator circuits and are positioned away from the generator wiring.

Test Step	Result / Action to Take
G1 VERIFY THE GENERATOR IS THE SOURCE OF THE RADIO INTERFERENCE	
• Start the engine and allow the engine to idle.	**Yes** REFER to Section 415-00 for diagnosis and testing of the in-vehicle entertainment system.

• Tune the audio unit to a station where the interference is present. • Ignition OFF. • Disconnect: Generator C1104B. • Start the engine and allow the engine to idle, determine if the interference is still present. • **Is the interference present with the generator disconnected?**	**No** INSTALL a new generator. REFER to Generator - 4.0L SOHC or Generator - 4.6L (2V) in this section. TEST the system for normal operation.

Generator - 4.0L SOHC



Item	Part Number	Description
1	6B209	Front End Accessory Drive (FEAD) belt tensioner
2	8620	FEAD belt
3	W711953	Generator B+ terminal nut
4	-	Generator B+ terminal (part of 14300)
5	-	Generator electrical connectors (part of 14300)
6	W500328	Generator bolts (3 required)
7	10300	Generator
8	N807805	Generator pulley nut
9	10344	Generator pulley
10	10329	Radial arm adapter
11	-	Radial arm adapter nut (part of 10329)
12	-	Radial arm adapter cap (part of 10329)

Removal and Installation

NOTE: The radial arm adapter is a serviceable item. Do not replace the generator if the radial arm adapter is the only concern.

1. Disconnect the battery. For additional information, refer to Section 414-01 .
2. Rotate the Front End Accessory Drive (FEAD) belt tensioner counterclockwise and position the FEAD belt aside.

3. Position the protective cover aside and remove and discard the generator B+ terminal nut.
    - To install, tighten to 17 Nm (150 lb-in).

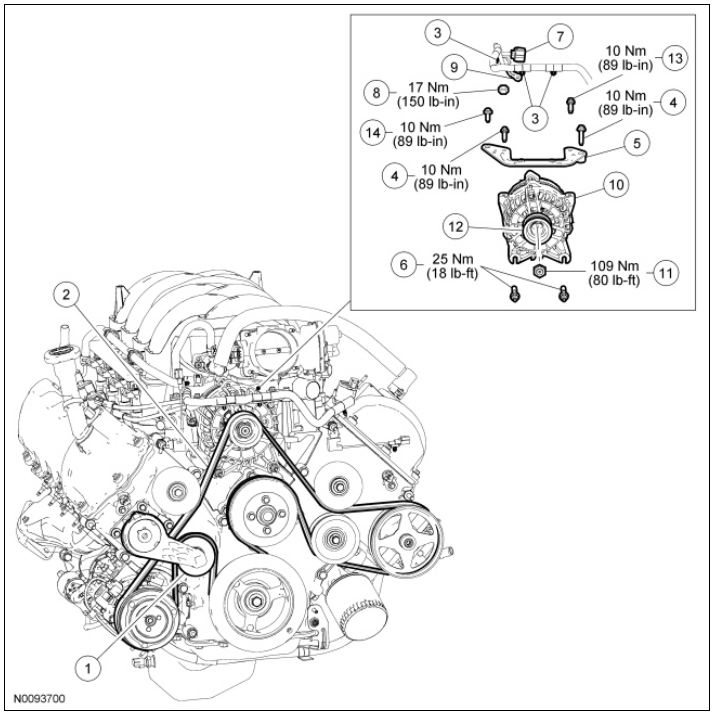
4. Disconnect the generator B+ terminal and the 2 electrical connectors.

5. Remove the 3 bolts and the generator.
    - To install, tighten to 47 Nm (35 lb-ft).

6. If necessary, remove the nut and the generator pulley.
    - To install, tighten to 109 Nm (80 lb-ft).

7. To install, reverse the removal procedure.
    - Install a new generator B+ terminal nut.

Generator - 4.6L (2V)



Item	Part Number	Description
1	6B209	Front End Accessory Drive (FEAD) belt tensioner
2	8620	FEAD belt
3	-	Generator harness locators (3 required) (part of 14305)
4	N807309	Generator bracket bolts (2 required)
5	10153	Generator bracket
6	N804178	Generator nuts (2 required)
7	-	Generator electrical connector (part of 14305)
8	W711953	Generator B+ terminal nut
9	-	Generator B+ terminal (part of 14305)
10	10300	Generator
11	N807805	Generator pulley nut
12	10344	Generator pulley
13	N704682	Generator bolt
14	N807691	Generator bolt

Removal and Installation

1. Disconnect the battery. For additional information, refer to Section 414-01 .

2. Remove the Throttle Body (TB). For additional information, refer to Section 303-04B .

3. Rotate the Front End Accessory Drive (FEAD) belt tensioner clockwise and position the FEAD aside.

4. Remove the 3 harness locators from the generator bracket.

5. Remove the 4 bolts and the generator bracket.
    - To install, tighten to 10 Nm (89 lb-in).

6. Loosen the 2 bolts and position the generator aside.
    - To install, tighten to 25 Nm (18 lb-ft).

7. Disconnect the generator electrical connector.

8. Position the protective cover aside, remove and discard the nut and position the generator B+ terminal aside.
    - To install, tighten to 17 Nm (150 lb-in).

9. Remove the generator.

10. If necessary, remove the nut and the generator pulley.
    - To install, tighten to 109 Nm (80 lb-ft).

11. To install, reverse the removal procedure.
    - Install a new generator B+ terminal nut.

General Specifications

Item	Specification
Battery	
Cold Cranking Amps (CCA) measured at -18°C (0°F)	650 CCA
Voltage	12 volts

Torque Specifications

Description	Nm	lb-ft	lb-in
Battery cable body ground terminal nut	9	-	80
Battery cable bracket nuts (4.6L)	20	-	177
Battery cable engine front cover bracket nut (4.0L)	20	-	177
Battery cable engine front cover bracket nut (4.6L)	10	-	89
Battery cable engine ground terminal nut (4.6L)	25	18	-
Battery cable frame bracket nut (4.0L)	9	-	80
Battery cable right engine mount bracket bolt (4.6L)	20	-	177
Battery cable terminal bolts	7	-	62
Battery hold-down bolt	9	-	80
Battery Junction Box (BJB) terminal nuts	9	-	80
Battery tray bolts	20	-	177
Generator B+ terminal nut	17	-	150
Power steering line bracket nut (4.6L)	12	-	106
Starter motor ground cable terminal nut (4.0L)	25	18	-
Starter solenoid positive cable terminal nut	12	-	106
Starter solenoid wire cable terminal nut	6	-	53

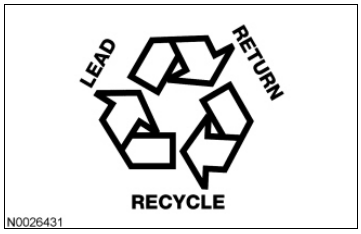
Battery and Cables

Vehicles are equipped with a 12V, maintenance-free battery.

The battery and cable system consists of the following components:

- Battery
- Battery cable assembly
- Battery tray

Ford Motor Company strongly recommends that lead-acid batteries be returned to an authorized recycling facility for disposal.



Principles of Operation

Battery Eye Operation

The battery eye indicates the state-of-charge of the battery by responding to the specific gravity of a single battery cell electrolyte. The battery eye has a viewing plate, 2 colored balls of different specific gravity and a small passage. As the state-of-charge and specific gravity changes, the balls change their position in the passageway and subsequently display a different color in the viewing eye. The primary purpose of the battery is to be a quick indicator of state-of-charge for assembly plants and dealership pre-delivery processes.

The color of the battery eye indicates the approximate state-of-charge.

- Red - indicates low state-of-charge.
- Yellow/Black - indicates between high and low state-of-charge.
- Green - indicates high state-of-charge.
- No color can occur after the battery has been in service for several years and some of the plate material has coated the balls.
- A clear battery eye can occur if the battery case becomes damaged and the electrolyte has fallen below the plates.

NOTE: The battery eye may remain red for a period of time (up to several days), even after the battery is fully charged, because the acid is not yet fully mixed.

Do not install a new battery based solely on the indication of the battery eye. The battery eye color simply indicates the battery state-of-charge, not its condition. For example, a red or yellow/black battery eye usually indicates the battery is discharged, not defective. If the battery eye indicates the battery may be discharged, it is necessary to recharge the battery before testing its condition.

Charging a Battery

Batteries discharge while the vehicle is on the dealer lot or parked by the customer for an extended period of time due to normal parasitic key-off loads. Also, vehicles still in dealer inventory or in long-term storage may be driven short distances with heavy electrical loads. Over a period of time (30 days or more), this could result in vehicles having shallow or deeply discharged batteries.

- Deeply discharged - A battery that is drained over a prolonged period of time, such as an unsold vehicle or a vehicle in storage, to the point the battery is dead.
- Shallow discharge - A battery that is drained by leaving an accessory on for several hours or a few days and has a very low charge.

The vehicle charging system is designed to supply the electrical power needed to maintain the battery near full charge during normal vehicle use. The charging system is not capable of bringing a deeply discharged battery back to near full charge in a short amount of time such as allowing the vehicle to idle for 15 minutes to "recharge the battery". Discharged batteries should be charged using an external charger.

NOTE: Battery chargers have improved greatly with the addition of the new generation pulse chargers. These chargers pulse current into the battery, breaking down the sulfation layer on the battery plates and generally reduce charging times to less than an hour.

NOTE: Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm to approximately 5°C (41°F) before charging. This may require 4 to 8 hours at room temperature.

The following chart summarizes 2 recommended methods of charging.

Type of Battery Discharge	Pulse Charger	Standard Charger
Deeply discharged	Follow directions supplied with the pulse charger	2 to 8 hours and may take up to an hour to accept initial charge
Shallow discharge	45 minutes to an hour charge	2 hours below (40A) on manual setting or medium automatic setting

Inspection And Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Battery • Battery mounting	• Battery cables • Battery posts

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, GO to Pinpoint Test A in the Pinpoint Test procedure.

Pinpoint Test

Special Tool(s)

 ST3285-A	GR 1 190 V3.0 Intelligent Diagnostic Charger 162-00036 or equivalent

Pinpoint Test A: Battery Condition Test

Normal Operation

Battery condition is determined by measuring battery terminal voltage after a specific discharge current is applied for a specified time period.

This pinpoint test is intended to diagnose the following:

- Battery charge
- Battery

PINPOINT TEST A: BATTERY CONDITION TEST

Test Step	Result / Action to Take
A1 TEST THE BATTERY CONDITION	
NOTE: A red test-eye indicates the battery is discharged, not necessarily defective. **NOTE:** Failure to fully charge the battery before retesting may cause false readings. • Verify the battery condition using the Intelligent Diagnostic Charger. • **Is the battery OK?**	**Yes** RETURN the battery to service. **No** If the analyzer reads REPLACE BATTERY or REPLACE-BAD CELL, INSTALL a new battery. REFER to Battery in this section.

Component Test

Battery - Drain Tests

⚠ WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

NOTICE: **To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.**

NOTE: No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

Check for current drains on the battery in excess of 50 mA (0.050 amp) with all the electrical accessories off and the vehicle at rest for at least 40 minutes. Current drains can be tested with the following procedure.

NOTE: Many electronic modules draw 10 mA (0.010 amp) or more continuously.

NOTE: Typically, a drain of approximately 1 amp is attributed to an engine compartment lamp, glove compartment lamp or interior lamp staying on continually. Other component failures or wiring shorts are located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading falls to an acceptable level. If the drain is still not located after checking all the fuses, it may be due to the generator. Disconnect the generator and retest.

NOTE: To accurately test the drain on a battery, an in-line ammeter must be used between the negative battery post and its respective cable. Use of a test lamp or voltmeter is not an accurate method.

1. Drive the vehicle at least 5 minutes and over 48 km/h (30 mph) to turn on and activate the vehicle systems.

2. After driving the vehicle and before testing, make sure the junction box(es)/fuse panel(s) is accessible without turning on the interior lights or the underhood lights.

3. Allow the vehicle to sit with the key out of the ignition for at least 40 minutes to allow the modules to time out/power down.

4. Connect a fused jumper wire (30A) between the negative battery cable and the negative battery post to prevent modules from resetting.

5. Disconnect the negative battery cable from the negative battery post without breaking the connection of the jumper wire.

6. **NOTE:** It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire 40-minute procedure must be repeated.

Connect the battery tester between the negative battery cable and the post. The meter must be capable of reading milliamps and should have a 10-amp capability.

7. **NOTE:** If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

   Remove the jumper wire.

8. Note the amperage draw. Draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.

NOTE: If the vehicle sits for an extended period of time and the battery drains, there is the possibility of a control module staying alive and not going into sleep mode. If a module does stay alive, it can also result in battery drain. If a module is suspect, isolate individual modules by disconnecting each module one at a time and note if the excessive draw goes away.

NOTE: For vehicles equipped with aftermarket bodies or boxes which contain electrical connections, disconnect the aftermarket to factory connections to isolate the body from the chassis.

9. If the current draw is excessive, remove the fuses from the Battery Junction Box (BJB) one at a time and note the current drop. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located. The excessive draw can be isolated by continuing to pull sub system fuses. Do not reinstall the fuses until testing is finished. To correctly isolate each of the circuits, all of the fuses may need to be removed, then install one fuse and note the amperage draw, remove the fuse and install the next fuse. Continue this process with each fuse.
   - Once the main circuit is identified, continue to remove the fuses from the Smart Junction Box (SJB) one at a time and note the current reading. Do not reinstall the fuses until testing is finished. To correctly isolate each of the circuits, all of the fuses may need to be removed, then install one fuse and note the amperage draw, remove the fuse and install the next fuse. Continue this process with each fuse.

10. Check the wiring diagrams for any circuits that run from the battery without passing through the BJB or the SJB . If the current draw is still excessive, disconnect these circuits until the draw is found. Also, disconnect the generator electrical connections and retest if the draw cannot be located. The generator may be internally shorted, causing the current drain.

Battery Disconnect

⚠ WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

⚠ WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches. Refer to the Description and Operation portion of Section 501-20B for location of the RCM and impact sensor(s). To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped). Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

⚠ WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

NOTICE: **If equipped with the CD6 audio unit, precautions must be taken when the battery has been disconnected. When reconnecting the battery, make sure no interruption of power occurs for 30 seconds. If power is interrupted during the first 30 seconds, permanent damage to the CD6 audio unit will result.**

1. **NOTE:** When the battery is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven to relearn its strategy.

   NOTE: When disconnecting the battery ground cable to interrupt power to the vehicle electrical system, disconnect the battery ground cable only. It is not necessary to disconnect the positive battery cable.

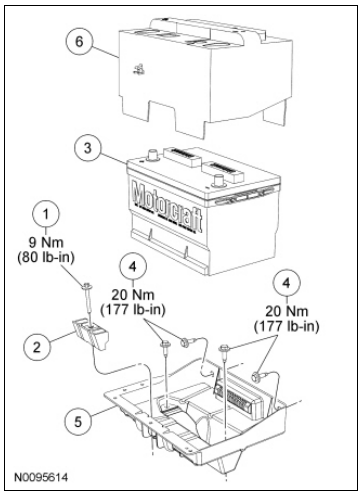
   Disconnect the battery ground cable.

   - To connect, tighten to 7 Nm (62 lb-in).

2. Disconnect the positive battery cable.
   - To connect, tighten to 7 Nm (62 lb-in).

3. To connect, reverse the disconnect procedure.

Battery and Battery Tray - Exploded View



Item	Part Number	Description
1	W712657	Battery hold-down bolt
2	10747	Battery hold-down clamp
3	10655	Battery
4	W701834	Battery tray bolts (4 required)
5	10723	Battery tray
6	10A687	Battery shield

1. For additional information, refer to the procedures in this section.

Battery

Removal and Installation

⚠ WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

1. Disconnect the battery. For additional information, refer to Battery Disconnect in this section.

2. Remove the battery hold-down clamp and bolt.
   - To install, tighten to 9 Nm (80 lb-in).

3. ***NOTICE:*** **Be sure the battery cover is re-installed to avoid premature battery failure.**

   Remove the battery, and if equipped, remove the battery cover.

4. To install, reverse the removal procedure.

Battery Tray

Removal and Installation

⚠ WARNING: Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.

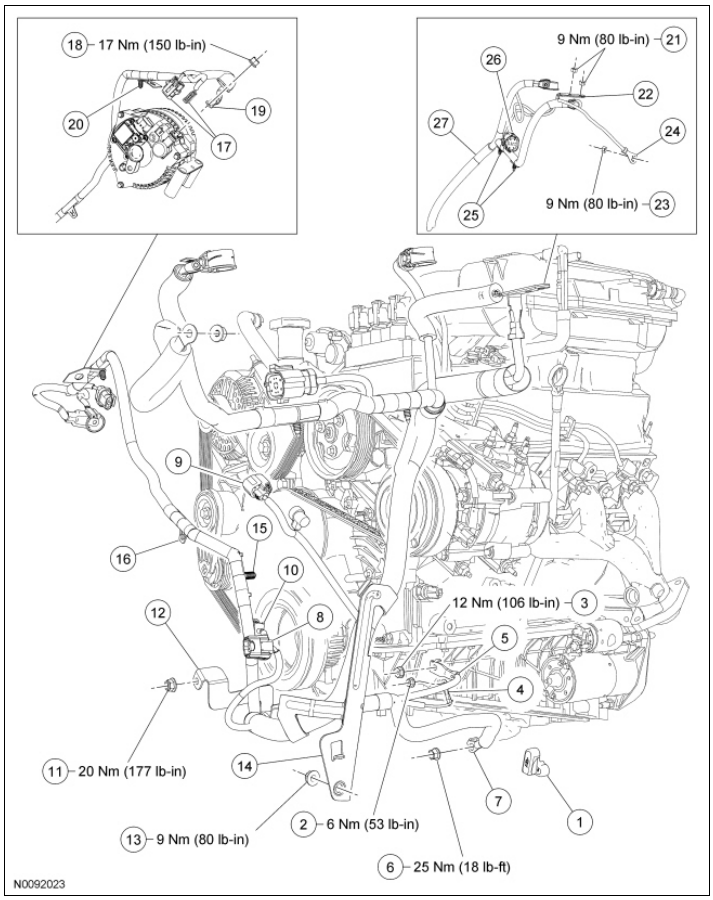
1. Remove the battery. For additional information, refer to Battery in this section.

2. Remove the 4 battery tray bolts.
   - To install, tighten to 20 Nm (177 lb-in).

3. Remove the battery tray.
   - Release the battery cable harness locators.

4. To install, reverse the removal procedure.

Battery Cables - 4.0L



Item	Part Number	Description
1	11N087	Starter solenoid terminals protective cap
2	W705790	Starter solenoid wire cable terminal nut
3	W706414	Starter solenoid positive cable terminal nut
4	-	Starter solenoid wire cable terminal (part of 14300)
5	-	Starter solenoid positive cable terminal (part of 14300)
6	N802001	Starter motor ground cable terminal nut
7	-	Starter motor ground cable terminal (part of 14300)
8	-	Power steering pressure switch electrical connector (part of 14300)
9	-	A/C compressor electrical connector (part of 14300)
10	-	Oil pressure sending unit electrical connector (part of 14300)
11	W520112	Battery cable engine front cover bracket nut
12	-	Battery cable engine front cover bracket (part of 14300)
13	W520112	Battery cable frame bracket nut
14	-	Battery cable frame bracket (part of 14300)

15	-	Battery cable harness locator (part of 14300)
16	-	Battery cable harness locator (part of 14300)
17	-	Generator electrical connectors (part of 14300)
18	W705790	Generator B+ terminal nut
19	-	Generator B+ terminal (part of 14300)
20	-	Battery cable harness locator (part of 14300)
21	W705790	Battery Junction Box (BJB) nuts (2 required)
22	-	BJB terminal (part of 14300)
23	W705790	Battery cable body ground terminal nut
24	-	Battery cable body ground terminal (part of 14300)
25	-	Battery cable harness locators (2 required) (part of 14300)
26	-	Battery cable harness electrical connector (part of 14300)
27	14300	Battery cable

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Disconnect the battery. For additional information, refer to Battery Disconnect in this section.
3. Remove the starter solenoid terminals protective cap.
4. Remove the starter solenoid wire cable terminal nut.
   - To install, tighten to 6 Nm (53 lb-in).
5. Remove the starter solenoid positive cable terminal nut.
   - To install, tighten to 12 Nm (106 lb-in).
6. Disconnect the starter solenoid wire cable terminal.
7. Disconnect the starter solenoid positive cable terminal.
8. Remove the nut and disconnect the starter motor ground cable terminal.
   - To install, tighten to 25 Nm (18 lb-ft).
9. Disconnect the power steering pressure switch electrical connector.
10. Disconnect the A/C compressor electrical connector.
11. Disconnect the oil pressure sending unit electrical connector.
12. Remove the nut and position the battery cable engine front cover bracket aside.
    - To install, tighten to 20 Nm (177 lb-in).
13. Remove the nut and position the battery cable frame bracket aside.
    - To install, tighten to 9 Nm (80 lb-in).
14. Release the battery cable harness locators from the front of the engine.

15. Disconnect the 2 generator electrical connectors.

16. Position the protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 17 Nm (150 lb-in).

17. Release the battery cable harness locator from the generator harness guide.

18. Open the Battery Junction Box (BJB) cover and remove the 2 BJB nuts.
    - To install, tighten to 9 Nm (80 lb-in).

19. Disconnect the BJB terminal.

20. Remove the nut and position the battery cable body ground terminal aside.
    - To install, tighten to 9 Nm (80 lb-in).

21. Remove the 2 battery cable harness locators from the battery tray.

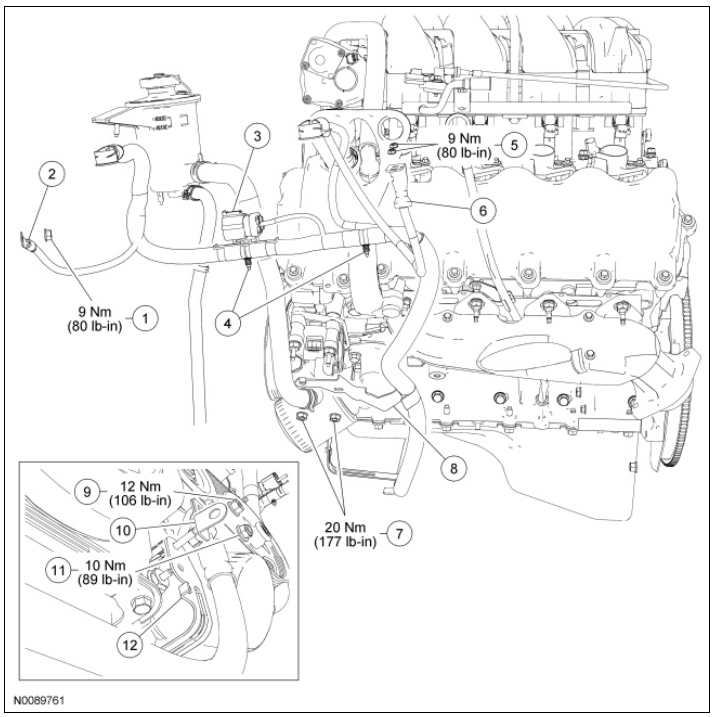
22. Disconnect the battery cable harness electrical connector.

23. Remove the battery cables.

24. To install, reverse the removal procedure.

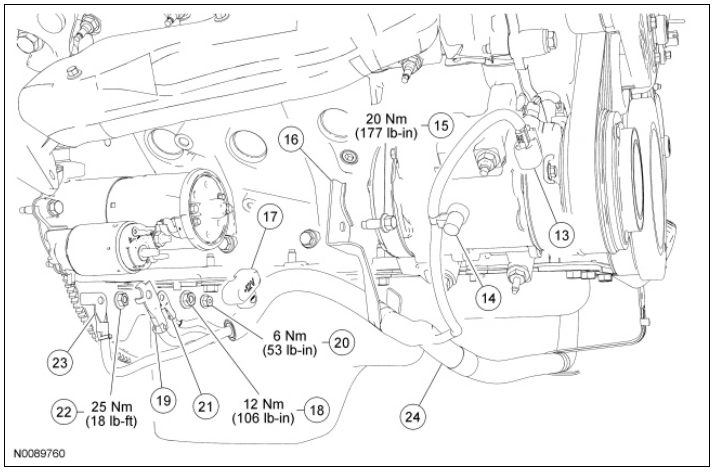
Battery Cables - 4.6L

LH Engine Connections



Item	Part Number	Description
1	W705790	Battery cable body ground terminal nut
2	-	Battery cable body ground terminal (part of 14300)
3	-	Battery cable electrical connector (part of 14300)
4	-	Battery cable locators (2 required) (part of 14300)
5	W705790	Battery Junction Box (BJB) terminal nuts (2 required)
6	-	BJB terminal (part of 14300)
7	W520112	Battery cable bracket nuts (2 required)
8	10W652	Battery cable bracket
9	N805320	Power steering line bracket nut
10	-	P/S line bracket (part of 3A719)
11	W520111	Battery cable engine front cover bracket nut
12	-	Battery cable engine front cover bracket (part of 14300)

RH Engine Connections



Item	Part Number	Description
13	-	A/C compressor electrical connector (part of 14300)
14	-	A/C compressor electrical connector harness locator (part of 14300)
15	W505223	Battery cable right engine mount bracket bolt
16	10W652	Battery cable right engine mount bracket
17	11N087	Starter solenoid terminals protective cap
18	W706414	Starter solenoid positive cable terminal nut
19	-	Starter solenoid positive cable terminal (part of 14300)
20	W705790	Starter solenoid wire cable terminal nut
21	-	Starter solenoid wire cable terminal (part of 14300)
22	W520112	Battery cable engine ground terminal nut
23	-	Battery cable engine ground terminal (part of 14300)
24	14300	Battery cable

Removal and Installation

1. Disconnect the battery. For additional information, refer to Battery Disconnect in this section.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

3. Remove the nut and position the battery cable body ground terminal aside.
   - To install, tighten to 9 Nm (80 lb-in).

4. Disconnect the battery cable electrical connector.

5. Remove the 2 battery cable locators from the battery tray.

6. Remove the Battery Junction Box (BJB) terminal nuts.
   - To install, tighten to 9 Nm (80 lb-in).

7. Position the generator harness terminal aside.

8. Position the BJB terminal aside.

9. Remove the 2 nuts and position the battery cable bracket aside.

- To install, tighten to 20 Nm (177 lb-in).

10. Remove the nut and position the power steering line bracket aside.
    - To install, tighten to 12 Nm (106 lb-in).

11. Remove the nut and position the battery cable engine front cover bracket aside.
    - To install, tighten to 10 Nm (89 lb-in).

12. Disconnect the A/C compressor electrical connector.

13. Remove the A/C compressor electrical connector harness locator.

14. Remove the bolt and position the battery cable right engine mount bracket aside.
    - To install, tighten to 20 Nm (177 lb-in).

15. Remove the starter solenoid terminals protective cap.

16. Remove the nut and position the starter solenoid positive cable terminal aside.
    - To install, tighten to 12 Nm (106 lb-in).

17. Remove the nut and position the starter solenoid wire cable terminal aside.
    - To install, tighten to 6 Nm (53 lb-in).

18. Remove the nut and position the battery cable engine ground terminal aside.
    - To install, tighten to 25 Nm (18 lb-ft).

19. Remove the battery cable.

20. To install, reverse the removal procedure.

Torque Specifications

Description	Nm	lb-in
Antenna cable bracket bolt	8	71
Satellite radio antenna bolt	5	44
Satellite Digital Audio Receiver System (SDARS) module bolt	7	62
SDARS module nut	7	62
Subwoofer enclosure bolt (except Explorer Sport Trac)	5	44

Information and Entertainment System

Audio Line-Up

The following audio systems are available:

- Base
  - AM/FM single CD Audio Front Control Module (ACM)
  - Four speakers
- Audiophile
  - AM/FM 6-CD changer ACM
  - Four speakers plus subwoofer
- Navigation
  - Navigation ACM
  - Audiophile sound system (4 speakers plus subwoofer)

All audio systems include the following features:

- Speed sensitive volume
- Accessory delay
- MP3 capability
- Audio input jack

The following options are available:

- Satellite radio
- SYNC system
- Family entertainment system

Antenna - AM/FM, Satellite Radio, and Global Positioning System (GPS)

The vehicle is equipped with a fixed mast AM/FM antenna mounted on the right front fender. The AM/FM antenna cable has 2 parts. The AM/FM antenna upper cable is included as part of the antenna base. The AM/FM lead-in cable connects the ACM to the upper cable. The 2 cables connect behind the glove compartment.

The satellite radio antenna (if equipped) consists of a satellite radio antenna cable and a roof-mounted satellite radio antenna. For vehicles with satellite audio and navigation, a combination satellite audio/Global Positioning System (GPS) antenna is utilized, as well as a 2-piece satellite radio antenna cable to connect the satellite radio antenna to the ACM .

Speakers

All vehicles are equipped with 4 speakers mounted in the doors. The subwoofer is mounted behind the rear seat (Explorer Sport Trac), or behind the RH rear quarter trim panel (Explorer, Mountaineer).

Navigation System

The navigation system consists of the following:

- Navigation ACM
- GPS antenna (integral to the satellite radio antenna)
- Satellite radio/ GPS splitter cable (located behind the ACM)
- Microphone (located in the auto-dimming interior mirror)

The ACM controls the operation of the navigation system and the audio system. The system uses a GPS antenna, a vehicle speed input, and other sensor information to accurately establish the vehicle position.

Family Entertainment System

The family entertainment system consists of the following:

- Rear Entertainment Module (RETM) (mounted to the headliner)
- A/V ports for connecting a gaming system
- 2 wireless headphones
- A wireless remote control

SYNC System

The SYNC system consists of the following:

- Accessory Protocol Interface Module (APIM), located in the floor console
- SYNC-specific steering wheel controls
- Microphone (located in the auto-dimming interior mirror)
- Universal Serial Bus (USB) cable and port (located in the center console)
- Audio input jack (located in the center console)

SYNC is a hands-free communications and entertainment system that allows the following interactions:

- Send and receive phone calls via a Bluetooth-enabled phone
- Send and receive text messages via a Bluetooth-enabled phone
- Connect media devices (such as an iPod® or USB flash device) in order to play audio files
- Play media files via a Bluetooth-enabled audio device

For vehicles with SYNC V2, the following additional features are provided:

- Vehicle health reports
    - ♦ Provides vehicle data to the customer upon request
- Emergency call (eCall)
    - ♦ Initiates an emergency call through a paired mobile phone when the air bags deploy

Once a vehicle has had the APIM flashed to V2, it cannot be reverted back to V1.

Not all features are available with every phone.

For additional information on audio system operation, including the SYNC system, refer to the Owner's Literature.

Satellite Audio

The satellite audio system is comprised of the following:

- Satellite Digital Audio Receiver System (SDARS) module, located behind the glove compartment (vehicles without navigation)

- ACM (vehicles with navigation)
- Satellite radio antenna cable
- Satellite radio antenna

For vehicles with navigation, the satellite radio receiver is built-in to the ACM .

Information and Entertainment System

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent
 ST3086-A	Multi-Media Interface Tester 105-00120
 ST3051-A	Universal Serial Bus (USB) Male-A to Male-A Cable CCMUSB2-AM-AM-10

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

Audio Front Control Module (ACM)

The Audio Front Control Module (ACM) can be operated with the ignition in RUN or ACC. The accessory delay feature allows the audio system to be operated for a preset period of time after the ignition is turned off and a front door has not been opened. The ACM sends AC voltage audio signals to the speakers or to the amplifier, depending on vehicle configuration. The ACM can produce its own DTCs, which can be communicated to the scan tool through the Medium Speed Controller Area Network (MS-CAN).

Satellite Audio

The satellite audio system consists of a Satellite Digital Audio Receiver System (SDARS) module (integral to the ACM for vehicles with navigation), a satellite radio antenna, and a satellite radio antenna cable. The satellite radio antenna receives digital audio signals and sends them to the satellite receiver. The stand-alone SDARS module communicates via the MS-CAN .

Navigation System

The vehicle navigation system guides the user to a pre-entered destination. No navigation map DVD is needed, as the map guidance information is stored in the ACM . The ACM calculates route information based on Global Positioning System (GPS) data. The GPS antenna tracks several satellites simultaneously. The ACM also uses vehicle speed and transmission gear selected signals received through the MS-CAN to detect

vehicle speed and direction, resulting in more accurate navigation tracking.

The navigation display is shown on the ACM display. Either the touchscreen or the buttons on the ACM can be used to interact with the navigation system.

The compass heading is derived from the GPS antenna signal. There are no serviceable parts for the compass.

A voice recognition system allows the user to interface with the system without using the touchscreen. A microphone located in the auto-dimming interior mirror provides a direct input to the ACM . The microphone is shared with the SYNC system.

Jukebox Feature

The navigation ACM contains a 10 Gigabyte on-board hard drive that is capable of storing music ripped (recorded) from a music disc. The music can be loaded into the jukebox by inserting a disc (in the proper format) and following the on-screen instructions to load the music into the ACM . The jukebox cannot rip MP3 discs.

SYNC System

The SYNC system allows interaction with several types of customer devices, including mobile phones and media devices. The system is comprised of the Accessory Protocol Interface Module (APIM), a microphone (located in the auto-dimming interior mirror), the Universal Serial Bus (USB) cable and port, and the audio input jack. The APIM contains an on-board Bluetooth chipset, which enables certain wireless devices to interact with the system.

The APIM consists of 2 internal modules: the Consumer Interface Processor (CIP) and the Vehicle Interface Processor (VIP). The modules are not replaceable individually, but can be flashed independently, if required.

The CIP interfaces with all of the inputs to the APIM . It contains an analog-to-digital-to-analog converter, as well as the Bluetooth chipset. Any consumer-available application upgrades that are available are loaded directly to the CIP through the USB port.

The VIP provides an interface between the CIP and the vehicle. Its main functions are controlling the APIM power management and translating both inbound and outbound signals over the CAN . In addition, the VIP interrogates the modules on the network to retrieve any DTCs when a vehicle health report is requested.

The APIM can receive inputs from the following audio sources:

- USB port
- Audio input jack
- Bluetooth

The USB port can be used for connecting a media device (such as an iPodÂ®) with the device's available cable, or for directly plugging in a portable mass storage device (such as a "thumb drive"). When playing media files stored on a mass storage device, the SYNC system only plays files that do not have Digital Rights Management (DRM) protection. The USB port can also be used for uploading vehicle application upgrades.

The USB port is powered by the APIM , so no external power source is needed to power a device plugged into the USB port if the device supports this feature.

The audio input jack can be used for connecting a media device (such as an iPodÂ®) utilizing a 1/8-inch audio jack. When a device is connected through the audio input jack, only the speaker volume can be controlled by the ACM . All other functions (such as seek, fast forward, pause, etc.) must be carried out on the

device itself.

The Bluetooth interface can accommodate both Bluetooth-enabled mobile phones and Bluetooth-enabled media devices. Any Bluetooth device used with the SYNC system must first be paired with the system before it is operational.

Bluetooth is a secure, short-range radio frequency that allows devices to communicate wirelessly through radio waves. The operating range of a Bluetooth signal is a maximum of 32 feet.

Only one Bluetooth phone and one Bluetooth media device can be connected to the system at any one time. If an additional device of either type is paired with the system and made active, the APIM disconnects any active connection and establishes a connection with the new device.

It is important to understand that not all mobile phones have the same level of features when interacting with the SYNC system. For a list of compatible phones, refer to the SyncMyRide website .

In addition to audio information, metadata may also be sent to the APIM from a device plugged into the USB port. Metadata consists of information such as artist, album title, song title, and genre. The metadata is used by the APIM to create indexes that can be used to sort for particular music, based on customer preference. Not all USB devices can send metadata to the APIM ; also, no metadata is transferred when a device is connected through the audio input jack. When a new media device is connected to the SYNC system, the APIM automatically indexes the information. This may take several minutes (depending on the amount of data on the device), and is considered normal operation. When a device that was previously connected to the SYNC system is reconnected, the APIM updates the index (rather than creating a new one), which reduces the amount of time needed to index the device.

The APIM receives both stereo and mono sound inputs, and can also transmit both stereo and mono sound. The mono function is used to receive the microphone input. It is also used to send sound to the ACM for voice prompts, the Text-To-Speech (TTS) feature, ringtones, and any audio received through a connected mobile phone. The TTS feature speaks information so that it does not have to be read from the display.

The APIM communicates on the MS-CAN and High Speed Controller Area Network (HS-CAN). Communication with the scan tool is established through the HS-CAN .

Voice Recognition For Vehicles With Navigation And The SYNC System

When the audio system enters voice recognition mode, the ACM initially controls the voice recognition feature. The microphone is wired directly to the APIM , which relays the microphone input to the ACM through dedicated wiring. If the first command spoken is part of the ACM voice recognition set, the ACM retains control of the voice recognition and takes the appropriate action(s). If the first command spoken is part of the APIM voice recognition set, the ACM shuts off its own voice recognition and broadcasts a Controller Area Network (CAN) message to the APIM , transferring the voice recognition to the SYNC system and providing the voice command that was spoken. The ACM controls the voice engine for the base audio, navigation, and climate control systems. The APIM controls the voice engine for the SYNC system (USB port, audio input jack, Bluetooth).

AM/FM Antenna

The AM/FM antenna is located on the right front fender. The antenna mast receives radio waves and sends them to the ACM through the 2-piece AM/FM antenna cable.

Global Positioning System (GPS) Antenna

For vehicles equipped with navigation, the GPS antenna receives information from satellites. The compass

heading is also derived from the GPS signal. The vehicle utilizes a combination satellite radio/ GPS antenna.

Steering Wheel Controls

The steering wheel controls consist of a series of resistors. Each steering wheel control switch function corresponds with a specific resistance value within the switch. When a switch is pressed, the ACM (or the APIM) monitors the change in reference voltage to determine the requested function.

Family Entertainment System

When a video disc is inserted into the Rear Entertainment Module (RETM) and the PLAY button is pressed, an image is displayed on the screen and a stereo signal is transmitted to the ACM . The family entertainment system allows for single/dual-play mode. The RETM communicates via the MS-CAN .

Single-Play Mode

In single-play mode, any audio input routed through the RETM is broadcast through all of the vehicle speakers. These audio inputs include the RETM , SYNC system audio, and peripheral devices plugged into the RETM .

Dual-Play Mode

In dual-play mode, the ACM continues to control the output to the front speakers, while the RETM mutes the audio to the rear speakers. The RETM continues to broadcast the rear audio source to the headphones. When the headphones are set to channel A, all audio sources can be accessed. When the headphones are set to channel B, only the DVD audio and auxiliary audio sources (such as a gaming system) can be sent to the headphones.

Audio Input Jack

The audio input jack allows for a portable MP3 player to be connected to the vehicle audio system. When a portable MP3 player is connected, audio from the MP3 player can be played through the vehicle speakers.

Subwoofer

The Audiophile subwoofer and amplifier are integral. The enable/clip detection circuit carries out 2 functions: to turn the amplifier on, and to indicate to the ACM when the subwoofer output distortion signal reaches a damaging level. The ACM then clips the audio output signal to prevent damage to the subwoofer.

Noise Suppression Equipment

The radio frequency suppression equipment reduces interference transmitted through the speakers by the engine ignition and electrical systems. When installing any new radio suppression equipment components, make sure that a good contact is made at all connections.

Audio Signals

Stereo signals contain left and right channel information. They are used for most audio signals.

A mono signal is used for the microphone input to the APIM . The mono signal is also used for the voice prompts, the TTS feature, ringtones, and any audio received through a connected mobile phone. These audio signals are output from the APIM to the ACM . The mono output from the APIM utilizes separate circuits from the stereo output.

A digital signal is used to transmit data from a media device connected through the USB port to the APIM . The APIM then converts the signal to analog and relays the signal to the receiving module, which varies by vehicle configuration.

A wireless signal is used to broadcast audio signals from a Bluetooth media device to the APIM , which converts the wireless audio signal to analog and relays it to the ACM .

Network Communication

The following audio system components communicate via the MS-CAN :

- ACM
- Navigation ACM
- SDARS module
- RETM

There are numerous messages internal to the audio system. The functions of these messages include (but are not limited to):

- Changing the audio source
- Changing equalizer settings
- Updating the ACM display
- Dialing phone numbers from the ACM (if equipped with the SYNC system)

In addition, the following messages are utilized by the audio system in conjunction with systems outside of the audio system:

Audio System Message List

Message	Transmitting Module	Receiving Module(s)	Audio System Function
Accessory Delay Status	SJB	Navigation ACM RETM	When active, this signal allows the audio component to be operated after the vehicle is shut off.
eCall Notification	Restraints Control Module (RCM)	APIM	Provides the eCall status to the RCM . This message is also used to confirm that the APIM and RCM are both configured for the eCall feature.
eCall Status	APIM	RCM	Provides the eCall status to the APIM . This message is also used to confirm that the APIM and RCM are both configured for the eCall feature.
Ignition Switch Position	SJB	ACM RETM	Indicates the ignition position to the audio system modules in order to control power management.
Illumination Dimmer Level	SJB	ACM RETM	Controls the backlight intensity, based on the position of the dimmer switch.
Navigation Radio Rolling Wheel Count	IC	ACM	Provides for more accurate tracking of the vehicle position when the GPS signal is temporarily unavailable. This message only applies to vehicles

			with navigation.
Odometer Rolling Count	PCM	APIM	Provides the odometer reading to the APIM in order to initiate maintenance interval notifications. This message only applies to vehicles with SYNC V2.
Transmission Selector (PRNDL) Range	IC	ACM	For the navigation system, this signal is used for more accurate navigation tracking. For the parking assist system, this signal is used by the ACM to determine if it should enable the speaker mute feature if a parking aid tone sounds.
Vehicle Speed	IC	ACM	Used by the ACM for the speed-compensated volume function.
Volume Cutback	Parking Aid Module (PAM)	ACM	When this signal is active, the speaker output is reduced to allow the parking aid tone to be more easily heard.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Audio Front Control Module (ACM) • AM/FM antenna • Satellite radio antenna • Rear Entertainment Module (RETM) • Noise suppression equipment	• Smart Junction Box (SJB) fuse(s): ♦ 3 (20A) (ACM hot at all times) ♦ 5 (5A) (auto-dimming interior mirror) ♦ 11 (5A) (ACM hot in START) ♦ 12 (5A) (ACM hot in RUN/ACC) • Battery Junction Box (BJB) fuse(s): ♦ 22 (20A) (subwoofer) ♦ 41 (15A) (Accessory Protocol Interface Module (APIM), RETM , Satellite Digital Audio Receiver System (SDARS) module) • Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).
5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

If the scan tool does not communicate with the VCM :

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM .
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. **NOTE:** Do not press any buttons on the ACM while it is carrying out the self-test.

   Clear the continuous DTCs and carry out the self-test diagnostics for the ACM .

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Charts.

DTC Charts

Audio Front Control Module (ACM) â Without Navigation DTC Chart

DTC	Description	Action
B1117	Audio Steering Wheel Button Stuck	GO to Pinpoint Test F .
B1318	Battery Voltage Low	GO to Pinpoint Test AC .
B1342	ECU is Faulted	**NOTE:** DTC B1342 can set as a result of a speaker circuit fault. In this case, DTC B2965 should also set. Make sure to repair the speaker circuit fault before diagnosing DTC B1342. CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is the only DTC retrieved again, INSTALL a new Audio Front Control Module (ACM). REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation.
B2103	Antenna Not Connected	GO to Pinpoint Test A .
B2404	Audio Steering Wheel Switch Circuit Failure	GO to Pinpoint Test F .
B2405	Audio Disc CD Player Thermal Shutdown Fault	The ACM was over temperature. This may occur during extended use. Audio operation will resume after the ACM cools. CLEAR the DTCs. This is normal operation.
B2406	Audio Disc CD Player Internal Fault	**NOTE:** DTC B1342 may also be set. CLEAR the DTCs. REPEAT the self-test. If DTC B2406 is retrieved again, INSTALL a new ACM . REFER to Audio

		Control Module (ACM) in this section. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to Section 418-01 .
B2924	Audio Button Stuck	GO to Pinpoint Test Y .
B2965	Audio System Speaker Circuit Fault	GO to Pinpoint Test C .
U0140	Lost Communication With Body Control Module (GEM)	GO to Pinpoint Test AJ .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	GO to Pinpoint Test AK .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	GO to Pinpoint Test AM .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	GO to Pinpoint Test AN .
U0197	Lost Communication With Telephone Control Module	GO to Pinpoint Test AO .
U2050	No Application Present	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing / Corrupt	REFER to Section 418-01 .

Audio Front Control Module (ACM) â With Navigation DTC Chart

NOTE: This module utilizes a 5-character DTC followed by a 2-character failure-type code. The failure-type code provides information about specific fault conditions such as opens or shorts to ground. Continuous memory DTCs have an additional 2-character DTC status code suffix to assist in determining DTC history.

DTC	Description	Action
B119F:01	GPS Antenna: General Electrical Failure	GO to Pinpoint Test K .
B119F:13	GPS Antenna: Circuit Open	GO to Pinpoint Test K .
B11BA:1C	Steering Wheel Audio Switch Pack: Circuit Voltage Out of Range	GO to Pinpoint Test F .
B11BA:63	Steering Wheel Audio Switch Pack: Circuit / Component Protection Time-Out	GO to Pinpoint Test F .
B1201:1C	Steering Wheel Audio Switch Pack 2: Circuit Voltage Out of Range	GO to Pinpoint Test F .
B1201:63		GO to Pinpoint Test F .

	Steering Wheel Audio Switch Pack 2: Circuit / Component Protection Time-Out	
B121C:01	Hard Drive: General Electrical Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B121C:01 is retrieved again, INSTALL a new Audio Front Control Module (ACM). REFER to Audio Control Module (ACM) in this section. REPEAT the self-test.
B1A01:01	Speaker #1: General Electrical Failure	GO to Pinpoint Test X .
B1A02:01	Speaker #2: General Electrical Failure	GO to Pinpoint Test X .
B1A03:01	Speaker #3: General Electrical Failure	GO to Pinpoint Test X .
B1A04:01	Speaker #4: General Electrical Failure	GO to Pinpoint Test X .
B1A05:01	Speaker #5: General Electrical Failure	GO to Pinpoint Test D .
B1A56:21	Antenna: Signal Amplitude â © Minimum	**NOTE:** If DTC B1A56:21 sets after running the bezel diagnostic tests disregard this DTC. This test is used for end of line or repair bay testing at the Ford plant. Each plant has its own assigned frequency and signal strength requirements. The running and passing of this test depends on local radio stations. If no local station is broadcasting on the required frequency the test will fail. Therefore test ran from the bezel diagnostic screen and the DTC generated from the test can be disregarded. DISREGARD this DTC.
B1A89:01	Satellite Antenna: General Electrical Failure	GO to Pinpoint Test B .
B1A89:13	Satellite Antenna: Circuit Open	GO to Pinpoint Test B .
B1D19:49	Compact Disc Unit: Internal Electronic Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B1D19:49 is retrieved again, INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. REPEAT the self-test.
B1D19:4B	Compact Disc Unit: Over Temperature	The ACM was over temperature. This may occur during extended use. Audio operation will resume after the ACM cools. CLEAR the DTCs. This is normal operation.
B1D78:13	Auxiliary Input: Circuit Open	**NOTE:** This DTC applies to vehicles without the SYNC system only. For all others, disregard the DTC. GO to Pinpoint Test I .
B1D79:01	Microphone Input: General Electrical Failure	For vehicles with the SYNC system, GO to Pinpoint Test V . For all others, GO to Pinpoint Test N .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AJ .
U0155:00	Lost Communication With Instrument Panel	GO to Pinpoint Test AK .

	Cluster (IPC) Control Module: No Sub Type Information	
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	GO to Pinpoint Test E .
U0196:00	Lost Communication With Entertainment Control Module-Rear "A": No Sub Type Information	GO to Pinpoint Test AN .
U0197:00	Lost Communication With Telephone Control Module: No Sub Type Information	GO to Pinpoint Test AO .
U2013:63	Switch Pack: Circuit / Component Protection Time-Out	GO to Pinpoint Test Y .
U2014:09	Control Module Hardware: Component Failure	GO to Pinpoint Test M .
U2014:41	Control Module Hardware: General Checksum Failure	CLEAR the DTCs. REPEAT the self-test. If DTC U2014:41 is retrieved again, INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. REPEAT the self-test.
U2014:96	Control Module Hardware: Component Internal Failure	GO to Pinpoint Test T .
U201A:51	Control Module Main Calibration Data: Not Programmed	REFER to Section 418-01 .
U2100:00	Initial Configuration Not Complete: No Sub Type Information	REFER to Section 418-01 .
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	REFER to Section 418-01 .
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AC .
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AD .

Satellite Digital Audio Receiver System (SDARS) Module DTC Chart

DTC	Description	Action
B1031		GO to Pinpoint Test B .

	SDARS Satellite Antenna Open	
B1032	SDARS Satellite Antenna Short	GO to Pinpoint Test B .
B1318	Battery Voltage Low	GO to Pinpoint Test AE .
B1342	ECU is Faulted	**NOTE:** Repair all other DTCs before diagnosing DTC B1342. CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new Satellite Digital Audio Receiver System (SDARS) module. REFER to Satellite Digital Audio Receiver System (SDARS) Module in this section. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to Section 418-01 .
U0184	Lost Communication With Radio (ACM)	GO to Pinpoint Test AL .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	GO to Pinpoint Test AN .
U0197	Lost Communication With Telephone Control Module	GO to Pinpoint Test AO .
U2050	No Application Present	REFER to Section 418-01 .

Rear Entertainment Module (RETM) DTC Chart

DTC	Description	Action
B1119	Audio Disc DVD Player Thermal Shutdown	The Rear Entertainment Module (RETM) was over temperature. This may occur during extended use or high in-vehicle temperature. Operation will resume after the unit cools. This is normal operation. CLEAR the DTCs.
B111F	LCD Thermal Shutdown	The Liquid Crystal Display (LCD) screen was over temperature. This may occur during extended use or high in-vehicle temperature. Operation will resume after the unit cools. This is normal operation. CLEAR the DTCs.
B1317	Battery Voltage High	GO to Pinpoint Test AH .
B1318	Battery Voltage Low	GO to Pinpoint Test AI .
B1342	ECU is Faulted	**NOTE:** Repair all other DTCs before diagnosing DTC B1342. CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to Section 418-01 .
B2656	DVD (Digital Versatile Disk) Error	CLEAR the DTCs. REPEAT the self-test. If DTC B2656 is still present, INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation.
B2924	Audio Button Stuck	

		VERIFY no RETM buttons are stuck and that no RETM button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again, INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation.
U0140	Lost Communication With Body Control Module (GEM)	GO to Pinpoint Test AJ .
U0184	Lost Communication With Radio (ACM)	GO to Pinpoint Test AL .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	GO to Pinpoint Test AM .
U2050	No Application Present	REFER to Section 418-01 .

Accessory Protocol Interface Module (APIM) â V1 DTC Chart

DTC	Description	Action
B1038	Microphone Input Circuit Failure	GO to Pinpoint Test V .
B1117	Audio Steering Wheel Button Stuck	GO to Pinpoint Test F .
B1136	Audio Steering Wheel Switch #2 Circuit Failure	GO to Pinpoint Test F .
B1317	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AF .
B1318	Battery Voltage Low	GO to Pinpoint Test AG .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is still present, INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. REPEAT the self-test.
U0184	Lost Communication With Radio (ACM)	GO to Pinpoint Test AL .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	GO to Pinpoint Test AN .
U2050	No Application Present	REFER to Section 418-01 .
U261C	USB #1 Device Error	GO to Pinpoint Test R .

Accessory Protocol Interface Module (APIM) â V2 DTC Chart

NOTE: This module utilizes a 5-character DTC followed by a 2-character failure-type code. The failure-type code provides information about specific fault conditions such as opens or shorts to ground. Continuous memory DTCs have an additional 2-character DTC status code suffix to assist in determining DTC history.

DTC	Description	Action
B1201:1C	Steering Wheel Audio Switch Pack 2: Circuit Voltage Out of Range	GO to Pinpoint Test F .
B1201:63	Steering Wheel Audio Switch Pack 2: Circuit / Component Protection Time-Out	GO to Pinpoint Test F .
B1252:04	USB Port: System Internal Failure	GO to Pinpoint Test R .
B1252:11	USB Port: Circuit Short to Ground	GO to Pinpoint Test R .
B1D79:01	Microphone Input: General Electrical Failure	GO to Pinpoint Test V .
U0100:00	Lost Communication With ECM/PCM: No Sub Type Information	GO to Pinpoint Test AP .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AJ .
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test AQ .
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AK .
U0184:00	Lost Communication With Radio: No Sub Type Information	GO to Pinpoint Test AL .
U0196:00	Lost Communication With Entertainment Control Module-Rear "A": No Sub Type Information	GO to Pinpoint Test AN .
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	RETRIEVE and FOLLOW other DTCs present in the Accessory Protocol Interface Module (APIM) or Smart Junction Box (SJB).
U0423:00	Invalid Data Received From Instrument Panel Control Module: No Sub Type Information	RETRIEVE and FOLLOW other DTCs present in the APIM or Instrument Cluster (IC).
U0485:00	Invalid Data Received From Radio: No Sub Type Information	RETRIEVE and FOLLOW other DTCs present in the APIM or Audio Front Control Module (ACM).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	REFER to Section 418-01 .
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	REFER to Section 418-01 .
U3000:04	Control Module: System Internal Failure	GO to Pinpoint Test P .
U3000:41	Control Module: General Checksum Failure	CLEAR the DTCs. REPEAT the self-test. If DTC U3000:41 is still present, INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. REPEAT the self-test.
U3000:42	Control Module: General Memory Failure	CLEAR the DTCs. REPEAT the self-test. If DTC U3000:42 is still present, INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. REPEAT the self-test.

U3000:88	Control Module: Bus Off	REFER to Section 418-00 .
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AG .
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AF .

Symptom Chart â General Audio System

General Audio System

Symptom Chart â Sound Quality

Sound Quality

Symptom Chart â Satellite Radio

Satellite Radio

Symptom Chart â Navigation

Navigation

Symptom Chart â SYNC System

SYNC System

Symptom Chart â Family Entertainment System

Family Entertainment System

Pinpoint Tests

Pinpoint Test A: Poor Reception â AM/FM

Normal Operation

The AM/FM radio antenna receives AM and FM radio waves. The antenna then sends the radio waves to the Audio Front Control Module (ACM) through the AM/FM antenna cable.

The noise suppression equipment reduces engine ignition and electrical systems interference transmitted through the speakers.

The RDS function allows the vehicle operator to choose which genre (category) of music to listen to. When the SCAN button is pressed, the ACM only stops at songs falling within the selected category. If no song in the selected category is found, the ACM continues to scan without stopping. This may appear to be a reception issue, but it is actually due to the customer setting.

- DTC B1A56:21 (Antenna: Signal Amplitude â © Minimum) â sets when the signal strength is less than the pre-configured threshold value during the ACM self-test. This DTC applies to vehicles with navigation only.
- DTC B2103 (Antenna Not Connected) â sets when the signal strength is less than the pre-configured threshold value during the ACM self-test. In order for this DTC to set, the ACM must be tuned to AM, and the self-test must be run with the scan tool. This DTC applies to vehicles without navigation only.

This pinpoint test is intended to diagnose the following:

- No song found in the selected category
- AM/FM antenna
- AM/FM antenna cable
- Charging system
- Ignition system
- Noise suppression equipment
- ACM

PINPOINT TEST A: POOR RECEPTION â AM/FM

Test Step	Result / Action to Take
A1 CHECK THE RDS SETTING	
• Turn the RDS function off. Refer to the Owner's Literature. • Scan for a good channel. • **Does the audio system find a good channel with normal reception?**	**Yes** The system is operating correctly. The concern was a result of no song being found in the selected category. **No** GO to A2 .
A2 CHECK THE AUDIO SYSTEM RECEPTION	
• Check the audio system reception with the engine running, and with the engine off. • **Does the poor reception only occur with the engine running?**	**Yes** GO to A3 . **No** GO to A7 .
A3 CHECK THE NOISE SUPPRESSION EQUIPMENT	
• Check all required noise suppression equipment and the radio frequency interference suppression bond for security, cleanliness, and	**Yes** GO to A4 . **No** CLEAN and SECURE the antenna connections, or

metal-to-metal contact. • **Are the connections clean, secure, and in metal-to-metal contact?**	INSTALL new noise suppression equipment as needed. TEST the system for normal operation.
A4 CHECK THE RADIO INTERFERENCE CAPACITOR	
• Install a new radio interference capacitor. • Start the vehicle. • Operate the audio system in radio tuner (AM/FM) mode. • **Is the reception OK?**	**Yes** The cause of the concern was an inoperative radio interference capacitor. The system is now operating correctly. **No** GO to A5 .
A5 CHECK THE GENERATOR	
• Ignition OFF. • Disconnect: Generator C102a. • Start the engine. • Operate the audio system in radio tuner (AM/FM) mode. • **Is the reception OK?**	**Yes** INSTALL a new generator. REFER to Section 414-00 . TEST the system for normal operation. **No** GO to A6 .
A6 CHECK THE IGNITION CIRCUITS	
• Ignition OFF. • Connect: Generator C102a. • Check the ignition circuits for correct routing, grounding, and integrity of the connections. • **Are the ignition components OK?**	**Yes** USE a jumper cable to ground various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal). When the noise is eliminated, PROVIDE a permanent ground where necessary. TEST the system for normal operation. **No** REPAIR the ignition system as necessary. TEST the system for normal operation.
A7 CHECK THE AM/FM ANTENNA CABLE	
• Ignition OFF. • Disconnect: AM/FM Antenna Cable-to-AM/FM Antenna Connection. • Disconnect: AM/FM Antenna Cable At ACM . • Measure the resistance of the AM/FM antenna cable between the ACM and the rear AM/FM antenna cable; and between the front AM/FM antenna cable core and shield. • **Is the resistance of the AM/FM antenna cable core less than 2 ohms, and the resistance between the core and shield of the AM/FM antenna cable greater than 10,000 ohms?**	**Yes** GO to A8 . **No** INSTALL a new AM/FM antenna cable. REFER to Antenna Lead-In Cable in this section. TEST the system for normal operation.
A8 ISOLATE THE AM/FM ANTENNA	

• Connect: AM/FM Antenna Cable At ACM . • Install a new AM/FM antenna. Refer to Antenna â AM/FM in this section. • Operate the audio system in radio tuner (AM/FM) mode. • **Is the reception OK?**	**Yes** The cause of the concern was an inoperative AM/FM antenna. The system is now operating correctly. **No** GO to A9 .
A9 ISOLATE THE AM/FM ANTENNA CABLE	
• Ignition OFF. • Install a new AM/FM antenna cable. Refer to Antenna Lead-In Cable in this section. • Operate the audio system in radio tuner (AM/FM) mode. • **Is the reception OK?**	**Yes** The cause of the concern was an inoperative antenna cable. The system is now operating correctly. **No** GO to A10 .
A10 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: Poor Reception/Poor Sound Quality/No Sound â Satellite Radio

Normal Operation â Vehicles Without Navigation

Digital signals are received by the satellite radio antenna and sent to the Satellite Digital Audio Receiver System (SDARS) module, which converts the signals and provides audio signals to the Audio Front Control Module (ACM) (vehicles without the SYNC system) or to the Accessory Protocol Interface Module (APIM) (vehicle with the SYNC system). For vehicles equipped with a family entertainment system, the audio signals first route through the Rear Entertainment Module (RETM), then to the appropriate receiving module.

Vehicles With Navigation

Digital signals are received by the satellite radio antenna and sent directly to the ACM , as the satellite radio receiver is built-in to the ACM .

A short to ground in the satellite radio antenna typically has no effect on the antenna signal; however, an open in the antenna circuit results in no sound from the satellite radio system. A short to voltage in the antenna circuit can have varying effects on the system.

DTC Description	Fault Trigger Conditions
• B1031 â SDARS Satellite Antenna Open	Set by the SDARS module when an open or high resistance is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand, and applies to vehicles without navigation only.
• B1032 â SDARS Satellite Antenna Short	Set by the SDARS module when a short to ground or short to voltage is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand, and applies to vehicles without navigation only.
• B1A89:01 â Satellite Antenna: General Electrical Failure	Set by the ACM when any fault is detected in the satellite radio antenna circuit. This DTC can be either continuous or on-demand, and applies to vehicles with navigation only.
• B1A89:13 â Satellite Antenna: Circuit Open	Set by the ACM when an open is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand, and applies to vehicles with navigation only.

This pinpoint test is intended to diagnose the following:

- Obstructions to the line of sight
- No song found in the selected category
- Antenna
- Satellite radio antenna cable
- Wiring, terminals or connectors
- SDARS module (vehicles without navigation)
- ACM (vehicles with navigation)

PINPOINT TEST B: POOR RECEPTION/POOR SOUND QUALITY/NO SOUND â SATELLITE AUDIO

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
B1 CHECK FOR A SATELLITE ANTENNA FAULT MESSAGE	
• Operate the audio system in satellite radio mode and observe the audio system display. • **Does the display indicate a satellite radio antenna fault?**	**Yes** GO to B2 . **No** GO to B4 .
B2 CHECK THE SATELLITE RADIO ANTENNA CABLE RESISTANCE	
• Ignition OFF. • Disconnect: Satellite Radio Antenna Connection At SDARS Module (or ACM). • Disconnect: Satellite Radio Antenna Cable In-Line Connection At RH Kick Panel (Vehicles Without Navigation).	**Yes** GO to B3 . **No** INSTALL a new satellite radio antenna cable, as necessary. REFER to Antenna Cable â Satellite Radio in this section.

• Disconnect: Satellite Radio Antenna Connection At Satellite Radio Antenna. • Measure the resistance of the upper satellite radio antenna cable core between the SDARS module (vehicles without navigation) or the in-line connection (vehicles with navigation) and the satellite radio antenna connection. • Measure the resistance of the lower satellite radio antenna cable core between the ACM and the in-line connection (vehicles with navigation). • Measure the resistance of each satellite radio antenna cable between the core and the shield of the antenna cable. • **Is the resistance of each satellite radio antenna cable core less than 2 ohms, and the resistance between the core and shield of each satellite radio antenna cable greater than 10,000 ohms?**	CLEAR any DTCs present. TEST the system for normal operation.
B3 ISOLATE THE SATELLITE RADIO ANTENNA	
• Install a new satellite radio antenna. Refer to Antenna â Satellite Radio in this section. • Operate the audio system in satellite radio mode. • **Is the reception OK?**	**Yes** The concern was caused by an inoperative satellite radio antenna. The system is operating correctly at this time. **No** For vehicles without navigation, GO to B16 . For vehicles with navigation, GO to B19 .
B4 CHECK THE CATEGORY FILTER SETTING	
• Turn the category filter function off. For additional information, refer to the Owner's Literature. • Scan for a good channel. • **Does the satellite radio system find a good channel with normal reception?**	**Yes** The system is operating correctly at this time. The concern was a result of no song being found in the selected category. **No** GO to B5 .
B5 CHECK THE OPERATION OF THE SATELLITE AUDIO	
• Drive the vehicle to an open location, free of obstacles. • Operate the audio system in satellite radio mode. • **Is the reception/sound quality OK?**	**Yes** The system is OK at this time. ADVISE the customer that the satellite signal can be affected by obstructions to the satellite antenna line of sight. **No** For vehicles without navigation, GO to B6 . For vehicles with navigation, GO to B19 .
B6 DETERMINE THE VEHICLE CONTENT	

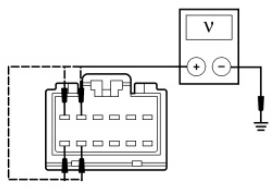
<table>
<tr><td>• Determine if the vehicle is equipped with the SYNC system and/or the family entertainment system.
• Is the vehicle equipped with the SYNC system and/or the family entertainment system?</td><td>Yes
For vehicles equipped with only the family entertainment system, GO to B12 .

For vehicles equipped with the SYNC system (with or without the family entertainment system), GO to B7 .

No
GO to B10 .</td></tr>
<tr><td>B7 CHECK THE SYNC SYSTEM OR FAMILY ENTERTAINMENT SYSTEM AUDIO</td><td></td></tr>
<tr><td>• For vehicles without a family entertainment system, using the Multi-Media Interface Tester, test the audio output for the audio input jack, USB port, and Bluetooth connection.
• For vehicles with a family entertainment system, insert a known good DVD and operate the audio system in family entertainment system mode.
• Do the SYNC system and/or family entertainment system audio sources operate correctly?</td><td>Yes
GO to B8 .

No
For vehicles without a family entertainment system, GO to Pinpoint Test U .

For vehicles with a family entertainment system, GO to Pinpoint Test G .</td></tr>
<tr><td>B8 CHECK THE AUDIO CIRCUITS TO THE APIM FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: SDARS Module C3290.
• Disconnect: APIM C3342.
• Ignition ON.
• Measure the voltage between the SDARS module, harness side and ground as follows:

<table><tr><th>Positive Meter Lead</th><th>Negative Meter Lead</th></tr><tr><td>C3290-5</td><td>VME41 (GN/OG)</td></tr><tr><td>C3290-11</td><td>RME41 (BU/BN)</td></tr><tr><td>C3290-6</td><td>VME42 (VT/BN)</td></tr><tr><td>C3290-12</td><td>RME42 (YE/BU)</td></tr></table>
 

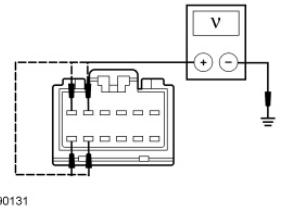
N0090131</td><td>Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to B9 .</td></tr>
</table>

• **Is any voltage present?**	
B9 CHECK THE AUDIO CIRCUITS TO THE APIM FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the SDARS module, harness side and the APIM , harness side; and between the SDARS module, harness side and ground as follows: • **Is the resistance less than 5 ohms between the SDARS module and the APIM , and greater than 10,000 ohms between the SDARS module and ground?**	**Yes** GO to B14 . **No** REPAIR the circuit in question. TEST the system for normal operation.
B10 CHECK THE AUDIO CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SDARS Module C3290. • Disconnect: ACM C290b. • Ignition ON. • Measure the voltage between the SDARS module, harness side and ground as follows:	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to B11 .

Positive Meter Lead	Negative Meter Lead	Circuit
C3290-5	C3342-10, then ground	VME41 (GN/OG)
C3290-11	C3342-11, then ground	RME41 (BU/BN)
C3290-6	C3342-7, then ground	VME42 (VT/BN)
C3290-12	C3342-8, then ground	RME42 (YE/BU)

Positive Meter Lead	Negative Meter Lead
C3290-5	VME41 (GN/OG)
C3290-11	RME41 (BU/BN)
C3290-6	VME42 (VT/BN)
C3290-12	RME42 (YE/BU)



- **Is any voltage present?**

B11 CHECK THE AUDIO CIRCUITS TO THE ACM FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the SDARS module, harness side and the ACM , harness side; and between the SDARS module, harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C3290-5	C290b-1, then ground	VME41 (GN/OG)/ VME17 (GN) (at ACM)
C3290-11	C290b-2, then ground	RME41 (BU/BN)/ RME17 (GY) (at ACM)
C3290-6	C290b-9, then ground	VME42 (VT/BN)/ VME18 (VT) (at ACM)
C3290-12	C290b-10, then ground	RME42 (YE/BU)/ RME18 (YE) (at ACM)

- **Is the resistance less than 5 ohms between the SDARS module and the ACM , and greater than 10,000 ohms between the SDARS module and ground?**

Yes
GO to B16 .

No
REPAIR the circuit in question. TEST the system for normal operation.

B12 CHECK THE AUDIO CIRCUITS TO THE RETM FOR A SHORT TO VOLTAGE

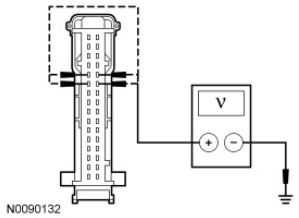
- Ignition OFF.
- Disconnect: SDARS Module C3290 (If Connected).
- Disconnect: RETM C9029.
- Ignition ON.
- Measure the voltage between the RETM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead
C9029-5	VME58 (YE/VT)
C9029-6	RME58 (BN/BU)

Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to B13 .

C9029-21	VME59 (YE/OG)
C9029-22	RME59 (WH/GN)



- **Is any voltage present?**

B13 CHECK THE AUDIO CIRCUITS TO THE RETM FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the RETM , harness side and the SDARS module, harness side; and between the RETM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C9029-5	C3290-5, then ground	VME58 (YE/VT)/ VME41 (GN/OG) (at SDARS module)
C9029-6	C3290-11, then ground	RME58 (BN/BU)/ RME41 (BU/BN) (at SDARS module)
C9029-21	C3290-6, then ground	VME59 (YE/OG)/ VME42 (VT/BN) (at SDARS module)
C9029-22	C3290-12, then ground	RME59 (WH/GN)/ RME42 (YE/BU) (at SDARS module)

- **Is the resistance less than 5 ohms between the RETM and the SDARS module, and greater than 10,000 ohms between the RETM and ground?**

Yes
GO to B15 .

No
REPAIR the circuit in question. TEST the system for normal operation.

B14 ISOLATE THE APIM

- Ignition OFF.
- Connect: SDARS Module C3290.
- Connect: ACM C290b.
- Connect: RETM C9029 (If Equipped).
- Connect fused jumper wires between the APIM pins as follows:

Yes
REMOVE the jumper wires. GO to B17 .

No
REMOVE the jumper wires.

	If the vehicle is equipped with a family entertainment system GO to B15 . Otherwise, GO to B16 .

APIM Connector-Pin/Circuit	APIM Connector-Pin/Circuit
C3342-7 VME42 (VT/BN)	C3342-23 VME53 (VT/GN)
C3342-8 RME42 (YE/BU)	C3342-24 RME53 (BN/WH)
C3342-10 VME41 (GN/OG)	C3342-25 VME52 (BU)
C3342-11 RME41 (BU/BN)	C3342-26 RME52 (GY/OG)

- Operate the audio system in satellite radio mode.
- **Does the satellite radio audio operate correctly?**

B15 ISOLATE THE RETM

- Ignition OFF.
- Connect: SDARS Module C3290 (If Disconnected).
- Connect: ACM C290b (If Disconnected).
- Connect: APIM C3342 (If Disconnected).
- Disconnect: RETM C9029 (If Connected).
- Connect fused jumper wires between the RETM pins as follows:

Yes
REMOVE the jumper wires. GO to B18 .

No
REMOVE the jumper wires. GO to B16 .

RETM Connector-Pin/Circuit	RETM Connector-Pin/Circuit
C9029-5 VME58 (YE/VT)	C9029-10 VME17 (GN)
C9029-6 RME58 (BN/BU)	C9029-9 RME17 (GY)
C9029-21 VME59 (YE/OG)	C9029-26 VME18 (VT)
C9029-22 RME49 (WH/GN)	C9029-25 RME18 (YE)

- Operate the audio system in satellite radio mode.
- **Does the satellite radio audio operate correctly?**

B16 CHECK FOR CORRECT SDARS MODULE OPERATION	
• Connect: All Disconnected Connectors. • Disconnect the SDARS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SDARS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SDARS module. REFER to Satellite Digital Audio Receiver System (SDARS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
B17 CHECK FOR CORRECT APIM OPERATION	
• Connect: All Disconnected Connectors. • Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
B18 CHECK FOR CORRECT RETM OPERATION	
• Connect: All Disconnected Connectors. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
B19 CHECK FOR CORRECT ACM OPERATION	
• Connect: All Disconnected Connectors. • Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) â Except Audiophile

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Refer to Wiring Diagrams Cell 132 , Video System for schematic and connector information.

Normal Operation

The Audio Front Control Module (ACM) directs audio signals to the speakers in the form of an AC voltage. The ACM provides internal circuit protection for shorts to ground or shorts to voltage.

If the vehicle is equipped with the family entertainment system, the rear channel audio signals from the ACM route to the Rear Entertainment Module (RETM), then to the speakers. In dual-play mode, the RETM mutes the rear speaker output. Make sure the audio system is in single-play mode before diagnosing a rear speaker concern.

A short to ground or short to voltage in the circuitry to one of the speakers may cause multiple speakers to lose sound due to the built-in overload protection feature of the ACM . In this case, a speaker fault DTC will set, and this pinpoint test should be followed to isolate the damaged circuit.

- DTC B2965 (Audio System Speaker Circuit Fault) â sets when an open, short to ground, or short to voltage is detected on any of the speaker circuits. If the ACM activates the built-in overload protection, DTC B1342 may also be set. The cause of DTC B2965 must be repaired before DTC B1342 can be cleared.

This pinpoint test is intended to diagnose the following:

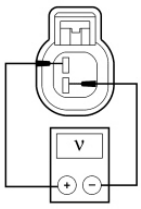
- Wiring, terminals or connectors
- Speaker
- ACM
- RETM (if equipped)

PINPOINT TEST C: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
C1 CHECK THE AUDIO SIGNALS TO THE SUSPECT SPEAKER	
• Ignition OFF. • Disconnect: Suspect Speaker. • Operate the audio system in radio tuner (AM/FM), single-play mode. • Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows:	**Yes** INSTALL a new speaker for the suspect speaker. REFER to Speaker â Door in this section. CLEAR any DTCs present. TEST the system for normal operation.

Suspect Speaker	Positive Meter Lead	Negative Meter Lead
LH front	C523-1 VME07 (WH)	C523-2 RME07 (WH/BN)
RH front	C612-1 VME10 (WH/VT)	C612-2 RME10 (WH/OG)
LH rear	C702-1 VME09 (WH/GN)	C702-2 RME09 (BN/YE)
RH rear	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)



N0085779

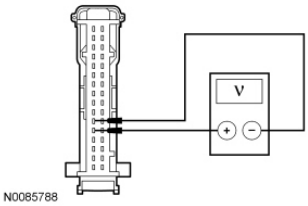
- **Is a fluctuating AC voltage present?**

No
If the vehicle is equipped with the family entertainment system and the concern is with a rear speaker, GO to C2 .

Otherwise, GO to C5 .

C2 CHECK THE AUDIO SIGNALS TO THE RETM

- Ignition OFF.
- Disconnect: RETM C9029.
- Operate the audio system in radio tuner (AM/FM), single-play mode.
- Measure the AC voltage between the RETM C9029-11, circuit VME12 (BN/WH), harness side and the RETM C9029-12, circuit RME12 (BN/BU), harness side.

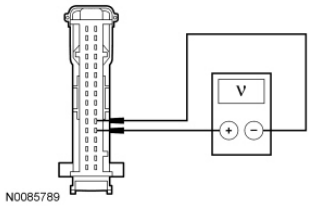


N0085788

- Measure the AC voltage between the RETM C9029-27, circuit VME09 (WH/GN), harness side and the RETM C9029-28, circuit RME09 (BN/YE), harness side.

Yes
GO to C5 .

No
GO to C3 .

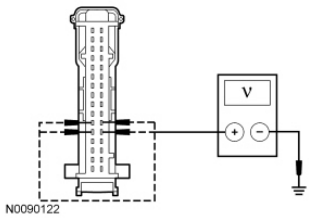


- **Is a fluctuating AC voltage present?**

C3 CHECK THE AUDIO CIRCUITS TO THE RETM FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: ACM C290a.
- Ignition ON.
- Measure the voltage between the RETM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead
C9029-11 VME12 (BN/WH)	Ground
C9029-12 RME12 (BN/BU)	Ground
C9029-27 VME09 (WH/GN)	Ground
C9029-28 RME09 (BN/YE)	Ground



- **Is any voltage present?**

Yes
REPAIR the circuit in question.
CLEAR any DTCs present.
TEST the system for normal operation.

No
GO to C4 .

C4 CHECK THE AUDIO CIRCUITS TO THE RETM FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the RETM , harness side and the ACM , harness side; and between the RETM , harness side and ground as follows:

Yes
GO to C7 .

No
REPAIR the circuit in question.
CLEAR any DTCs present.
TEST the system for normal

operation.

Positive Meter Lead	Negative Meter Lead	Circuit
C9029-11	C290a-10, then ground	VME12 (BN/WH)
C9029-12	C290a-23, then ground	RME12 (BN/BU)
C9029-27	C290a-9, then ground	VME09 (WH/GN)
C9029-28	C290a-22, then ground	RME09 (BN/YE)

- **Are the resistances less than 5 ohms between the RETM and the ACM , and greater than 10,000 ohms between the RETM and ground?**

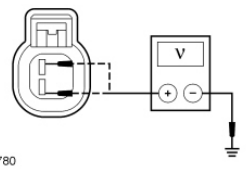
C5 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: ACM C290a.
- Ignition ON.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Yes
REPAIR the circuit in question.
CLEAR any DTCs present.
TEST the system for normal operation.

No
GO to C6 .

Suspect Speaker	Positive Meter Lead	Negative Meter Lead
LH front	C523-1	VME07 (WH)
	C523-2	RME07 (WH/BN)
RH front	C612-1	VME10 (WH/VT)
	C612-2	RME10 (WH/OG)
LH rear	C702-1	VME09 (WH/GN)
	C702-2	RME09 (BN/YE)
RH rear	C802-1	VME12 (BN/WH)
	C802-2	RME12 (BN/BU)



- **Is any voltage present?**

C6 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the ACM (or RETM), harness side and the suspect speaker, harness side; and between the ACM (or RETM), harness side and ground as follows: • **Is the resistance less than 5 ohms between the ACM (or RETM) and the suspect speaker, and greater than 10,000 ohms between the ACM (or RETM) and ground?**	**Yes** If the vehicle is equipped with the family entertainment system, GO to C8 . Otherwise, GO to C7 . **No** REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

Suspect Speaker	Positive Meter Lead	Negative Meter Lead	Circuit
LH front	C290a-8	C523-1, then ground	VME07 (WH)
	C290a-21	C523-2, then ground	RME07 (WH/BN)
RH front	C290a-11	C612-1, then ground	VME10 (WH/VT)
	C290a-12	C612-2, then ground	RME10 (WH/OG)
LH rear	C290a-9 or C9029-30	C702-1, then ground	VME09 (WH/GN)
	C290a-22 or C9029-29	C702-2, then ground	RME09 (BN/YE)
RH rear	C290a-10 or C9029-14	C802-1, then ground	VME12 (BN/WH)
	C290a-23 or C9029-13	C802-2, then ground	RME12 (BN/BU)

C7 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Connect: All Disconnected Connectors. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.
C8 CHECK FOR CORRECT RETM OPERATION	
• Ignition OFF.	**Yes** INSTALL a new RETM .

• Connect: All Disconnected Connectors. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	REFER to Rear Entertainment Module (RETM) in this section. CLEAR any ACM DTCs present. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any ACM DTCs present.

Pinpoint Test D: The Subwoofer is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

To enable the subwoofer amplifier, the Audio Front Control Module (ACM) sends voltage through the enable/clip circuit. The circuit acts as both an output (to enable the amplifier) and an input (to detect an amplifier overload condition). The voltage sent by the ACM passes through a variable resistor in the subwoofer amplifier, then to ground. As the amplifier reaches maximum output, the resistance in the variable resistor decreases. This decreases the voltage drop, resulting in the ACM detecting a higher voltage on the enable/clip circuit. When the voltage reaches the clip threshold, the ACM clips the audio output signal to the amplifier (heard as distortion), in order to prevent damage to the amplifier and speakers.

The enable/clip status is based on the following voltages, as detected by the ACM :

- Less then 0.4 volt: amplifier disabled
- Between 3.8 and 6.7 volts: amplifier enabled
- Greater than 8.5 volts: amplifier clipped

An open in the enable/clip circuit causes the subwoofer to produce no sound because the enable signal does not reach the subwoofer amplifier. A short to ground or short to voltage can cause severe distortion to be heard in the subwoofer.

The subwoofer amplifier and subwoofer speaker are integral to the enclosure and cannot be serviced separately.

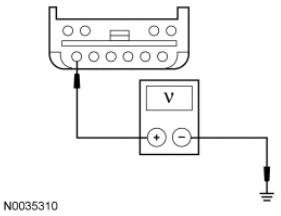
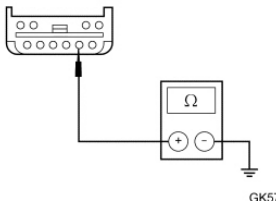
DTC B1A05:01 (Speaker #5: General Electrical Failure) â sets on-demand when a failure is detected on the audio signal circuitry to the subwoofer. This DTC applies to vehicles with navigation only.

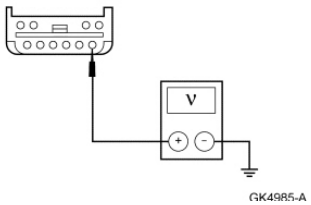
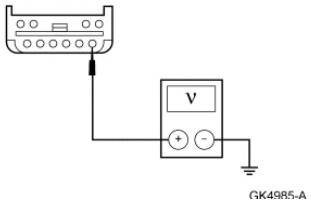
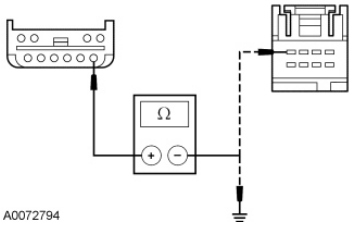
This pinpoint test is intended to diagnose the following:

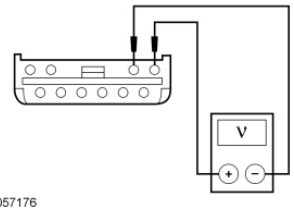
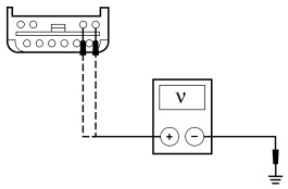
- Fuse
- Wiring, terminals or connectors
- Subwoofer
- ACM

PINPOINT TEST D: THE SUBWOOFER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
D1 CHECK THE SUBWOOFER VOLTAGE SUPPLY	
• Ignition OFF. • Disconnect: Subwoofer C466 (Explorer, Mountaineer) or C3041 (Explorer Sport Trac). • Measure the voltage between the subwoofer C466-6 (Explorer, Mountaineer) or C3041-6 (Explorer Sport Trac), circuit SBB22 (BN/RD), harness side and ground.  N0035310 • **Is the voltage greater than 10 volts?**	**Yes** GO to D2 . **No** VERIFY the Battery Junction Box (BJB) fuse 22 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
D2 CHECK THE SUBWOOFER GROUND CIRCUIT FOR CONTINUITY	
• Measure the resistance between the subwoofer C466-2 (Explorer, Mountaineer) or C3041-2 (Explorer Sport Trac), circuit GD114 (BK/BU), harness side and ground.  GK5794-A • **Is the resistance less than 5 ohms?**	**Yes** GO to D3 . **No** REPAIR the circuit. TEST the system for normal operation.
D3 CHECK THE SUBWOOFER ENABLE CIRCUIT FOR CORRECT VOLTAGE	
• Operate the audio system in radio tuner (AM/FM) mode. • Measure the voltage between the subwoofer C466-1 (Explorer, Mountaineer) or C3041-1 (Explorer Sport Trac), circuit SME23 (VT/RD), harness side and ground.	**Yes** GO to D6 . **No** GO to D4 .

 • **Is the voltage between 3.8 and 6.7 volts?**	
D4 CHECK THE SUBWOOFER ENABLE CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290c. • Disconnect: Subwoofer C466 (Explorer, Mountaineer) or C3041 (Explorer Sport Trac). • Ignition ON. • Measure the voltage between the subwoofer C466-1 (Explorer, Mountaineer) or C3041-1 (Explorer Sport Trac), circuit SME23 (VT/RD), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to D5 .
D5 CHECK CIRCUIT SME23 (VT/RD) FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the subwoofer C466-1 (Explorer, Mountaineer) or C3041-1 (Explorer Sport Trac), circuit SME23 (VT/RD), harness side and the ACM C290c-4, circuit SME23 (VT/RD), harness side; and between the subwoofer C466-1 (Explorer, Mountaineer) or C3041-1 (Explorer Sport Trac), circuit SME23 (VT/RD), harness side and ground.  • **Is the resistance less than 5 ohms between the subwoofer and the ACM , and greater than 10,000 ohms between the subwoofer and ground?**	**Yes** GO to D9 . **No** REPAIR the circuit. TEST the system for normal operation.
D6 CHECK THE AUDIO SIGNAL TO THE SUBWOOFER	

• Operate the audio system in radio tuner (AM/FM) mode. • Measure the AC voltage between the subwoofer C466-7 (Explorer, Mountaineer) or C3041-7 (Explorer Sport Trac), circuit VME22 (VT/GN), harness side and the subwoofer C466-8 (Explorer, Mountaineer) or C3041-8 (Explorer Sport Trac), circuit RME22 (GN/WH), harness side.  A0057176 • **Is a fluctuating AC voltage present?**	**Yes** INSTALL a new subwoofer. REFER to Subwoofer Speaker â Explorer, Mountaineer or Subwoofer Speaker â Explorer Sport Trac in this section. TEST the system for normal operation. **No** GO to D7 .
D7 CHECK THE AUDIO CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290c. • Ignition ON. • Measure the voltage between the subwoofer C466-7 (Explorer, Mountaineer) or C3041-7 (Explorer Sport Trac), circuit VME22 (VT/GN), harness side and ground; and between the subwoofer C466-8 (Explorer, Mountaineer) or C3041-8 (Explorer Sport Trac), circuit RME22 (GN/WH), harness side and ground.  N0035293 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to D8 .
D8 CHECK THE AUDIO CIRCUITS FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the subwoofer, harness side and the ACM , harness side; and between the subwoofer, harness side and ground as follows:	**Yes** GO to D9 . **No** REPAIR the circuit in question. TEST the system for normal operation.

Positive Meter Lead	Negative Meter Lead	Circuit
	C290c-1	

C466-7 (Explorer, Mountaineer) C3041-7 (Explorer Sport Trac)		VME22 (VT/GN)
C466-8 (Explorer, Mountaineer) C3041-8 (Explorer Sport Trac)	C290c-2	RME22 (GN/WH)

- **Is the resistance less than 5 ohms between the subwoofer and the ACM , and greater than 10,000 ohms between the subwoofer and ground?**

D9 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Connect: All Disconnected Connectors. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Audio Does Not Reduce When The Parking Aid Tone Sounds

Normal Operation

The Parking Aid Module (PAM) sends the volume cutback message to the Audio Front Control Module (ACM) via the Medium Speed Controller Area Network (MS-CAN). When the PAM sounds the parking aid tone, it sends an enabled message to the ACM . When the ACM receives this message, it reduces the speaker output so that the parking aid tone can be heard more clearly.

- DTC U0159 (Lost Communication With Parking Assist Control Module (PAM)) â set by the non-navigation ACM when the volume cutback message is missing for greater than 5 seconds. When the message is missing, the ACM defaults to no volume cutback when the parking aid tone is sounding.

- DTC U0159:00 (Lost Communication With Parking Assist Control Module "A": No Sub Type Information) â set by the navigation ACM when the volume cutback message is missing for greater than 5 seconds. When the message is missing, the ACM defaults to no volume cutback when the parking aid tone is sounding.

This pinpoint test is intended to diagnose the following:

- Parking aid system concern
- ACM

PINPOINT TEST E: THE AUDIO DOES NOT REDUCE WHEN THE PARKING AID TONE SOUNDS

Test Step	Result / Action to Take
E1 CHECK THE PARKING AID SIGNAL	
• Apply the parking brake. • Place an object behind the vehicle within the range of the parking aid sensors. Refer to Section 413-13 . • Ignition ON. • Place the transmission in REVERSE (R). • Enter the following diagnostic mode on the scan tool: ACM DataLogger. • Monitor the parking aid input status PID (RPA_STAT) while the parking aid tone is sounding. • **Does the PID read "Enabled" while the parking aid tone is sounding?**	**Yes** GO to E2 . **No** REFER to Section 413-13 to continue diagnosis of the parking aid system.
E2 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Steering Wheel Controls Are Inoperative/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio/Navigation for schematic and connector information.

Normal Operation

There are 4 different steering wheel controls configurations:

- Non-navigation, without the SYNC system
  - ♦ VOL-, VOL+, SEEK-, SEEK+, MEDIA
  - ♦ All switches are wired to the Audio Control Module (ACM).
- Non-navigation, with the SYNC system
  - ♦ VOL-, VOL+, SEEK-, SEEK+, VOICE, MEDIA, PHONE, OK
  - ♦ The VOL-, VOL+, SEEK-, and SEEK+ switches are wired to the ACM. The remaining switches are wired to the Accessory Protocol Interface Module (APIM).
- Navigation, without the SYNC system
  - ♦ VOL-, VOL+, SEEK-, SEEK+, VOICE, MEDIA
  - ♦ All switches are wired to the ACM.
- Navigation, with the SYNC system
  - ♦ VOL-, VOL+, SEEK-, SEEK+, VOICE, MEDIA, PHONE

- All switches are wired to the ACM.

Voltage is sent from the APIM (or ACM) to the steering wheel controls, and the same module grounds the return circuit. The VOL-, VOL+, SEEK- and SEEK+ switches share signal and return circuits, while the VOICE, MEDIA, PHONE and OK switches share separate signal and return circuits.

For all configurations, when a switch is pressed, the voltage is routed through a specific resistor value for each function. The ACM (or APIM) then uses the reference voltage to determine which control input function has been selected.

DTC Description	Fault Trigger Conditions
• B1117 â Audio Steering Wheel Button Stuck (ACM)	Set by the non-navigation ACM when a steering wheel control switch is detected as active for more than 120 seconds during normal operation, or for any duration during the self-test. A short to ground in the signal return circuit should not set this DTC.
• B1117 â Audio Steering Wheel Button Stuck (APIM)	Set by the APIM (V1) when a steering wheel control switch is detected as active for more than 120 seconds during normal operation, or for any duration during the self-test. A short to ground in the signal return circuit should not set this DTC, as the reference voltage would fall out-of-range, resulting in DTC B1136 being set.
• B1136 â Audio Steering Wheel Switch #2 Circuit Failure	Set by the APIM (V1) when a steering wheel control voltage is out-of-range. This can be caused by any failure except a stuck button, which would result in DTC B1117 being set.
• B11BA:1C â Steering Wheel Audio Switch Pack: Circuit Voltage Out of Range	Set by the navigation ACM when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit except for a stuck switch or a short to ground in the signal return circuit. This DTC applies to the VOL-, VOL+, SEEK-, SEEK+, and MEDIA switches.
• B11BA:63 â Steering Wheel Audio Switch Pack: Circuit / Component Protection Time-Out	Set by the navigation ACM when a steering wheel control switch is detected as active for more than 120 seconds during normal operation, or for more than 3 seconds during the self-test. A short to ground in the signal return circuit should not set this DTC, as the reference voltage would fall out-of-range, resulting in DTC B11BA:1C being set. This DTC applies to the VOL-, VOL+, SEEK-, SEEK+, and MEDIA switches.
• B1201:1C â Steering Wheel Audio Switch Pack 2: Circuit Voltage Out of Range	Set by the navigation ACM when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit except for a stuck switch or a short to ground in the signal return circuit. This DTC applies to the VOICE and PHONE switches.
	Set by the APIM (V2) when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering

• B1201:1C â Steering Wheel Audio Switch Pack 2: Circuit Voltage Out of Range	wheel controls circuit except for a stuck switch or a short to ground in the signal return circuit. This DTC only applies to vehicles without navigation.
• B1201:63 â Steering Wheel Audio Switch Pack 2: Circuit / Component Protection Time-Out	Set by the navigation ACM when a steering wheel control switch is detected as active for more than 120 seconds during normal operation, or for any duration during the self-test. A short to ground in the signal return circuit should not set this DTC, as the reference voltage would fall out-of-range, resulting in DTC B1201:1C being set. This DTC applies to the VOICE and PHONE switches.
• B1201:63 â Steering Wheel Audio Switch Pack 2: Circuit / Component Protection Time-Out	Set by the APIM (V2) when a steering wheel control switch is detected as active for more than 120 seconds during normal operation, or for any duration during the self-test. A short to ground in the signal return circuit should not set this DTC, as the reference voltage would fall out-of-range, resulting in DTC B1201:1C being set. This DTC only applies to vehicles without navigation.
• B2404 â Audio Steering Wheel Switch Circuit Failure	Set by the non-navigation ACM when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit except for a stuck switch or a short to ground in the signal return circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Steering wheel controls
- ACM
- APIM (without navigation only)

PINPOINT TEST F: THE STEERING WHEEL CONTROLS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: For vehicles equipped with navigation or not equipped with SYNC, start this pinpoint test at Step F3.

Test Step	Result / Action to Take
F1 CHECK THE SYNC SYSTEM OPERATION	
NOTE: Carrying out a Master Reset returns all preference settings to the factory defaults, erases all the phone book and call histories, and deletes any devices paired with the SYNC system.	**Yes** The SYNC system is operating correctly at this time. For a concern with the VOL-, SEEK-,

<table>
<tr><td>• Connect: Multi-Media Interface Tester.
• Using the Multi-Media Interface Tester, test the audio output for the audio input jack, USB port, and Bluetooth connection using the VOICE switch on the steering wheel controls to enter each mode.
• Do all of the SYNC inputs function correctly?</td><td>SEEK+ or MEDIA switch, GO to F3 .

For all other concerns, CARRY OUT a SYNC system Master Reset. REFER to the Owner's Literature. REVIEW the SYNC system operation with the customer. If the customer device still does not operate correctly, the fault is with the customer device.

No
GO to F2 .</td></tr>
<tr><td>F2 RESET THE APIM AND RECHECK SYNC SYSTEM OPERATION</td><td></td></tr>
<tr><td>• Carry out an APIM power reset by disconnecting the battery for 5 minutes, then reconnecting it.
• Connect: Multi-Media Interface Tester.
• Using the Multi-Media Interface Tester, test the audio output for the audio input jack, USB port, and Bluetooth connection using the VOICE switch on the steering wheel controls to enter each mode.
• Do all of the SYNC inputs function correctly?</td><td>Yes
The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset. REFER to the Owner's Literature.

REVIEW the SYNC system operation with the customer. If the customer device still does not operate correctly, the fault is with the customer device.

No
GO to F3 .</td></tr>
<tr><td>F3 DETERMINE THE INOPERATIVE STEERING WHEEL CONTROLS</td><td></td></tr>
<tr><td>• Determine which steering wheel controls are inoperative by pressing each steering wheel control switch individually while operating the audio system in various modes (AM/FM, SYNC (if equipped), etc.).
• Is the concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA switch?</td><td>Yes
GO to F4 .

No
GO to F5 .</td></tr>
<tr><td>F4 MONITOR THE STEERING WHEEL CONTROL PIDs (EXCEPT NAVIGATION/SYNC SWITCHES)</td><td></td></tr>
<tr><td>• Enter the following diagnostic mode on the scan tool: ACM DataLogger.
• Monitor the steering wheel controls PIDs while pressing each steering wheel controls switch as follows:

<table><tr><th>Steering Wheel Controls Switch</th><th>PID</th></tr><tr><td>VOL-</td><td>SW_VOLDOWN</td></tr><tr><td>VOL+</td><td>SW_VOLUP</td></tr><tr><td>SEEK-</td><td>SW_SEEKMINUS</td></tr><tr><td>SEEK+</td><td>SW_SEEKPLUS</td></tr></table></td><td>Yes
GO to F11 .

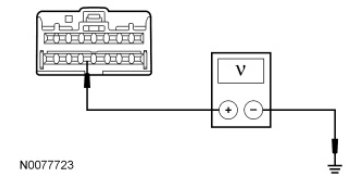
No
If only one PID value is incorrect or the PID value always reads one particular switch position, INSTALL new steering wheel controls. REFER to Steering Wheel Controls in this section. CLEAR any DTCs present. TEST the system for normal operation.

Otherwise, GO to F6 .</td></tr>
</table>

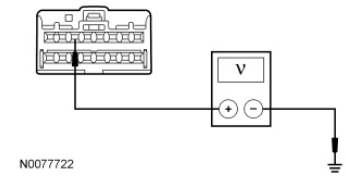
MEDIA	SW_MODE

- **Do the PID values agree with the switch positions?**

F5 MONITOR THE STEERING WHEEL CONTROL PIDs (NAVIGATION/SYNC SWITCHES)	
• Enter the following diagnostic mode on the scan tool: ACM DataLogger (With Navigation) or APIM DataLogger (Without Navigation). • Monitor the steering wheel controls PIDs while pressing each steering wheel controls switch as follows: **ACM PIDs** **Steering Wheel Controls Switch** / **ACM PID** VOICE / SW_VOICE PHONE / SW_PHONE **APIM PIDs** **Steering Wheel Controls Switch** / **APIM PID** VOICE / VOICE_SW PHONE / PHONE_SW OK / OK_SW • **Do the PID values agree with the switch positions?**	**Yes** For vehicles with navigation, GO to F11 . For vehicles without navigation, GO to F12 . **No** If only one PID value is incorrect or the PID value always reads one particular switch position, INSTALL new steering wheel controls. REFER to Steering Wheel Controls in this section. CLEAR any DTCs present. TEST the system for normal operation. Otherwise, GO to F6 .
F6 CHECK THE REFERENCE VOLTAGE CIRCUIT TO THE CLOCKSPRING FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: Clockspring C218a. • Disconnect: ACM C290a or APIM C3342. • Ignition ON. • For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA switches, measure the voltage between the clockspring C218a-13, circuit VME14 (GY/YE), harness side and ground.	**Yes** REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation. **No** GO to F7 .



- For a concern with the VOICE, PHONE, or OK switches, measure the voltage between the clockspring C218a-6, circuit VMN02 (WH/BN), harness side and ground.



- **Is any voltage present?**

F7 CHECK THE CIRCUITS TO THE CLOCKSPRING FOR AN OPEN OR SHORT TO GROUND

NOTE: Circuits RME24 (BU/WH) and RH106 (VT/OG) do not need to be checked for a short to ground.

- Ignition OFF.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA switches, measure the resistance between the ACM , harness side and the clockspring, harness side; and between the ACM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C90a-18	C218a-13, then ground	VME14 (GY/YE)
C290a-19	C218a-12	RME124 (BU/WH)

- For a concern with the VOICE, PHONE, or OK switches, measure the voltage between ACM (vehicles with navigation) or APIM (vehicles without navigation), harness side and the clockspring, harness side; and between the ACM (vehicles with navigation) or APIM (vehicles without navigation), harness side and ground as follows:

Yes
GO to F8 .

No
REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

Positive Meter Lead	Negative Meter Lead	Circuit
C290a-17 or C3342-14	C218a-6, then ground	VMN02 (WH/BN)
C290a-16 or C3342-15	C218a-4	RH106 (VT/OG)

- **Is the resistance less than 5 ohms between the ACM (or APIM) and the clockspring, and greater than 10,000 ohms between the ACM (or APIM) and ground?**

F8 CHECK THE REFERENCE VOLTAGE CIRCUIT TO THE STEERING WHEEL CONTROLS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: Clockspring C218b.
- Disconnect: Steering Wheel Controls C2208.
- Ignition ON.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA switches, measure the voltage between the clockspring C218b-10, circuit VME14 (GY/YE), harness side and ground.
- For a concern with the VOICE, PHONE, or OK switches, measure the voltage between the clockspring C218b-12, circuit VMN02 (WH/BN), harness side and ground.
- **Is any voltage present?**

Yes
REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

No
GO to F9 .

F9 CHECK THE CIRCUITS TO THE STEERING WHEEL CONTROLS FOR AN OPEN OR SHORT TO GROUND

NOTE: Circuits RME24 (BU/WH) and RH106 (VT/OG) do not need to be checked for a short to ground.

- Ignition OFF.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA switches, measure the resistance between the clockspring, harness side and the steering wheel controls, harness side; and between the clockspring, harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C218b-10		

Yes
GO to F10 .

No
REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

	C2208-2, then ground	VME14 (GY/YE)
C218b-11	C2208-4	RME24 (BU/WH)

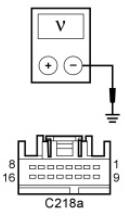
- For a concern with the VOICE, PHONE, or OK switches, measure the voltage between the upper clockspring connector, harness side and the steering wheel controls, harness side; and between the upper clockspring connector, harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C218b-12	C2208-6	VMN02 (WH/BN)
C218b-6	C2208-7	RH106 (VT/OG)

- **Is the resistance less than 5 ohms between the clockspring and the steering wheel controls, and greater than 10,000 ohms between the clockspring and ground?**

F10 CHECK THE REFERENCE VOLTAGE CIRCUITS TO THE CLOCKSPRING

- Ignition OFF.
- Disconnect: Clockspring C218a.
- Ignition ON.
- For vehicles without the SYNC system, measure the voltage between the lower clockspring C218a-6, circuit VMN02 (WH/BN) and C218a-12, circuit RME24 (BU/WH); and between the lower clockspring C218a-13, circuit VME14 (GY/YE) and C218a-12, circuit RME24 (BU/WH).



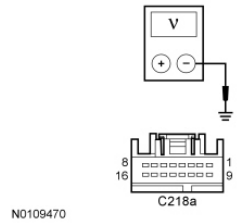
N0109470

- For vehicles with the SYNC system, measure the voltage between the lower clockspring C218a-6, circuit VMN02 (WH/BN) and C218a-4, circuit RH106 (VT/OG); and between the lower clockspring C218a-13, circuit VME14 (GY/YE) and C218a-12, circuit RME24

Yes
INSTALL a new clockspring. REFER to Section 501-20B . CLEAR any DTCs present. TEST the system for normal operation.

No
For vehicles without SYNC, GO to F11 .

For vehicles with SYNC, GO to F12 .

(BU/WH).  N0109470 • **Is the voltage approximately 5 volts?**	
F11 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Connect: All Disconnected Connectors. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.
F12 CHECK FOR CORRECT APIM OPERATION	
• Connect: All Disconnected Connectors. • Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.

Pinpoint Test G: The Family Entertainment System Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Refer to Wiring Diagrams Cell 132 , Video System for schematic and connector information.

Normal Operation

The Rear Entertainment Module (RETM) routes audio signals to the Audio Front Control Module (ACM). In single-play mode, the ACM plays the DVD audio on all speakers. In dual-play mode, the audio to the rear speakers is muted and the RETM continues to control the rear audio source to the headphones.

If the vehicle is equipped with the SYNC system, the audio signals from the Accessory Protocol Interface Module (APIM) are routed through the RETM to the ACM . This allows for single-play and dual-play to

include SYNC system audio sources.

For vehicles without navigation, the satellite radio signals are also routed to the RETM after passing from the Satellite Digital Audio Receiver System (SDARS) module through the APIM .

This pinpoint test is intended to diagnose the following:

- Incorrect customer setting
- Damaged DVD
- Wiring, terminals or connectors
- RETM
- ACM

PINPOINT TEST G: THE VIDEO SYSTEM IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before diagnosing the family entertainment system, make sure a known good DVD is installed.

Test Step	Result / Action to Take
G1 IDENTIFY THE SYMPTOM	
• Operate the audio system in DVD single-play mode and observe the DVD audio. Refer to the Owner's Literature. • **Does the DVD audio operate correctly?**	**Yes** GO to G2 . **No** If the vehicle is equipped with satellite audio (but not navigation) or the SYNC system, GO to G3 . Otherwise, GO to G4 .
G2 CHECK THE OPERATION OF THE DVD VIDEO	
• Operate the audio system in DVD single-play mode and observe the DVD audio. • **Does the DVD video operate correctly?**	**Yes** The system is operating correctly at this time. The concern was either caused by an incorrect system setting, or the customer using a damaged DVD. INFORM the customer that pressing the power button or the VIDEO button while a DVD is playing can cause the display to go blank. **No** GO to G6 .
G3 CHECK THE RETM AUDIO PASS-THROUGH	
NOTE: If the vehicle is equipped with both the SYNC system and satellite radio (but not navigation), either step 1 or step 2 can be followed.	**Yes** GO to G6 . **No** GO to G4 .

- For vehicles equipped with the SYNC system, connect the Multi-Media Interface Tester, and operate the audio system in SYNC mode. Refer to the tool instructions.
- For vehicles equipped with satellite radio (but not navigation), operate the audio system in satellite radio mode
- Observe the audio output.
- **Does the SYNC system (or satellite radio) audio operate correctly?**

G4 CHECK THE AUDIO CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: RETM C9029.
- Disconnect: ACM C290b.
- Ignition ON.
- Measure the voltage between the ACM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C240b-1	Ground	VME17 (GN)
C240b-2	Ground	RME17 (GY)
C240b-9	Ground	VME18 (VT)
C240b-10	Ground	RME18 (YE)

- **Is any voltage present?**

Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to G5 .

G5 CHECK THE AUDIO CIRCUITS TO THE ACM FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the ACM , harness side and the RETM , harness side; and between the ACM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C240b-1		

Yes
GO to G6 .

No
REPAIR the circuit in question. TEST the system for normal operation.

	C9029-10, then ground	VME17 (GN)
C240b-2	C9029-9, then ground	RME17 (GY)
C240b-9	C9029-26, then ground	VME18 (VT)
C240b-10	C9029-25, then ground	RME18 (YE)

- **Is the resistance less than 5 ohms between the ACM and the RETM , and greater than 10,000 ohms between the ACM and ground?**

G6 CHECK FOR LOST COMMUNICATION DTCs	
• Using the scan tool, retrieve all continuous DTCs from all modules. • **Is DTC U0184, U0184:00, U0196, or DTC U0196:00 present in any module?**	**Yes** REFER to the DTC Charts in this section. **No** GO to G7 .
G7 CHECK FOR CORRECT RETM OPERATION	
• Connect: ACM C290b. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. If the concern remains, GO to G8 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
G8 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Satellite Radio Is Inoperative/Does Not Operate Correctly â Vehicles Without Navigation

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

Digital signals are received by the satellite radio antenna and sent through the satellite radio antenna cable to the Satellite Digital Audio Receiver System (SDARS) module, where the signals are converted to analog. The digital audio signals are converted to analog and sent to the appropriate module, depending on vehicle configuration.

When a satellite radio subscription is activated, the Electronic Serial Number (ESN) of the SDARS module is associated with the Vehicle Identification Number (VIN). As a result, the SDARS module cannot be swapped from one vehicle to another.

If there is an open in the satellite radio antenna circuit, there is no satellite audio. The audio system display indicates a satellite antenna concern when the audio system is operated in satellite radio mode. To diagnose an open in the satellite radio antenna circuit, GO to Pinpoint Test B .

This pinpoint test is intended to diagnose the following:

- Subscription status
- SDARS module

PINPOINT TEST H: THE SATELLITE RADIO IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
H1 VERIFY THE AUDIO SYSTEM OPERATION	
• Operate the audio system in radio tuner (AM/FM) mode. • **Does the audio system operate correctly?**	**Yes** GO to H2 . **No** GO to Symptom Chart to diagnose the audio system concern.
H2 VERIFY AN ACTIVE SUBSCRIPTION	
• Operate the audio system in satellite radio mode and observe the audio system display. • **Does the display read CALL SIRIUS?**	**Yes** The subscription has expired. INFORM the customer to contact Sirius to re-activate the subscription. **No** If the display indicates a satellite antenna fault, GO to Pinpoint Test B . Otherwise, GO to H3 .
H3 CHECK FOR SDARS MODULE DTCs	
• Carry out the SDARS module self-test. • **Are any satellite audio system DTCs present?**	**Yes** If DTC B1031 or DTC B1032 is present, GO to Pinpoint Test B . For all other DTCs, REFER to the DTC Charts in this section.

	No GO to H4 .
H4 CHECK FOR CORRECT SDARS MODULE OPERATION	
• Ignition OFF. • Disconnect the SDARS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SDARS module connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SDARS module. REFER to Satellite Digital Audio Receiver System (SDARS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Audio Input Jack Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation â Vehicles Without the SYNC System

Audio signals are sent from the audio input jack to the Audio Front Control Module (ACM). There are no external power or ground circuits to the audio input jack.

Vehicles With the SYNC System

Audio signals are sent from the audio input jack to the Accessory Protocol Interface Module (APIM). The signals are then sent to the ACM . There are no external power or ground circuits to the audio input jack.

- DTC B1D78:13 (Auxiliary Input: Circuit Open) â sets in continuous memory by the navigation ACM (vehicles without the SYNC system only) when an open is detected in the audio input jack circuitry for greater than 250 milliseconds.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Audio input jack
- APIM (vehicles with the SYNC system)
- ACM (vehicles without the SYNC system)

PINPOINT TEST I: THE AUDIO INPUT JACK IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

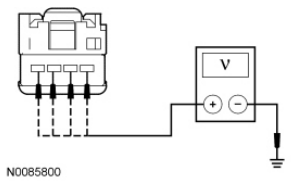
NOTE: Before carrying out this pinpoint test, make sure the MP3 device is operating correctly.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>I1 CHECK THE AUDIO INPUT JACK AUDIO</td><td></td></tr>
<tr><td>• Using the Multi-Media Interface Tester, attempt to play a file using the audio input jack.
• Does the file play correctly?</td><td>Yes
The system is operating correctly at this time. The concern may be with the customer device.

No
GO to I2 .</td></tr>
<tr><td>I2 DETERMINE THE VEHICLE CONTENT</td><td></td></tr>
<tr><td>• Determine if the vehicle is equipped with the SYNC system.
• Is the vehicle equipped with the SYNC system?</td><td>Yes
GO to I3 .

No
GO to I4 .</td></tr>
<tr><td>I3 CHECK THE APIM AUDIO OUTPUT</td><td></td></tr>
<tr><td>• Using the Multi-Media Interface Tester, attempt to play a file using either the Universal Serial Bus (USB) port or Bluetooth.
• Is the audio output OK for the USB port or Bluetooth?</td><td>Yes
GO to I4 .

No
GO to Pinpoint Test P .</td></tr>
<tr><td>I4 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: Audio Input Jack C3312.
• Disconnect: ACM C290b (Vehicles Without the SYNC System) or APIM C3342 (Vehicles With the SYNC System).
• Ignition ON.
• Measure the voltage between the audio input jack, harness side and ground as follows:

<table><tr><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>C3312-1</td><td>VME46 (BU/GN)</td></tr><tr><td>C3312-2</td><td>RME46 (WH/GN)</td></tr><tr><td>C3312-3</td><td>RME45 (YE/GN)</td></tr><tr><td>C3312-4</td><td>VME45 (BU)</td></tr></table>
 

• Is any voltage present?</td><td>Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to I5 .</td></tr>
</table>

I5 CHECK THE AUDIO INPUT JACK CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the audio input jack, harness side and the ACM (or APIM , if equipped with the SYNC system), harness side; and between the audio input jack, harness side and ground as follows:

Vehicles Without The SYNC System

Positive Meter Lead	Negative Meter Lead	Circuit
C3312-1	C240b-6, then ground	VME46 (BU/GN)
C3312-2	C240b-14, then ground	RME46 (WH/GN)
C3312-3	C240b-8, then ground	RME45 (YE/GN)
C3312-4	C240b-7, then ground	VME45 (BU)

Vehicles With The SYNC System

Positive Meter Lead	Negative Meter Lead	Circuit
C3312-1	C3342-47, then ground	VME46 (BU/GN)
C3312-2	C3342-48, then ground	RME46 (WH/GN)
C3312-3	C3342-46, then ground	RME45 (YE/GN)
C3312-4	C3342-45, then ground	VME45 (BU)

- **Is the resistance less than 5 ohms between the audio input jack and the ACM (or APIM , if equipped with the SYNC system), and greater than 10,000 ohms between the audio input jack and ground?**

Yes
GO to I6 .

No
REPAIR the circuit in question. TEST the system for normal operation.

I6 ISOLATE THE AUDIO INPUT JACK

- Connect: ACM C290b (Vehicles Without the SYNC System) or APIM C3342 (Vehicles With the SYNC System).

Yes
The concern was caused by an inoperative audio input jack. The system is operating correctly at this time.

• Install a new audio input jack. Refer to Audio Input Jack in this section. • Using the Multi-Media Interface Tester, attempt to play a file using the audio input jack. • **Does the system operate correctly?**	**No** For vehicles without the SYNC system, GO to I7 . For vehicles with the SYNC system, GO to I8 .
I7 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
I8 CHECK FOR CORRECT APIM OPERATION	
• Ignition OFF. • Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: Loud Popping Sound When Cycling The Ignition

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

Voltage is sent through the start input circuit to the Audio Front Control Module (ACM) with the ignition in the START position. Upon receiving this signal, the ACM mutes all speaker outputs to eliminate the possibility of voltage spikes producing a popping noise through the speakers.

For the Audiophile audio system, the ACM disables the subwoofer and the audio amplifier while the ignition is in the START position by keeping the enable circuit voltages below 0.4 volt.

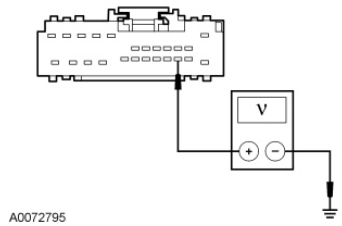
If there is a short to voltage on either of the enable circuits, distortion is heard in the speakers whenever the ACM is powered up, and that should be the primary concern addressed. If the speakers have distorted sound, GO to Symptom Chart - Sound Quality .

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- ACM

PINPOINT TEST J: LOUD POPPING SOUND WHEN CYCLING THE IGNITION

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
J1 CHECK THE START INPUT CIRCUIT VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290a. • Disconnect: Starter Relay. • Hold the key in the START position. • Measure the voltage between the ACM C290a-15, circuit CBP11 (BN), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** VERIFY the Smart Junction Box (SJB) fuse 11 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

Pinpoint Test K: No Global Positioning System (GPS) Antenna Signal

Normal Operation

The Global Positioning System (GPS) antenna (integral to the satellite radio antenna) provides information from the GPS satellite system to the Audio Front Control Module (ACM). This information is used to calculate vehicle position and direction of travel.

A splitter is used in the lower satellite radio antenna cable to split the signals between the satellite radio and the GPS . It is possible that a concern in the GPS signal line after the splitter may cause a navigation system concern without affecting the satellite radio.

- DTC B119F:01 (GPS Antenna: General Electrical Failure) â sets when any failure is detected in the GPS antenna circuit.
- DTC B119F:13 (GPS Antenna: Circuit Open) â sets when an open is detected in the GPS antenna circuit.

This pinpoint test is intended to diagnose the following:

- Satellite radio antenna cable
- ACM

PINPOINT TEST K: NO GPS ANTENNA SIGNAL

Test Step	Result / Action to Take
K1 CHECK THE OPERATION OF THE SATELLITE RADIO	
• Operate the audio system in satellite radio mode. • Observe the audio system display. • **Does the audio system display indicate a satellite radio antenna fault?**	**Yes** GO to Pinpoint Test B . **No** GO to K2 .
K2 CHECK FOR GPS SIGNAL-RELATED DTCs	
• Clear the ACM DTCs. • Carry out the ACM self-test. • **Is DTC B119F:01 or DTC B119F:13 retrieved?**	**Yes** INSTALL a new lower satellite radio antenna cable. REFER to Antenna Cable â Satellite Radio in this section. CLEAR the DTCs. TEST the system for normal operation. **No** GO to K3 .
K3 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.

Pinpoint Test L: The Voice Guidance Is Inoperative/Does Not Operate Correctly

Normal Operation

The voice-assisted route guidance is broadcast through the front speakers. The voice guidance volume can be adjusted using the settings on the Audio Front Control Module (ACM).

This pinpoint test is intended to diagnose the following:

- Incorrect voice guidance setting
- Audio system concern
- ACM

PINPOINT TEST L: THE VOICE GUIDANCE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
L1 CHECK THE VOICE GUIDANCE SETTING	
• Adjust the voice volume to approximately 50%. Refer to the Owner's Literature. • Set a destination and start the route using the navigation controls. Refer to the Owner's Literature. • Observe the voice guidance. • **Does the voice guidance operate correctly?**	**Yes** The concern was caused by an incorrect customer setting. INSTRUCT the customer about the correct use of the voice guidance feature. **No** GO to L2 .
L2 CHECK THE SPEAKER OUTPUT	
• Carry out the speaker walk test. Refer to Audio Control Module (ACM) Self-Diagnostic Mode in this section. • **Do the front speakers operate correctly?**	**Yes** GO to L3 . **No** GO to Pinpoint Test X .
L3 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: The Position Cursor Is Inaccurate

Normal Operation

The primary source of vehicle location for the navigation system is the Audio Front Control Module (ACM) receiving the position signal through the Global Positioning System (GPS) antenna (integral to the satellite radio antenna).

In addition, the ACM receives the navigation rolling wheel count signal from the Instrument Cluster (IC) (which gateways the signal from the ABS module). This secondary signal is used to calculate vehicle position

when the GPS signal is lost. It also supports the adaptive learning function of the ACM , whereby the ACM can compensate for long-term differences between the GPS signal location and the actual distance traveled by the vehicle.

If DTC B119F:01 or B119F:13 is present, GO to Pinpoint Test K to diagnose a concern with the GPS antenna.

- DTC U2014:09 (Control Module Hardware: Component Failure) â sets when the ACM detects a fault in the internal gyroscope. The gyroscope is not serviceable.

This pinpoint test is intended to diagnose the following:

- GPS antenna concern
- Communication network concern
- ACM

PINPOINT TEST M: THE POSITION CURSOR IS INACCURATE

Test Step	Result / Action to Take
M1 CHECK THE ACM FOR GPS -RELATED DTCs	
• Retrieve the ACM continuous DTCs. • **Is DTC B119F:01 or B119F:13 present?**	**Yes** GO to Pinpoint Test K . **No** GO to M2 .
M2 CHECK FOR DTC U0155:00	
• Review the ACM continuous DTCs. • **Is DTC U0155:00 present?**	**Yes** GO to Pinpoint Test AK . **No** GO to M3 .
M3 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.

Pinpoint Test N: Voice Recognition Is Inoperative/Does Not Operate Correctly â Vehicles Without The SYNC System

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE switch is pressed, it changes the reference voltage from the Audio Front Control Module (ACM) on the voice recognition circuit, and the ACM enters voice recognition mode. A microphone located in the audio-dimming interior mirror receives the voice command and sends a signal to the ACM .

The microphone test is available through the Integrated Diagnostic System (IDS) scan tool or through the ACM self-diagnostic mode. Running this test causes the ACM to produce a test tone. If the system is operating correctly, the microphone detects the tone and produces a voltage signal to the ACM indicating the tone was heard.

- DTC B1D79:01 (Microphone Input: General Electrical Failure) â set by the ACM during the microphone test when it does not receive an adequate signal from the microphone when the test tone is sounded.

This pinpoint test is intended to diagnose the following:

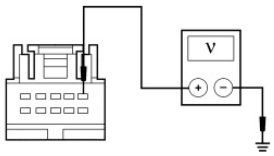
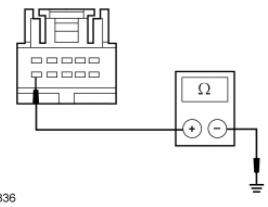
- Fuse
- Wiring, terminals or connectors
- Steering wheel controls
- Microphone (part of the auto-dimming interior mirror)
- ACM

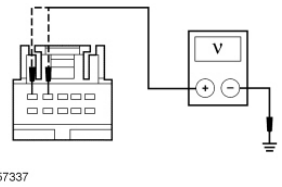
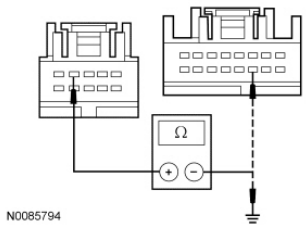
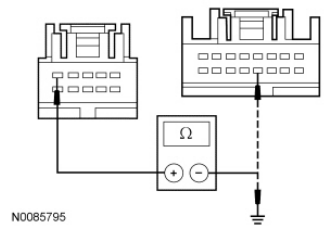
PINPOINT TEST N: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY â VEHICLES WITHOUT THE SYNC SYSTEM

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
N1 CHECK THE OPERATION OF THE STEERING WHEEL CONTROLS	
• Operate the audio system in radio tuner (AM/FM) mode. • Press the VOICE button on the steering wheel controls. • **Does the audio system enter voice recognition mode?**	**Yes** GO to N2 . **No** GO to Pinpoint Test F to diagnose the steering wheel controls system.
N2 CHECK FOR DTC B1D79:01	
• Carry out the microphone test. Refer to Audio Control Module (ACM) Self-Diagnostic Mode in this section. • Observe the display once the test tone has stopped sounding. • **Is DTC B1D79:01 present?**	**Yes** GO to N4 . **No** GO to N3 .
N3 CHECK THE OPERATION OF THE VOICE RECOGNITION â NAVIGATION SYSTEM	

• Press the VOICE switch on the steering wheel controls. • Wait for the audio system to acknowledge the VOICE switch being pressed. • While still in voice recognition mode, speak the command "NAVIGATION", and observe the audio system. • **Does the navigation system acknowledge the command "NAVIGATION"?**	**Yes** The system is operating correctly at this time. ADVISE the customer on the correct operation of the voice recognition system. **No** GO to N4 .
N4 CHECK THE MICROPHONE VOLTAGE SUPPLY	
• Ignition OFF. • Disconnect: Auto-Dimming Interior Mirror C9012. • Ignition ON. • Measure the voltage between the auto-dimming interior mirror C9012-1, circuit CBP05 (YE), harness side and ground.  N0057331 • **Is the voltage greater than 10 volts?**	**Yes** GO to N5 . **No** VERIFY the Smart Junction Box (SJB) fuse 5 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible sources of the circuit short.
N5 CHECK THE MICROPHONE GROUND FOR CONTINUITY	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the auto-dimming interior mirror C9012-10, circuit GD143 (BK/VT), harness side and ground.  N0057336 • **Is the resistance less than 5 ohms?**	**Yes** GO to N6 . **No** REPAIR the circuit. TEST the system for normal operation.
N6 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE	

• Connect: Negative Battery Cable. • Disconnect: ACM C290b. • Ignition ON. • Measure the voltage between the auto-dimming interior mirror C9012-4, circuit VMN07 (GY), harness side and ground; and between the auto-dimming interior mirror C9012-5, circuit RMN07 (VT), harness side and ground.  N0057337 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to N7 .
N7 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the auto-dimming interior mirror C9012-4, circuit VMN07 (GY), harness side and the ACM C290b-11, circuit VMN07 (GY), harness side; and between the auto-dimming interior mirror C9012-4, circuit VMN07 (GY), harness side and ground.  N0085794 • Measure the resistance between the auto-dimming interior mirror C9012-5, circuit RMN07 (VT), harness side and the ACM C290b-12, circuit RMN07 (VT), harness side; and between the auto-dimming interior mirror C9012-5, circuit RMN07 (VT), harness side and ground.  N0085795	**Yes** GO to N8 . **No** REPAIR the circuit in question. TEST the system for normal operation.

• **Is the resistance less than 5 ohms between the auto-dimming interior mirror and the ACM , and greater than 10,000 ohms between the auto-dimming interior mirror and ground?**	
N8 ISOLATE THE AUTO-DIMMING INTERIOR MIRROR	
• Connect: ACM C290b. • Install a new auto-dimming interior mirror. Refer to Interior Rear View Mirror in Section 501-09 . • Operate the audio system in radio tuner (AM/FM) mode. • Press the VOICE button on the steering wheel controls, and attempt several voice commands. • **Does the voice recognition operate correctly?**	**Yes** The fault was caused by an inoperative auto-dimming interior mirror. The system is now operating correctly. **No** GO to N9 .
N9 CHECK FOR CORRECT ACM OPERATION	
• Disconnect the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ACM connectors and make sure they seat correctly. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Speed Sensitive Volume Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The speed sensitive volume function adjusts the volume based on the Vehicle Speed Sensor (VSS) signal from the Instrument Cluster (IC). The IC does not generate the VSS signal; it gateways the signal from the PCM. The Smart Junction Box (SJB) also receives this signal and should exhibit symptoms if the signal is lost.

This pinpoint test is intended to diagnose the following:

- Speed sensitive volume setting
- VSS signal concern
- Communication network concern
- ACM

PINPOINT TEST O: THE SPEED SENSITIVE VOLUME DOES NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take

O1 CHECK THE SPEEDOMETER OPERATION	
• Drive the vehicle and observe the speedometer. • **Does the speedometer operate correctly?**	**Yes** GO to O2 . **No** REFER to Section 413-01 .
O2 CHECK THE SPEED SENSITIVE VOLUME SETTING	
• Turn the speed sensitive volume off. Refer to the Owner's Literature. • Operate the audio system in radio tuner (AM/FM) mode. • Drive the vehicle at various speeds and observe the speaker volume. • Set the speed sensitive volume to maximum compensation. Refer to the Owner's Literature. • Operate the audio system in radio tuner (AM/FM) mode. • Drive the vehicle at various speeds and observe the speaker volume. • **Does the volume remain constant with the speed sensitive volume turned off, and increase and decrease with vehicle speed with the speed sensitive volume set to maximum?**	**Yes** The system is operating correctly at this time. INSTRUCT the customer about the correct usage of the speed sensitive volume feature. **No** GO to O3 .
O3 CHECK FOR DTC U0155 OR DTC U0155:00	
• Using the scan tool, retrieve all continuous DTCs. • **Is DTC U0155:00 or DTC U0155 retrieved in any module?**	**Yes** GO to Pinpoint Test AK . **No** GO to O4 .
O4 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.

Pinpoint Test P: The SYNC System Is Completely Inoperative

Normal Operation

When a button on the Audio Control Module (ACM) is pressed, a network message is sent to the Accessory Protocol Interface Module (APIM) via the Medium Speed Controller Area Network (MS-CAN). The APIM takes the appropriate action and sends a status message to the ACM in order to update the display screen.

- DTC U3000:04 (Control Module: System Internal Failure) â sets when the APIM (V2) detects a fault due to a device conflict or an internal failure.

This pinpoint test is intended to diagnose the following:

- Audio system concern
- Communication network concern
- Customer error
- Customer device
- ACM
- APIM

PINPOINT TEST P: THE SYNC SYSTEM IS COMPLETELY INOPERATIVE

Test Step	Result / Action to Take
P1 CHECK FOR SCAN TOOL COMMUNICATION WITH THE APIM	
• Carry out the network test using the scan tool. • **Does the APIM pass the network test?**	**Yes** GO to P2 . **No** REFER to Section 418-00 .
P2 CHECK THE SYNC SYSTEM OPERATION	
NOTE: Carrying out a Master Reset returns all preference settings to the factory defaults, erases all the phone book and call histories, and deletes any devices paired with the SYNC system. • Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, test the audio output for the audio input jack, USB port, and Bluetooth connection using the VOICE switch on the steering wheel controls to enter each mode. • **Do all of the SYNC inputs function correctly?**	**Yes** The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset. REFER to the Owner's Literature. REVIEW the SYNC system operation with the customer. If the customer device still does not operate correctly, the fault is with the customer device. **No** GO to P3 .
P3 RESET THE APIM AND RECHECK SYNC SYSTEM OPERATION	
• Carry out an APIM power reset by disconnecting the battery for 5 minutes, then reconnecting it. • Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, test the audio output for the audio input jack, USB port, and Bluetooth connection using the VOICE switch on the steering wheel controls to enter each mode. • **Do all of the SYNC inputs function correctly?**	**Yes** The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset. REFER to the Owner's Literature. REVIEW the SYNC system operation with the customer. If the customer device still does not operate correctly, the fault is with the customer device. **No** If only some (but not all) of the inputs are inoperative, GO to Symptom Chart - SYNC System to diagnose the observed symptom. If all inputs are inoperative

	and/or DTC U3000:04 is present, INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section.

Pinpoint Test Q: Unable To Pair Bluetooth Device

Normal Operation

When a new Bluetooth device is added, the Accessory Protocol Interface Module (APIM) and the Bluetooth device must be paired together. Most Bluetooth devices can pair with the SYNC system, although functionality may vary. To determine if a Bluetooth device is supported, retrieve the Consumer Interface Processor (CIP) software level using the Accessory Protocol Interface Module (APIM) Software Level Check in this section, and verify the customer device is on the compatibility list for the current CIP software level.

Pairing a Bluetooth device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC system generates a unique Personal Identification Number (PIN) that must be entered on the Bluetooth device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For additional information on the pairing process, refer to the Owner's Literature.

This pinpoint test is intended to diagnose the following:

- Incompatible Bluetooth device
- Customer error
- Customer Bluetooth device
- APIM

PINPOINT TEST Q: UNABLE TO PAIR BLUETOOTH DEVICE

Test Step	Result / Action to Take
Q1 CHECK THE BLUETOOTH CONNECTION	
NOTE: Carrying out a Master Reset returns all preference settings to the factory defaults, erases all the phone book and call histories and deletes any devices paired with the SYNC system. • Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, connect to the SYNC system using Bluetooth. • Enter the following diagnostic mode on the scan tool: APIM DataLogger. • Monitor the Bluetooth device paired PID (BT_PAIR) and the Bluetooth device connected PID (BT_CONN). • **Do the PIDs BT_PAIR and BT_CONN both read "Yes"?**	**Yes** The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset. REFER to the Owner's Literature. REVIEW the pairing process with the customer. If the customer device still does not pair, the fault is with the customer device. **No** GO to Q2 .
Q2 CHECK FOR CORRECT APIM OPERATION	
• Disconnect the APIM connector.	**Yes** INSTALL a new APIM . REFER to

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: The Universal Serial Bus (USB) Port Is Inoperative/Does Not Operate Correctly

Normal Operation

The Universal Serial Bus (USB) port is connected to the Accessory Protocol Interface Module (APIM) through the USB cable. The USB port can be used to play audio files or upload software from mass storage devices, or for connecting a media device.

If supported by the user device, the USB can provide charging. Because of this feature, when a USB device is plugged into the USB port, the SYNC system does not automatically switch to the device.

If a USB mass storage device is used to play an audio file, the SYNC system only plays audio files that do not have Digital Rights Management (DRM) protection.

The USB cable and port are not serviceable separately.

- DTC B1252:04 (USB Port: System Internal Failure) â sets when the APIM (V2) detects an over-temperature condition in the USB circuit. This can be caused by a fault in the USB cable and port, or by the customer USB device.
- DTC B1252:11 (USB Port: Circuit Short to Ground) â sets when the APIM (V2) detects an over-current condition in the USB circuit. This can be caused by a fault in the USB cable and port, or by the customer USB device.
- DTC U261C (USB #1 Device Error) â sets when the APIM (V1) detects a fault in the USB circuit. This can be caused by a fault in the USB cable and port, or by the customer USB device.

This pinpoint test is intended to diagnose the following:

- Customer USB device
- USB cable and port
- APIM

PINPOINT TEST R: THE USB PORT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
R1 CHECK THE USB CONNECTION	
• Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, attempt to play a file using the USB port.	**Yes** The SYNC system is operating correctly. REVIEW the operation of the USB port with the customer. If the customer device still does not operate correctly, the fault is with the customer

• **Does the audio file play successfully using the USB connection?**	device. **No** GO to R2 .
R2 INSPECT THE USB CABLE	
• Ignition OFF. • Disconnect: USB Cable At APIM . • Inspect the USB cable for damage. • Connect: USB Cable At APIM . • Ignition ON. • Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, attempt to play a file using the USB port. • **Does the audio file play successfully using the USB connection?**	**Yes** The concern was caused by the USB connection not being seated correctly. The system is now operating correctly. **No** GO to R3 .
R3 RESET THE APIM AND RECHECK SYNC SYSTEM OPERATION	
NOTE: Carrying out a Master Reset returns all preference settings to the factory defaults, erases all the phone book and call histories, and deletes any devices paired with the SYNC system. • Carry out an APIM power reset by disconnecting the battery for 5 minutes, then reconnecting it. • Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, test the audio output for the audio input jack, USB port, and Bluetooth connection using the VOICE switch on the steering wheel controls to enter each mode. • **Do all of the SYNC inputs function correctly?**	**Yes** The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset. REFER to the Owner's Literature. REVIEW the SYNC system operation with the customer. If the customer device still does not operate correctly, the fault is with the customer device. **No** If only the USB port is inoperative, GO to R4 . If additional inputs are inoperative, GO to Symptom Chart - SYNC System to diagnose the observed symptom. If all inputs are inoperative, INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section.
R4 ISOLATE THE USB CABLE AND PORT	
• Install a new USB cable and port. Refer to Universal Serial Bus (USB) Cable and Port in this section. • Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, attempt to play a file using the USB port. • **Does the audio file play successfully using the USB connection?**	**Yes** The concern was caused by an inoperative USB cable. The system is now operating correctly. **No** GO to R5 .
R5 CHECK FOR CORRECT APIM OPERATION	
• Disconnect the APIM connector. • Check for: ♦ corrosion	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation.

♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.

Pinpoint Test S: The SYNC System Audible Prompts Are Inoperative/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The Text-To-Speech (TTS) and voice prompt features speak certain text information and interaction requests in order to minimize driver distraction by having to look at the audio system display while driving. The ring tone alerts the driver to an incoming call.

Audible prompts can range from a simple tone to more elaborate spoken text, based on the customer setting. When interaction mode is set to standard, detailed guidance is provided. When interaction mode is set to advanced, most prompts are tones only and minimal audible guidance is provided. Refer to the Owner's Literature for further information on voice interaction.

The audio signals for the TTS and voice prompt features, the ringtones, and audio from the outside device during a phone call, are sent from the Accessory Protocol Interface Module (APIM) to the Audio Front Control Module (ACM).

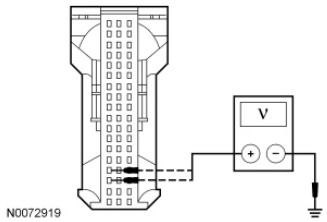
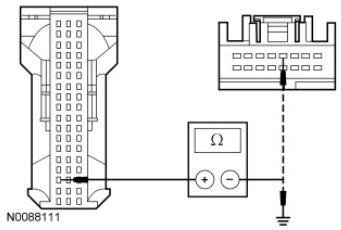
This pinpoint test is intended to diagnose the following:

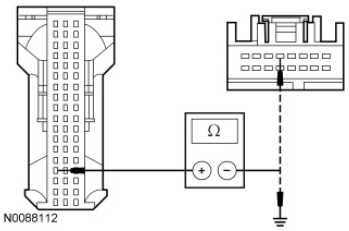
- Customer setting
- Wiring, terminals or connectors
- APIM
- ACM

PINPOINT TEST S: THE SYNC SYSTEM AUDIBLE PROMPTS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
S1 CHECK THE AUDIBLE PROMPT SETTING	
• Operate the audio system in SYNC mode. • Verify the audible prompts are enabled. Refer to "SYNC Voice Recognition Feature" in the Owner's Literature. • Press the VOICE button on the steering wheel controls and observe the SYNC voice prompt. • **Does the SYNC system produce an audible prompt correctly?**	**Yes** The system is operating correctly at this time. The concern was caused by a customer setting. INSTRUCT the customer about the correct operation of the audible prompt feature. **No** GO to S2 .

S2 CHECK FOR A VOLTAGE SIGNAL FROM THE APIM	
• Operate the audio system in SYNC mode, and verify the audible prompts are enabled. Refer to "SYNC Voice Recognition Feature" in the Owner's Literature. • While pressing the VOICE switch repeatedly, measure the AC voltage by back-probing between the ACM C290b-4, circuit VMN14 (WH/VT), harness side and the ACM C290b-5, circuit RMN14 (GY/BN), harness side. • **Is an AC voltage produced each time the VOICE switch is pressed?**	**Yes** GO to S6 . **No** GO to S3 .
S3 CHECK THE AUDIBLE PROMPT CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290b. • Disconnect: APIM C3342. • Ignition ON. • Measure the voltage between the APIM C3342-3, circuit VMN14 (WH/VT), harness side and ground; and between the APIM C3342-4, circuit RMN14 (GY/BN), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to S4 .
S4 CHECK THE AUDIBLE PROMPT CIRCUITS FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the APIM C3342-3, circuit VMN14 (WH/VT), harness side and the ACM C290b-4, circuit VMN14 (WH/VT), harness side; and between the APIM C3342-3, circuit VMN14 (WH/VT), harness side and ground.  	**Yes** GO to S5 . **No** REPAIR the circuit in question. TEST the system for normal operation.

• Measure the resistance between the APIM C3342-4, circuit RMN14 (GY/BN), harness side and the ACM C290b-5, circuit RMN14 (GY/BN), harness side; and between the APIM C3342-4, circuit RMN14 (GY/BN), harness side and ground.  • **Is the resistance less than 5 ohms between the APIM and the ACM , and greater than 10,000 ohms between the APIM and ground?**	
S5 CHECK FOR CORRECT APIM OPERATION	
• Connect: ACM C290b. • Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
S6 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test T: The Satellite Radio Is Inoperative/Does Not Operate Correctly â Vehicles With Navigation

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Refer to Wiring Diagrams Cell 132 , Video System for schematic and connector information.

Normal Operation

Digital signals are received by the satellite radio antenna and sent to the Audio Front Control Module (ACM) through the satellite radio antenna cable. The satellite receiver is internal to the ACM .

When a satellite radio subscription is activated, the Electronic Serial Number (ESN) of the built-in satellite receiver is associated with the Vehicle Identification Number (VIN). As a result, the ACM cannot be swapped from one vehicle to another.

If there is an open in the satellite radio antenna circuit, there is no satellite audio. The audio system display indicates a satellite antenna concern when the audio system is operated in satellite radio mode. To diagnose an open in the satellite radio antenna circuit, GO to Pinpoint Test K .

- DTC U2014:96 (Control Module Hardware: Component Internal Failure) â sets when the ACM detects an internal fault to the built-in satellite radio receiver. This results in complete loss of satellite radio functionality.

This pinpoint test is intended to diagnose the following:

- Subscription status
- ACM

PINPOINT TEST T: THE SATELLITE RADIO IS INOPERATIVE/DOES NOT OPERATE CORRECTLY â VEHICLES WITH NAVIGATION

Test Step	Result / Action to Take
T1 CHECK THE ACM DTCs	
• Retrieve the ACM DTCs. • **Is DTC U2014:96 present?**	**Yes** GO to T4 . **No** GO to T2 .
T2 CHECK THE SATELLITE RADIO DISPLAY	
• Turn the audio system on. • Operate the audio system in satellite radio mode and observe the ACM display. • **Does satellite radio information show on the ACM display?**	**Yes** GO to T3 . **No** GO to Pinpoint Test Z .
T3 VERIFY AN ACTIVE SUBSCRIPTION	
• Operate the audio system in satellite radio mode and observe the audio system display. • **Does the display read CALL SIRIUS?**	**Yes** The subscription has expired. INFORM the customer to contact Sirius to re-activate the subscription. **No** If the display indicates a satellite antenna fault, GO to Pinpoint Test B .

	Otherwise, GO to T4 .
T4 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

Pinpoint Test U: Poor Quality/Distorted/No Sound â SYNC System

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Refer to Wiring Diagrams Cell 132 , Video System for schematic and connector information.

Normal Operation

The Accessory Protocol Interface Module (APIM) transmits left and right channel analog audio signals. The signals include inputs from the Universal Serial Bus (USB) port, the audio input jack, and a Bluetooth media device.

If the vehicle is equipped with the family entertainment system, these audio signals are sent to the Rear Entertainment Module (RETM), then to the Audio Front Control Module (ACM). In vehicles without the family entertainment system, the audio signals are sent directly to the ACM .

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- APIM
- RETM (if equipped)
- ACM

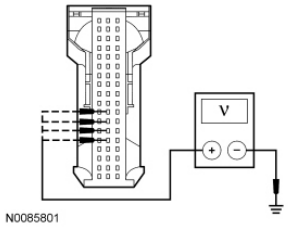
PINPOINT TEST U: POOR QUALITY/DISTORTED SOUND WHILE IN SYNC MODE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
U1 VERIFY THE OPERATION OF THE SYNC SYSTEM AUDIO SOURCES	
• Connect: Multi-Media Interface Tester. • Using the Multi-Media Interface Tester, test	**Yes** If the vehicle is equipped with the family entertainment system, GO to U2 .

the audio output for the audio input jack, USB port, and Bluetooth connection. • **Is there poor quality/distorted sound from each SYNC audio source?**	Otherwise, GO to U3 . **No** If the concern is only with one of the audio sources, GO to Symptom Chart - SYNC System to diagnose the observed symptom. If all audio sources operate correctly, the concern is with the customer device.
U2 CHECK THE OPERATION OF THE FAMILY ENTERTAINMENT SYSTEM AUDIO	
• **NOTE:** Make sure a known good DVD is inserted in the RETM before carrying out this step. • Operate the audio system in single-play DVD mode. • Observe the audio output. • **Is there poor quality/distorted sound while in DVD mode?**	**Yes** GO to Pinpoint Test G . **No** GO to U3 .
U3 CHECK THE AUDIO CIRCUITS FROM THE APIM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290b (Vehicles Without A Family Entertainment System). • Disconnect: RETM C9029 (Vehicles With A Family Entertainment System). • Disconnect: APIM C3342. • Measure the voltage between the APIM , harness side and ground as follows:	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to U4 .

Positive Meter Lead	Negative Meter Lead
C3342-23 VME53 (VT/GN)	Ground
C3342-24 RME53 (BN/WH)	Ground
C3342-25 VME52 (BU)	Ground
C3342-26 RME52 (GY/OG)	Ground



- **Is any voltage present?**

U4 CHECK THE AUDIO CIRCUITS FROM THE APIM FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the APIM , harness side, and the ACM (or RETM if equipped with the family entertainment system), harness side; and between the APIM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C3342-23	C290b-9 or C9029-20, then ground	VME53 (VT/GN)/ VME18 (VT) (at ACM)
C3342-24	C290b-10 or C9029-19, then ground	RME53 (BN/WH)/ RME18 (YE) (at ACM)
C3342-25	C290b-1 or C9029-4, then ground	VME52 (BU)/ VME17 (GN) (at ACM)
C3342-26	C290b-2 or C9029-3, then ground	RME52 (GY/OG)/ RME17 (GY) (at ACM)

- **Is the resistance less than 5 ohms between the APIM and the ACM (or RETM), and greater than 10,000 ohms between the APIM and ground?**

Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to U5 .

U5 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors.
- Disconnect the APIM connector.
- Check for:
  - ♦ corrosion

Yes
INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. If the concern is still present and the vehicle is equipped

♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	with the family entertainment system, GO to U6 . If the concern is still present and the vehicle is not equipped with the family entertainment system, GO to U7 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
U6 CHECK FOR CORRECT RETM OPERATION	
• Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. If the concern is still present, GO to U7 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
U7 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: Voice Recognition Is Inoperative/Does Not Operate Correctly â Vehicles With The SYNC System

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE switch is pressed, it changes a reference voltage signal, and the audio system enters voice recognition mode. If the vehicle is equipped with navigation, the VOICE switch is wired to the Audio Front Control Module (ACM). If the vehicle is not equipped with navigation, the VOICE switch is wired to the Accessory Protocol Interface Module (APIM). A microphone located in the auto-dimming interior mirror receives the voice command and sends a signal to the APIM . The microphone is also used to detect outgoing audio during a phone call.

If the vehicle is equipped with navigation, the APIM receives the microphone input and also broadcasts it to the ACM . The first voice commands spoken determine which system handles the voice commands.

The microphone test (vehicles with navigation only) is available through the Integrated Diagnostic System (IDS) scan tool or through the ACM self-diagnostic mode. Running this test causes the ACM to produce a test tone. If the system is operating correctly, the microphone detects the tone and produces a signal to the ACM indicating the tone was heard.

- DTC B1038 (Microphone Input Circuit Failure) â set by the APIM (V1) during the on-demand self-test if it does not detect the microphone.
- DTC B1D79:01 (Microphone Input: General Electrical Failure) â set by the navigation ACM or the APIM (V2) during the microphone test when it does not receive an adequate signal from the microphone when the test tone is sounded.

This pinpoint test is intended to diagnose the following:

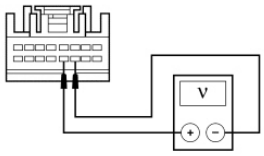
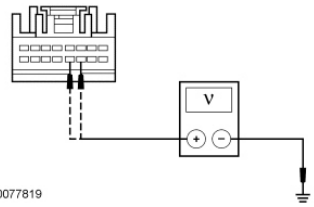
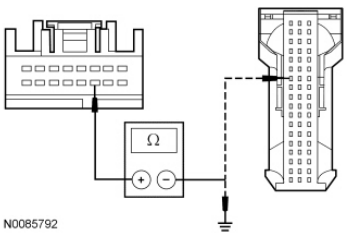
- Fuse
- Wiring, terminals or connectors
- Microphone (part of the auto-dimming interior mirror)
- Steering wheel controls
- ACM (if equipped with navigation)
- APIM

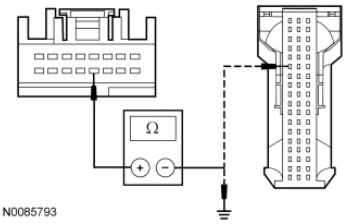
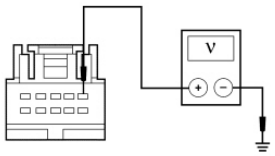
PINPOINT TEST V: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY â VEHICLES WITH THE SYNC SYSTEM

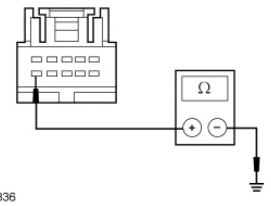
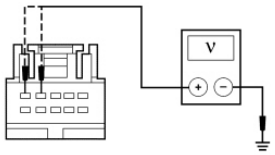
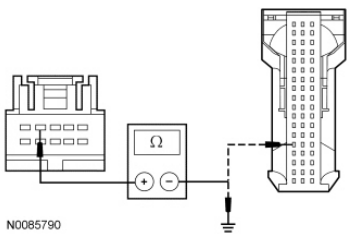
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

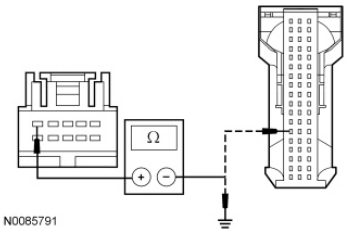
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
V1 VERIFY THE OPERATION OF THE STEERING WHEEL CONTROLS	
• Operate the audio system in radio tuner (AM/FM) mode. • Press the VOICE switch on the steering wheel controls. • **Does the audio system enter voice recognition mode?**	**Yes** If the vehicles is equipped with navigation, GO to V2 . Otherwise, GO to V5 . **No** GO to Pinpoint Test F to diagnose the steering wheel controls system.
V2 CHECK THE MICROPHONE SIGNAL TO THE ACM	
• Operate the audio system in radio tuner (AM/FM) mode. • Disconnect: ACM C290b. • **NOTE:** ACM C290b must be disconnected after the ACM is powered on or the ACM will not receive the RUN message over the network. • Press the VOICE switch on the steering wheel controls.	**Yes** GO to V11 . **No** GO to V3 .

• While speaking a command, measure the AC voltage between the ACM C290b-11, circuit VMN01 (BU/BN), harness side and the ACM C290b-12, circuit RMN01 (GN), harness side.  N0077818 • **Is a fluctuating AC voltage present?**	
V3 CHECK THE MICROPHONE CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: APIM C3342. • Ignition ON. • Measure the voltage between the ACM C290b-11, circuit VMN01 (BU/BN), harness side and ground; and between the ACM C290b-12, circuit RMN01 (GN), harness side and ground.  N0077819 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to V4 .
V4 CHECK THE MICROPHONE CIRCUITS TO THE ACM FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the ACM C290b-11, circuit VMN01 (BU/BN), harness side and the APIM C3342-12, circuit VMN01 (BU/BN), harness side; and between the ACM C290b-11, circuit VMN01 (BU/BN), harness side and ground.  N0085792	**Yes** GO to V5 . **No** REPAIR the circuit in question. TEST the system for normal operation.

• Measure the resistance between the ACM C290b-12, circuit RMN01 (GN), harness side and the APIM C3342-13, circuit RMN01 (GN), harness side; and between the ACM C290b-12, circuit RMN01 (GN), harness side and ground.  N0085793 • **Is the resistance less than 5 ohms between the ACM and the APIM , and greater than 10,000 ohms between the ACM and ground?**	
V5 CHECK THE MICROPHONE VOLTAGE SUPPLY	
• Ignition OFF. • Disconnect: Auto-Dimming Interior Mirror C9012. • Ignition ON. • Measure the voltage between the interior rear view mirror C9012-1, circuit CBP05 (YE), harness side and ground.  N0057331 • **Is the voltage greater than 10 volts?**	**Yes** GO to V6 . **No** VERIFY the Smart Junction Box (SJB) fuse 5 (5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible sources of the circuit short.
V6 CHECK THE MICROPHONE GROUND CIRCUIT FOR CONTINUITY	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the auto-dimming interior mirror C9012-10, circuit GD143 (BK/VT), harness side and ground.	**Yes** GO to V7 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0057336 • **Is the resistance less than 5 ohms?**	
V7 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE	
• Connect: Negative Battery Cable. • Disconnect: APIM C3342. • Ignition ON. • Measure the voltage between the auto-dimming interior mirror C9012-4, circuit VMN07 (GY), harness side and ground; and between the auto-dimming interior mirror C9012-5, circuit RMN07 (VT), harness side and ground.  N0057337 • **Is any voltage present?**	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No** GO to V8 .
V8 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the auto-dimming interior mirror C9012-4, circuit VMN07 (GY), harness side and the APIM C3342-5, circuit VMN07 (GY), harness side; and between the auto-dimming interior mirror C9012-4, circuit VMN07 (GY), harness side and ground.  N0085790 • Measure the resistance between the auto-dimming interior mirror C9012-5, circuit RMN07 (VT), harness side and the APIM C3342-6, circuit RMN07 (VT), harness side; and between the auto-dimming interior mirror C9012-5, circuit RMN07 (VT),	**Yes** GO to V9 . **No** REPAIR the circuit in question. TEST the system for normal operation.

harness side and ground.  • **Is the resistance less than 5 ohms between the auto-dimming interior mirror and the APIM , and greater than 10,000 ohms between the auto-dimming interior mirror and ground?**	
V9 ISOLATE THE AUTO-DIMMING INTERIOR MIRROR	
• Connect: APIM C3342. • Install a new auto-dimming interior mirror. Refer to Section 501-09 . • Operate the audio system in radio tuner (AM/FM) mode. • Press the VOICE switch on the steering wheel controls, and attempt several voice commands. • **Does the voice recognition operate correctly?**	**Yes** The fault was caused by an inoperative auto-dimming interior mirror. The system is now operating correctly. **No** GO to V10 .
V10 CHECK FOR CORRECT APIM OPERATION	
• Connect: All Disconnected Connectors. • Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
V11 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test W: Poor Quality/Distorted/No Sound From All Speakers

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

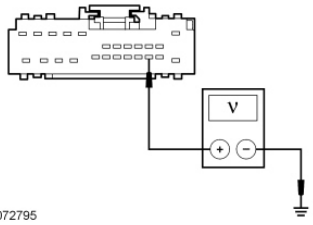
When the ignition is in the START position, voltage is supplied to the Audio Front Control Module (ACM) through the start sense circuit. When the ACM receives this voltage, it mutes the speaker output to prevent popping in the speakers as a result of voltage spikes during engine cranking; however, if there is a short to voltage on this circuit, the ACM continuously mutes the audio output, resulting in no sound from all speakers.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- ACM

PINPOINT TEST W: POOR QUALITY/DISTORTED/NO SOUND FROM ALL SPEAKERS

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
W1 CHECK THE START SENSE CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290a. • Ignition ON. • Measure the voltage between the ACM C290a-15, circuit CBP11 (BN), harness side and ground.  A0072795 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to W2 .
W2 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ACM connectors and make sure they seat correctly.	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

• Operate the system and determine if the concern is still present. • **Is the concern still present?**	

Pinpoint Test X: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) â Audiophile

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The Audio Front Control Module (ACM) directs audio signals to the audio amplifier in the form of an AC voltage. The amplifier boosts the audio signals and sends them to the speakers. The ACM provides internal circuit protection for shorts to ground or shorts to voltage.

If the vehicle is equipped with the family entertainment system, the rear channel audio signals from the ACM route to the Rear Entertainment Module (RETM), then to the audio amplifier. In dual-play mode, the RETM mutes the rear speaker output. Make sure the audio system is in single-play mode before diagnosing a speaker concern.

A short to ground or short to voltage in the circuitry to the audio amplifier can cause multiple speakers to lose sound due to the built-in overload protection feature of the ACM . In this case, a speaker fault DTC sets, and this pinpoint test should be followed to isolate the damaged circuit.

It should also be noted that when the ACM activates the built-in overload protection, DTC B1342 can also be set. The circuit failure must be repaired before DTC B1342 can be cleared.

To enable the audio amplifier, the ACM sends voltage through the enable/clip circuit. The circuit acts as both an output (to enable the amplifier) and an input (to detect an amplifier overload condition). The voltage sent by the ACM passes through a variable resistor in the audio amplifier, then to ground. As the amplifier reaches maximum output, the resistance in the variable resistor decreases. This decreases the voltage drop, resulting in the ACM detecting a higher voltage on the enable/clip circuit. When the voltage reaches the clip threshold, the ACM clips the audio output signal to the amplifier (heard as distortion), in order to prevent damage to the amplifier and speakers.

The enable/clip status is based on the following voltages, as detected by the ACM :

- Less than 0.4 volt: amplifier disabled
- Between 3.8 and 6.7 volts: amplifier enabled
- Greater than 8.5 volts: amplifier clipped

An open in the enable/clip circuit causes the speakers to produce no sound because the enable signal does not reach the audio amplifier. A short to ground or short to voltage can cause severe distortion to be heard in the speakers. In either of these scenarios, the subwoofer should continue to operate correctly, as it utilizes a separate amplifier and enable/clip circuit.

The speaker walk test can be used to isolate a concern with a particular speaker. This can reduce the diagnostic steps necessary to isolate the concern. To carry out the speaker walk test, refer to Audio Control Module (ACM) Self-Diagnostic Mode in this section.

DTC Description	Fault Trigger Conditions
• B1A01:01 â Speaker #1: General Electrical Failure	Set by the navigation ACM when a failure is detected on the LH front speaker circuitry to the audio amplifier. When this DTC sets, the speaker output is disabled.
• B1A02:01 â Speaker #2: General Electrical Failure	Set by the navigation ACM when a failure is detected on the RH front speaker circuitry to the audio amplifier. When this DTC sets, the speaker output is disabled.
• B1A03:01 â Speaker #3: General Electrical Failure	Set by the navigation ACM when a failure is detected on the RH rear speaker circuitry to the audio amplifier. When this DTC sets, the speaker output is disabled.
• B1A04:01 â Speaker #4: General Electrical Failure	Set by the navigation ACM when a failure is detected on the LH rear speaker circuitry to the audio amplifier. When this DTC sets, the speaker output is disabled.
• B2965 â Audio System Speaker Circuit Fault	Set by the non-navigation ACM when a failure is detected on any of the speaker circuits to the audio amplifier. When this DTC sets, the speaker output is disabled.

This pinpoint test is intended to diagnose the following:

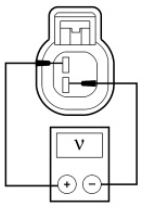
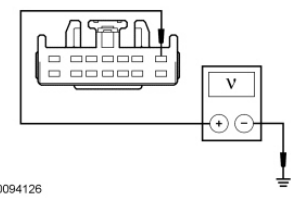
- Fuse
- Wiring, terminals or connectors
- Speaker
- Audio amplifier
- RETM (if equipped)
- ACM

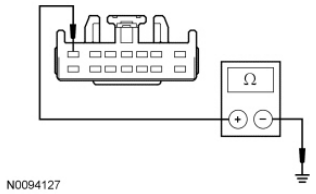
PINPOINT TEST X: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) â AUDIOPHILE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
X1 DETERMINE THE INOPERATIVE SPEAKER(S)	
• Carry out the speaker walk test. Refer to Audio Control Module (ACM) Self-Diagnostic Mode in this section. • **Is the concern with the subwoofer speaker?**	**Yes** GO to Pinpoint Test D . **No** GO to X2 .
X2 CHECK THE AUDIO SIGNALS TO THE SUSPECT SPEAKER	

• Ignition OFF. • Disconnect: Suspect Speaker. • Operate the audio system in radio tuner (AM/FM), single-play mode. • Measure the AC voltage between the suspect speaker pins, harness side as follows: **Suspect Speaker** / **Positive Meter Lead** / **Negative Meter Lead** LF door / C523-1 VME07 (WH) / C523-2 RME07 (WH/BN) RF door / C612-1 VME10 (WH/VT) / C612-2 RME10 (WH/OG) LR door / C702-1 VME09 (WH/GN) / C702-2 RME09 (BN/YE) RR door / C802-1 VME12 (BN/WH) / C802-2 RME12 (BN/BU)  N0085779 • **Is a fluctuating AC voltage present?**	**Yes** INSTALL a new speaker for the suspect speaker. REFER to Speaker â Door in this section. TEST the system for normal operation. **No** GO to X3 .
X3 CHECK THE AUDIO AMPLIFIER VOLTAGE	
• Ignition OFF. • Disconnect: Audio Amplifier C3154b. • Measure the voltage between the audio amplifier C3154b-1, circuit SBP03 (BU/RD), harness side and ground.  N0094126 • **Is the voltage greater than 10 volts?**	**Yes** GO to X4 . **No** VERIFY the Smart Junction Box (SJB) fuse 3 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

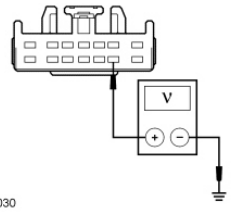
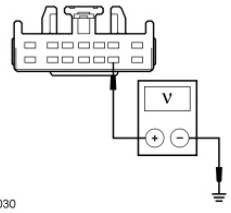
<table>
<tr><td>X4 CHECK THE AUDIO AMPLIFIER GROUND CIRCUIT FOR CONTINUITY</td><td></td></tr>
<tr><td>• Disconnect: Negative Battery Cable.
• Measure the resistance between the audio amplifier C3154b-7, circuit GD114 (BK/BU), harness side and ground.
 

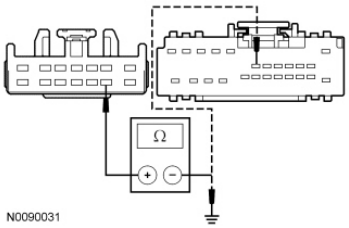
• Is the resistance less than 5 ohms?</td><td>Yes
GO to X5 .

No
REPAIR the circuit. TEST the system for normal operation.</td></tr>
<tr><td>X5 CHECK THE AUDIO SIGNALS TO THE AUDIO AMPLIFIER</td><td></td></tr>
<tr><td>• Ignition OFF.
• Connect: Audio Amplifier C3154b.
• Disconnect: Audio Amplifier C3154a.
• Operate the audio system in radio tuner (AM/FM) mode.
• Measure the AC voltage between the audio amplifier pins, harness side as follows:
<table><tr><th>Suspect Speaker</th><th>Positive Meter Lead</th><th>Negative Meter Lead</th></tr><tr><td>LF door</td><td>C3154a-8
VME07 (WH)</td><td>C3154a-4
RME07 (WH/BN)</td></tr><tr><td>RF door</td><td>C3154a-6
VME10 (WH/VT)</td><td>C3154a-2
RME10 (WH/OG)</td></tr><tr><td>LR door</td><td>C3154a-7
VME09 (WH/GN)</td><td>C3154a-3
RME09 (BN/YE)</td></tr><tr><td>RR door</td><td>C3154a-5
VME12 (BN/WH)</td><td>C3154a-1
RME12 (BN/BU)</td></tr></table>• Is a fluctuating AC voltage present?</td><td>Yes
GO to X6 .

No
If the vehicle is equipped with the family entertainment system and the concern is with a rear speaker, GO to X11 .

Otherwise, GO to X14 .</td></tr>
<tr><td>X6 CHECK THE AUDIO AMPLIFIER ENABLE CIRCUIT FOR CORRECT VOLTAGE</td><td></td></tr>
</table>

• Ignition OFF. • Disconnect: Audio Amplifier C3154b. • Operate the audio system in radio tuner (AM/FM) mode. • Measure the voltage between the audio amplifier C3154b-9, circuit CME27 (YE/VT), harness side and ground.  N0090030 • **Is the voltage between 3.8 and 6.7 volts?**	**Yes** GO to X9 . **No** GO to X7 .
X7 CHECK THE AUDIO AMPLIFIER ENABLE CIRCUIT FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: ACM C290a. • Ignition ON. • Measure the voltage between the audio amplifier C3154b-9, circuit CME27 (YE/VT), harness side and ground.  N0090030 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to X8 .
X8 CHECK THE AUDIO AMPLIFIER ENABLE CIRCUIT FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the audio amplifier C3154b-9, circuit CME27 (YE/VT), harness side and the ACM C290a-7, circuit CME27 (YE/VT); and between the audio amplifier C3154b-9, circuit CME27 (YE/VT), harness side and ground.	**Yes** GO to X16 . **No** REPAIR the circuit. TEST the system for normal operation.



- **Is the resistance less than 5 ohms between the audio amplifier and the ACM , and greater than 10,000 ohms between the audio amplifier and ground?**

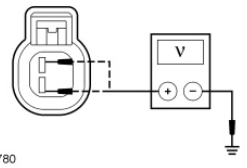
X9 CHECK THE SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: Suspect Speaker.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Positive Meter Lead	Negative Meter Lead
LF door	C523-1 VME07 (WH)	Ground
	C523-2 RME07 (WH/BN)	Ground
RF door	C612-1 VME10 (WH/VT)	Ground
	C612-2 RME10 (WH/OG)	Ground
LR door	C702-1 VME09 (WH/GN)	Ground
	C702-2 RME09 (BN/YE)	Ground
RR door	C802-1 VME12 (BN/WH)	Ground
	C802-2 RME12 (BN/BU)	Ground

Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to X10 .



- **Is any voltage present?**

X10 CHECK THE SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the audio amplifier, harness side and the suspect speaker, harness side; and between the audio amplifier, harness side and ground as follows:

Suspect Speaker	Positive Meter Lead	Negative Meter Lead	Circuit
LF door	C3154b-13	C523-1, then ground	VME07 (WH)
	C3154b-6	C523-2, then ground	RME07 (WH/BN)
RF door	C3154b-11	C612-1, then ground	VME10 (WH/VT)
	C3154b-4	C612-2, then ground	RME10 (WH/OG)
LR door	C3154b-12	C702-1, then ground	VME09 (WH/GN)
	C3154b-5	C702-2, then ground	RME09 (BN/YE)
RR door	C3154b-10	C802-1, then ground	VME12 (BN/WH)
	C3154b-3	C802-2, then ground	RME12 (BN/BU)

- **Are the resistances less than 5 ohms between the audio amplifier and the suspect speaker, and greater than 10,000 ohms between the audio amplifier and ground?**

Yes
INSTALL a new audio amplifier. REFER to Audio Amplifier in this section. TEST the system for normal operation.

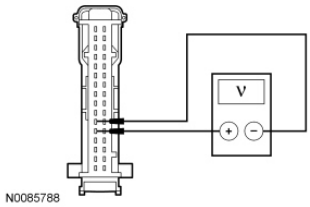
No
REPAIR the circuit in question. TEST the system for normal operation.

X11 CHECK THE AUDIO SIGNALS TO THE RETM

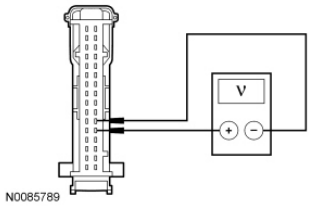
- Ignition OFF.
- Disconnect: RETM C9029.
- Operate the audio system in radio tuner (AM/FM), single-play mode.
- Measure the AC voltage between the RETM C9029-11, circuit VME12 (BN/WH), harness side and the RETM C9029-12, circuit RME12 (BN/BU), harness side.

Yes
GO to X14 .

No
GO to X12 .



- Measure the AC voltage between the RETM C9029-27, circuit VME09 (WH/GN), harness side and the RETM C9029-28, circuit RME09 (BN/YE), harness side.



- **Is a fluctuating AC voltage present?**

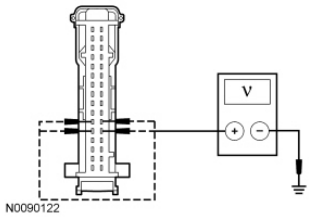
X12 CHECK THE AUDIO CIRCUITS TO THE RETM FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: ACM C290a.
- Ignition ON.
- Measure the voltage between the RETM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead
C9029-11 VME12 (BN/WH)	Ground
C9029-12 RME12 (BN/BU)	Ground
C9029-27 VME09 (WH/GN)	Ground
C9029-28 RME09 (BN/YE)	Ground

Yes
REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

No
GO to X13 .



- **Is any voltage present?**

X13 CHECK THE AUDIO CIRCUITS TO THE RETM FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the RETM , harness side and the ACM , harness side; and between the RETM , harness side and ground as follows:

Positive Meter Lead	Negative Meter Lead	Circuit
C9029-11	C290a-10, then ground	VME12 (BN/WH)
C9029-12	C290a-23, then ground	RME12 (BN/BU)
C9029-27	C290a-9, then ground	VME09 (WH/GN)
C9029-28	C290a-22, then ground	RME09 (BN/YE)

- **Are the resistances less than 5 ohms between the RETM and the ACM , and greater than 10,000 ohms between the RETM and ground?**

Yes
GO to X14 .

No
REPAIR the circuit in question. CLEAR any DTCs present. REPEAT the self-test.

X14 CHECK THE AUDIO CIRCUITS TO THE AUDIO AMPLIFIER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: ACM C290a.
- Ignition ON.
- Measure the voltage between the audio amplifier, harness side and ground as follows:

Suspect Speaker	Positive Meter Lead	Negative Meter Lead
LF door	C3154a-8 VME07 (WH)	Ground
	C3154a-4	Ground

Yes
REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

No
GO to X15 .

	RME07 (WH/BN)	
RF door	C3154a-6 VME10 (WH/VT)	Ground
	C3154a-2 RME10 (WH/OG)	Ground
LR door	C3154a-7 VME09 (WH/GN)	Ground
	C3154a-3 RME09 (BN/YE)	Ground
RR door	C3154a-5 VME12 (BN/WH)	Ground
	C3154a-1 RME12 (BN/BU)	Ground

- **Is any voltage present?**

X15 CHECK THE AUDIO CIRCUITS TO THE AUDIO AMPLIFIER FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- For a front speaker concern, measure the resistance between the audio amplifier, harness side and the ACM , harness side; and between the audio amplifier, harness side and ground as follows:

Suspect Speaker	Positive Meter Lead	Negative Meter Lead	Circuit
LF door	C3154a-8	C290a-8, then ground	VME07 (WH)
	C3154a-4	C290a-21, then ground	RME07 (WH/BN)
RF door	C3154a-6	C290a-11, then ground	VME10 (WH/VT)
	C3154a-2	C290a-12, then ground	RME10 (WH/OG)

- For a rear speaker concern, measure the resistance between the audio amplifier, harness side and the RETM , harness side; and between the audio amplifier, harness side and ground as follows:

Yes
If the vehicle is equipped with the family entertainment system and the concern is with a rear speaker, GO to X17 .

Otherwise, GO to X16 .

No
REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

Suspect Speaker	Positive Meter Lead	Negative Meter Lead	Circuit
LR door	C3154a-7	C9029-30, then ground	VME09 (WH/GN)
	C3154a-3	C9029-29, then ground	RME09 (BN/YE)
RR door	C3154a-5	C9029-14, then ground	VME12 (BN/WH)
	C3154a-1	C9029-13, then ground	RME12 (BN/BU)

- **Are the resistances less than 5 ohms?**

X16 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Connect: All Disconnected Connectors. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.
X17 CHECK FOR CORRECT RETM OPERATION	
• Ignition OFF. • Connect: All Disconnected Connectors. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present.

Pinpoint Test Y: The Audio Front Control Module (ACM) Does Not Respond To Touchscreen Or Button Presses

Normal Operation

When a button is pressed on the Audio Front Control Module (ACM) (whether it is a hard button or the touchscreen), a signal is sent over the Medium Speed Controller Area Network (MS-CAN) to the modules in the audio system.

- B2924 (Audio Button Stuck) â sets in continuous memory when an ACM hard button is stuck for longer than 2 minutes, or during the on-demand self-test if an ACM hard button is detected as active for any duration. Make sure no ACM buttons are pressed during the self-test. This DTC applies to vehicles without navigation only.
- U2013:63 (Switch Pack: Circuit / Component Protection Time-Out) â sets in continuous memory when an ACM hard button is stuck for longer than 2 minutes, or during the on-demand self-test if an ACM hard button is detected as active for any duration. Make sure no ACM buttons are pressed during the self-test. This DTC applies to vehicles with navigation only.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- ACM

PINPOINT TEST Y: THE ACM DOES NOT RESPOND TO TOUCHSCREEN OR BUTTON PRESSES

Test Step	Result / Action to Take
Y1 CHECK FOR DTC B2924 OR DTC U2013:63	
• Ignition ON. • Clear the ACM DTCs. • Wait 3 minutes. • Repeat the ACM self-test, making sure that no buttons are pressed during the test. • **Is DTC B2924 or DTC U2013:63 set in the ACM ?**	**Yes** GO to Y3 . **No** GO to Y2 .
Y2 CHECK FOR LOST COMMUNICATION DTCs	
NOTE: Audio system lost communication DTCs include U0184, U0184:00, U0193, U0193:00, U0196, U0196:00, U0197, and U0197:00. • Using the scan tool, retrieve all continuous DTCs from all modules. • **Are audio system lost communication DTCs present in any module?**	**Yes** REFER to the DTC Charts in this section. **No** GO to Y3 .
Y3 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Z: The Audio Front Control Module (ACM) Display Touchscreen Display Is Inoperative/Does Not Operate Correctly â Vehicles With Navigation

Normal Operation

The Audio Front Control Module (ACM) receives inputs via the Medium Speed Controller Area Network (MS-CAN) from the following modules:

- ♦ Accessory Protocol Interface Module (APIM): SYNC system information (if equipped)
- ♦ Rear Entertainment Module (RETM): family entertainment system information (if equipped)

If the ACM loses the signal from any of these modules, only that specific display is inoperative.

Because the satellite radio receiver is internal to the ACM , all satellite radio information on the display is directly generated by the ACM .

The compass heading is derived from the Global Positioning System (GPS) antenna. If there is a concern with the compass display, there should also be a concern with the GPS signal. GO to Pinpoint Test K .

This pinpoint test is intended to diagnose the following:

- Communication network concern
- ACM

PINPOINT TEST Z: THE ACM DISPLAY TOUCHSCREEN DISPLAY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY â VEHICLES WITH NAVIGATION

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>Z1 OBSERVE THE ACM DISPLAY</td><td></td></tr>
<tr><td>• Turn the audio system on and observe the ACM screen.
• Is the ACM display completely inoperative?</td><td>Yes
GO to Z4 .

No
GO to Z2 .</td></tr>
<tr><td>Z2 CHECK THE ACM DISPLAY SEGMENTS</td><td></td></tr>
<tr><td>• Carry out the Audio Display Test. Refer to Audio Control Module (ACM) Self-Diagnostic Mode in this section.
• Do all of the ACM segments illuminate?</td><td>Yes
GO to Z3 .

No
GO to Z5 .</td></tr>
<tr><td>Z3 OBSERVE THE SPECIFIC INOPERATIVE DISPLAY</td><td></td></tr>
<tr><td>• Observe the inoperative ACM display while carrying out the indicated diagnostic method as follows:

<table><tr><th>Inoperative Display</th><th>Diagnostic Method</th><th>Expected Results</th></tr></table></td><td>Yes
The system is operating correctly at this time. INSTRUCT the customer about the operation of the ACM displays.</td></tr>
</table>

Audio system	Turn the audio system on, press the RADIO button, and adjust the audio settings using the touchscreen.	The ACM changes the setting and updates the display to show the change in audio setting.	**No** GO to Z4 .
Satellite radio system	Turn the audio system on, press the MEDIA button until satellite radio mode is entered, and adjust the settings using the touchscreen.	The ACM changes the setting and updates the display to show the change in satellite radio setting.	
SYNC system (if equipped)	Turn the audio system on, press the PHONE button, and attempt several functions using the touchscreen.	The ACM display shows information relating to the phone.	
Family entertainment system (if equipped)	Turn the audio system on, insert a known good DVD in the RETM , press the AUX button until the audio system is in rear entertainment mode, and observe the display.	The ACM display shows information relating to the family entertainment system.	

- **Does the inoperative display confirm the expected results?**

Z4 CHECK FOR LOST COMMUNICATION DTCs	
NOTE: Audio system lost communication DTCs include U0184, U0184:00, U0196, U0196:00, U0197, and U0197:00. • Using the scan tool, retrieve all continuous DTCs from all modules. • **Are audio system lost communication DTCs present in any module?**	**Yes** REFER to the DTC Charts in this section. **No** GO to Z5 .
Z5 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AA: No Auxiliary Headphone Audio

Normal Operation

The Rear Entertainment Module (RETM) sends wireless audio signals to the headphones. In dual-play mode, the audio to the rear speakers is muted and the RETM continues to control the rear audio source to the headphones. When the headphones are set to channel A, all audio sources can be accessed. When the headphones are set to channel B, only the DVD audio and auxiliary audio sources (such as a gaming system) can be sent to the headphones.

This pinpoint test is intended to diagnose the following:

- Customer setting
- Headphone batteries
- Headphones
- RETM

PINPOINT TEST AA: NO AUXILIARY HEADPHONE AUDIO

Test Step	Result / Action to Take
AA1 CHECK THE HEADPHONE AUDIO	
NOTE: For additional information on operating the headphones, refer to the Owner's Literature. • Turn the suspect headphones on, and set them to channel A. • Operate the audio system in dual-play mode, and set the channel A source to FM1. • Adjust the volume as necessary, and observe the suspect headphone audio. • Set the suspect headphones to channel B. • Insert a known good DVD into the RETM . • Set the channel B source to DVD, adjust the volume as necessary, and observe the suspect headphone audio. • **Does the headphone audio operate correctly for both channels?**	**Yes** The system is OK at this time. The concern may have been caused by a customer setting. INSTRUCT the customer about the correct operation of the family entertainment system. **No** If there is no audio for both channels, GO to AA2 . If only one channel has no audio, REPLACE the suspect headphones. TEST the system for normal operation.
AA2 SUBSTITUTE THE HEADPHONE BATTERIES	
• Install new batteries in the suspect headphones. • Operate the audio system in dual-play mode and observe the headphone audio.	**Yes** The concern was caused by inoperative batteries. The system is now operating correctly. **No** GO to AA3 .

• **Does the headphone audio operate correctly?**	
AA3 ISOLATE THE HEADPHONES	
• Substitute a known good set of headphones. • Operate the audio system in dual-play mode and observe the headphone audio. • **Does the headphone audio operate correctly?**	**Yes** REPLACE the suspect headphones. TEST the system for normal operation. **No** GO to AA4 .
AA4 CHECK FOR CORRECT RETM OPERATION	
• Ignition OFF. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AB: While In Dual-Play Mode With Both Audio Sources Set To The SYNC System, One Audio Source Is Inoperative â Vehicles With A Family Entertainment System

Normal Operation

The Rear Entertainment Module (RETM) allows for dual-play mode to include separate SYNC system audio sources on the front and rear channels. To do this, the Accessory Protocol Interface Module (APIM) transmits SYNC system audio signals over an additional set of circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- APIM
- RETM

PINPOINT TEST AB: WHILE IN DUAL-PLAY MODE WITH BOTH AUDIO SOURCES SET TO THE SYNC SYSTEM, ONE AUDIO SOURCE IS INOPERATIVE â VEHICLES WITH A FAMILY ENTERTAINMENT SYSTEM

Test Step	Result / Action to Take
AB1 CHECK THE AUDIO CIRCUITS TO THE RETM FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: RETM C9029. • Disconnect: APIM C3342. • Ignition ON.	**Yes** REPAIR the circuit in question. TEST the system for normal operation. **No**

• Measure the voltage between the RETM , harness side and ground as follows: **Positive Meter Lead** / **Negative Meter Lead** / **Circuit** C9029-3 / Ground / RME52 (GY/OG) C9029-4 / Ground / VME52 (BU) C9029-19 / Ground / RME53 (BN/WH) C9029-20 / Ground / VME53 (VT/GN) • **Is any voltage present?**	GO to AB2 .
AB2 CHECK THE AUDIO CIRCUITS TO THE RETM FOR AN OPEN OR SHORT TO GROUND	
• Ignition OFF. • Measure the resistance between the RETM , harness side and the APIM , harness side; and between the RETM , harness side and ground as follows: **Positive Meter Lead** / **Negative Meter Lead** / **Circuit** C9029-3 / C3342-26, then ground / RME52 (GY/OG) C9029-4 / C3342-25, then ground / VME52 (BU) C9029-19 / C3342-24, then ground / RME53 (BN/WH) C9029-20 / C3342-23, then ground / VME53 (VT/GN) • **Is the resistance less than 5 ohms between the RETM and the APIM , and greater than 10,000 ohms between the RETM and ground?**	**Yes** GO to AB3 . **No** REPAIR the circuit in question. TEST the system for normal operation.
AB3 CHECK FOR CORRECT APIM OPERATION	
• Connect: RETM C9029. • Disconnect the APIM connector. • Check for: ♦ corrosion	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. If the concern is still present, GO to AB4 .

♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.
AB4 CHECK FOR CORRECT RETM OPERATION	
• Ignition OFF. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AC: DTC B1318 Or DTC U3003:16 (Audio Front Control Module (ACM))

Normal Operation

- DTC B1318 (Battery Voltage Low) â set by the non-navigation Audio Front Control Module (ACM) when the supply voltage falls below 10 volts for at least 10 seconds during normal operation.
- DTC U3003:16 (Battery Voltage: Circuit Voltage Below Threshold) â set by the navigation Audio Front Control Module (ACM) when the supply voltage falls below 10 volts for at least 10 seconds during normal operation, or for greater than 250 milliseconds during the self-test.

This pinpoint test is intended to diagnose the following:

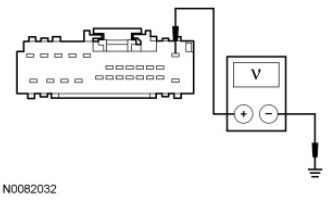
- Wiring, terminals or connectors
- High circuit resistance
- ACM

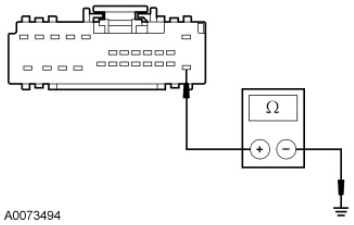
PINPOINT TEST AC: DTC B1318 OR U3003:16 (ACM)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AC1 RECHECK THE ACM DTCs	
• Ignition ON. • Clear the ACM DTCs. • Wait at least 15 seconds.	**Yes** GO to AC2 . **No**

• Repeat the ACM self-test. • **Is DTC B1318 or U3003:16 still present?**	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.
AC2 CHECK FOR CHARGING SYSTEM DTCs IN THE PCM	
• Retrieve the continuous DTCs from all modules. • **Is DTC P0620, P0622, P0625, or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to AC3 .
AC3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Check the battery condition and verify that the battery is fully charged. Refer to Section 414-01 . • **Is the battery OK and fully charged?**	**Yes** GO to AC4 . **No** REFER to Section 414-01 .
AC4 CHECK THE ACM VOLTAGE SUPPLY	
• Ignition OFF. • Measure and record the voltage at the battery. • Disconnect: ACM C290a. • Ignition ON. • Measure the voltage between the ACM C290a-1, circuit SBP03 (BU/RD), harness side and ground.  N0082032 • **Is the voltage at the ACM within 0.2 volt of the recorded battery voltage?**	**Yes** GO to AC5 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.
AC5 CHECK THE ACM GROUND CIRCUIT FOR CONTINUITY	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the ACM C290a-13, circuit GD114 (BK/BU), harness side and ground.	**Yes** GO to AC6 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.

 • **Is the resistance less than 5 ohms?**	
AC6 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Connect: Negative Battery Cable. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

Pinpoint Test AD: DTC U3003:17 (Audio Front Control Module (ACM) â With Navigation)

Normal Operation

- DTC U3003:17 (Battery Voltage: Circuit Voltage Above Threshold) â set by the Audio Front Control Module (ACM) when the supply voltage is greater than 15.8 volts for more than 250 milliseconds during normal operation or the self-test.

This pinpoint test is intended to diagnose the following:

- Charging system concern
- ACM

PINPOINT TEST AD: DTC U3003:17 (ACM â WITH NAVIGATION)

NOTE: DTC U3003:17 may be stored in the module memory due to past battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
AD1 CHECK FOR HIGH VOLTAGE DTCs SET IN OTHER MODULES	
• Ignition ON. • Retrieve all continuous DTCs from all modules. • **Is DTC B1317, B1676, P0563 (PCM), or U3003:17 set in more than one module?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AD2 .
AD2 CHECK THE BATTERY VOLTAGE	

• Turn off all interior/exterior lights and accessories. • Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage. • **Does the battery voltage rise to 15.5 volts or higher?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AD3 .
AD3 RECHECK FOR DTC U3003:17	
• Ignition OFF. • Ignition ON. • Clear the ACM DTCs. • Repeat the ACM self-test. • **Is DTC U3003:17 still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test AE: DTC B1318 (Satellite Digital Audio Receiver System (SDARS) Module)

Normal Operation

- DTC B1318 (Battery Voltage Low) â set by the Satellite Digital Audio Receiver System (SDARS) module when the supply voltage falls below 10 volts for at least 10 seconds during normal operation.

This pinpoint test is intended to diagnose the following:

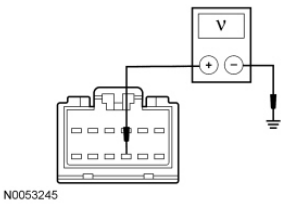
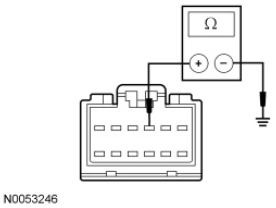
- Wiring, terminals or connectors
- High circuit resistance
- SDARS module

PINPOINT TEST AE: DTC B1318 (SDARS MODULE)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AE1 RECHECK THE SDARS MODULE DTCs	
• Ignition ON. • Clear the SDARS module DTCs. • Wait at least 15 seconds. • Repeat the SDARS module self-test. • **Is DTC B1318 still present?**	**Yes** GO to AE2 . **No** The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.
AE2 CHECK FOR CHARGING SYSTEM DTCs IN THE PCM	

• Retrieve the continuous DTCs from all modules. • **Is DTC P0620, P0622, P0625, or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to AE3 .
AE3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Check the battery condition and verify that the battery is fully charged. Refer to Section 414-01 . • **Is the battery OK and fully charged?**	**Yes** GO to AE4 . **No** REFER to Section 414-01 .
AE4 CHECK THE SDARS MODULE VOLTAGE SUPPLY	
• Ignition OFF. • Measure and record the voltage at the battery. • Disconnect: SDARS Module C3290. • Ignition ON. • Measure the voltage between the SDARS module C3290-9, circuit SBB41 (RD), harness side and ground.  N0053245 • **Is the voltage at the SDARS module within 0.2 volt of the recorded battery voltage?**	**Yes** GO to AE5 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.
AE5 CHECK THE SDARS MODULE GROUND CIRCUIT FOR CONTINUITY	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the SDARS module C3290-3, circuit GD114 (BK/BU), harness side and ground.  N0053246	**Yes** GO to AE6 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.

• **Are the resistances less than 5 ohms?**	
AE6 CHECK FOR CORRECT SDARS MODULE OPERATION	
• Ignition OFF. • Connect: Negative Battery Cable. • Disconnect the SDARS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SDARS module connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SDARS module. REFER to Satellite Digital Audio Receiver System (SDARS) Module in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AF: DTC B1317 Or DTC U3003:17 (Accessory Protocol Interface Module (APIM))

Normal Operation

- DTC B1317 (Battery Voltage High) â set by the Accessory Protocol Interface Module (APIM) (V1) when the supply voltage is greater than 15.8 volts for more than 250 milliseconds during normal operation.
- DTC U3003:17 (Battery Voltage: Circuit Voltage Above Threshold) â set by the APIM (V2) when the supply voltage is greater than 15.8 volts for more than 250 milliseconds during normal operation.

This pinpoint test is intended to diagnose the following:

- Charging system concern
- APIM

PINPOINT TEST AF: DTC B1317 OR DTC U3003:17 (APIM)

NOTE: DTC B1317 or DTC U3003:17 may be stored in the module memory due to past battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
AF1 CHECK FOR HIGH VOLTAGE DTCs SET IN OTHER MODULES	
• Ignition ON. • Retrieve all continuous DTCs from all modules. • **Is DTC B1317, B1676, P0563 (PCM), or U3003:17 set in more than one module?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AF2 .
AF2 CHECK THE BATTERY VOLTAGE	
• Turn off all interior/exterior lights and accessories.	**Yes** REFER to Section 414-00 to diagnose an overcharging condition.

• Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage. • **Does the battery voltage rise to 15.5 volts or higher?**	**No** GO to AF3 .
AF3 RECHECK FOR DTC B1317 OR DTC U3003:17	
• Ignition OFF. • Ignition ON. • Clear the APIM DTCs. • Repeat the APIM self-test. • **Is DTC B1317 or DTC U3003:17 still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test AG: DTC B1318 Or DTC U3003:16 (Accessory Protocol Interface Module (APIM))

Normal Operation

- DTC B1318 (Battery Voltage Low) â set by the Accessory Protocol Interface Module (APIM) (V1) when the supply voltage falls below 10 volts for at least 10 seconds during normal operation.
- DTC U3003:16 (Battery Voltage: Circuit Voltage Below Threshold) â set by the APIM (V2) when the supply voltage falls below 10 volts for at least 10 seconds during normal operation.

This pinpoint test is intended to diagnose the following:

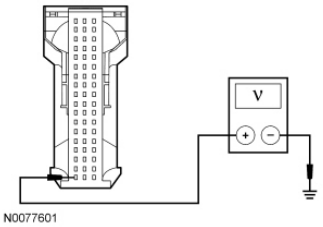
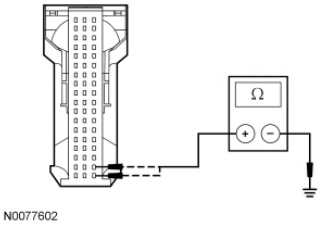
- Wiring, terminals or connectors
- High circuit resistance
- APIM

PINPOINT TEST AG: DTC B1318 OR DTC U3003:16 (APIM)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AG1 RECHECK THE APIM DTCs	
• Ignition ON. • Clear the APIM DTCs. • Wait at least 15 seconds. • Repeat the APIM self-test. • **Is DTC B1318 or DTC U3003:16 still present?**	**Yes** GO to AG2 . **No** The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

AG2 CHECK FOR CHARGING SYSTEM DTCs IN THE PCM	
• Retrieve the continuous DTCs from all modules. • **Is DTC P0620, P0622, P0625, or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to AG3 .
AG3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Check the battery condition and verify that the battery is fully charged. Refer to Section 414-01 . • **Is the battery OK and fully charged?**	**Yes** GO to AG4 . **No** REFER to Section 414-01 .
AG4 CHECK THE APIM VOLTAGE SUPPLY	
• Ignition OFF. • Measure and record the voltage at the battery. • Disconnect: APIM C3342. • Ignition ON. • Measure the voltage between the APIM C3342-1, circuit SBB41 (RD), harness side and ground.  N0077601 • **Is the voltage at the APIM within 0.2 volt of the recorded battery voltage?**	**Yes** GO to AG5 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.
AG5 CHECK THE APIM GROUND CIRCUITS FOR CONTINUITY	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the APIM C3342-37, circuit GD114 (BK/BU), harness side and ground; and between the APIM C3342-38, circuit GD114 (BK/BU), harness side and ground.  N0077602 • **Are the resistances less than 5 ohms?**	**Yes** GO to AG6 . **No** REPAIR the circuit in question for high resistance. CLEAR the DTCs. REPEAT the self-test.

AG6 CHECK FOR CORRECT APIM OPERATION	
• Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs.

Pinpoint Test AH: DTC B1317 (Rear Entertainment Module (RETM))

Normal Operation

- DTC B1317 (Battery Voltage High) â set by the Rear Entertainment Module (RETM) when the supply voltage is greater than 16.0 volts for more than 10 seconds during normal operation.

This pinpoint test is intended to diagnose the following:

- Charging system concern
- RETM

PINPOINT TEST AH: DTC B1317 (RETM)

NOTE: DTC B1317 may be stored in the module memory due to past battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
AH1 CHECK FOR HIGH VOLTAGE DTCs SET IN OTHER MODULES	
• Ignition ON. • Retrieve all continuous DTCs from all modules. • **Is DTC B1317, B1676, P0563 (PCM), or U3003:17 set in more than one module?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AH2 .
AH2 CHECK THE BATTERY VOLTAGE	
• Turn off all interior/exterior lights and accessories. • Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to AH3 .

• **Does the battery voltage rise to 15.5 volts or higher?**	
AH3 RECHECK FOR DTC B1317	
• Ignition OFF. • Ignition ON. • Clear the RETM DTCs. • Repeat the RETM self-test. • **Is DTC B1317 still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test AI: DTC B1318 (Rear Entertainment Module (RETM))

Normal Operation

- DTC B1318 (Battery Voltage Low) â set by the Rear Entertainment Module (RETM) when the supply voltage falls below 10 volts for at least 10 seconds during normal operation.

This pinpoint test is intended to diagnose the following:

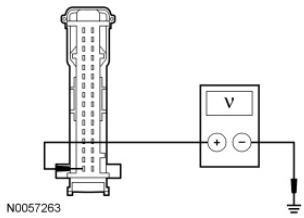
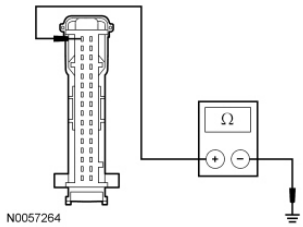
- Wiring, terminals or connectors
- High circuit resistance
- RETM

PINPOINT TEST AI: DTC B1318 (RETM)

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AI1 RECHECK THE RETM DTCs	
• Ignition ON. • Clear the RETM DTCs. • Wait at least 15 seconds. • Repeat the RETM self-test. • **Is DTC B1318 still present?**	**Yes** GO to AI2 . **No** The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.
AI2 CHECK FOR CHARGING SYSTEM DTCs IN THE PCM	
• Retrieve the continuous DTCs from all modules. • **Is DTC P0620, P0622, P0625, or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to AI3 .

AI3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Check the battery condition and verify that the battery is fully charged. Refer to Section 414-01 . • **Is the battery OK and fully charged?**	**Yes** GO to AI4 . **No** REFER to Section 414-01 .
AI4 CHECK THE RETM VOLTAGE SUPPLY	
• Ignition OFF. • Measure and record the voltage at the battery. • Disconnect: RETM C9029. • Ignition ON. • Measure the voltage between the RETM C9029-16, circuit SBB41 (RD), harness side and ground.  • **Is the voltage at the RETM within 0.2 volt of the recorded battery voltage?**	**Yes** GO to AI5 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.
AI5 CHECK THE RETM GROUND CIRCUITS FOR CONTINUITY	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the RETM C9029-1, circuit GD114 (BK/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to AI6 . **No** REPAIR the circuit for high resistance. CLEAR the DTCs. REPEAT the self-test.
AI6 CHECK FOR CORRECT RETM OPERATION	
• Ignition OFF. • Connect: Negative Battery Cable. • Disconnect the RETM connector.	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. TEST the system for normal operation.

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AJ: DTC U0140 Or DTC U0140:00

Normal Operation

Several audio system modules receive network messages from the Smart Junction Box (SJB) via the Medium Speed Controller Area Network (MS-CAN). The following information is included in the messages:

- ♦ Ignition switch position
- ♦ Illumination dimmer control
- ♦ Accessory delay status

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0140 (Lost Communication With Body Control Module (GEM)) â set by the non-navigation Audio Front Control Module (ACM) and the Rear Entertainment Module (RETM) when network messages are missing from the SJB for greater than 5 seconds with the ignition in RUN.
- DTC U0140:00 (Lost Communication With Body Control Module: No Sub Type Information) â set by the navigation ACM or the Accessory Protocol Interface Module (APIM) (V2) when network messages are missing from the SJB for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Audio system concern
- SJB

PINPOINT TEST AJ: DTC U0140 OR DTC U0140:00

Test Step	Result / Action to Take
AJ1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON. • Wait at least 10 seconds.	**Yes** GO to AJ2 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

• Retrieve all continuous DTCs from all modules. • **Is DTC U0140 or DTC U0140:00 set in any audio system module?**	
AJ2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ ACM ♦ APIM ♦ RETM (if equipped) ♦ SJB • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** For an audio system module, GO to DTC Charts in this section. For the SJB , REFER to Section 419-10 . **No** GO to AJ3 .
AJ3 CHECK FOR DTC U0140 OR DTC U0140:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0140 or DTC U0140:00 set in more than one audio system module?**	**Yes** GO to AJ4 . **No** If there is an observable symptom, GO to Symptom Chart - General Audio System to diagnose the observed symptom. If there is no observable symptom, DISREGARD the DTC.
AJ4 CHECK FOR CORRECT SJB OPERATION	
• Ignition OFF. • Disconnect the SJB connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SJB connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CLEAR all continuous DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs.

Pinpoint Test AK: DTC U0155 Or DTC U0155:00

Normal Operation

The Audio Front Control Module (ACM) receives network messages from the Instrument Cluster (IC) via the Medium Speed Controller Area Network (MS-CAN). The following information is included in the messages:

- ♦ Transmission gear selected
- ♦ Vehicle speed

As more than one module (including modules outside of the audio system) receives these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0155 (Lost Communication With Instrument Panel Cluster (IC) Control Panel) â set by the non-navigation Audio Front Control Module (ACM) when network messages are missing from the IC for greater than 5 seconds with the ignition in RUN.
- DTC U0155:00 (Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information) â set by the navigation ACM or the Accessory Protocol Interface Module (APIM) (V2) when network messages are missing from the IC for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Audio system concern
- IC

PINPOINT TEST AK: DTC U0155 OR DTC U0155:00

Test Step	Result / Action to Take
AK1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON. • Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0155 or DTC U0155:00 set in any module?**	**Yes** GO to AK2 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
AK2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ ACM ♦ APIM ♦ Smart Junction Box (SJB) ♦ IC • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** For an audio system module, REFER to DTC Charts in this section. For all other modules, REFER to the Master Diagnostic Trouble Code (DTC) Chart in Section 419-10 . **No** GO to AK3 .
AK3 CHECK FOR DTC U0155 OR DTC U0155:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0155 or DTC U0155:00 set in more than one module?**	**Yes** GO to AK4 . **No** If there is an observable symptom, GO to Symptom Chart

	- General Audio System to diagnose the observed symptom. If there is no observable symptom, DISREGARD the DTC.
AK4 CHECK FOR CORRECT IC OPERATION	
• Ignition OFF. • Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . CLEAR all continuous DTCs. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs.

Pinpoint Test AL: DTC U0184 Or DTC U0184:00

Normal Operation

Several audio system modules receive network messages from the Audio Front Control Module (ACM) via the Medium Speed Controller Area Network (MS-CAN).

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0184 (Lost Communication With Radio (ACM)) â set by the Satellite Digital Audio Receiver System (SDARS) module, the Accessory Protocol Interface Module (APIM) (V1), and the Rear Entertainment Module (RETM) when network messages are missing from the ACM for greater than 5 seconds with the ignition in RUN.
- DTC U0184:00 (Lost Communication With Radio) â set by the APIM (V2) when network messages are missing from the ACM for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Audio system concern
- ACM

PINPOINT TEST AL: DTC U0184 OR DTC U0184:00

Test Step	Result / Action to Take
AL1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON.	**Yes** GO to AL2 .

• Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON. • Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0184 or DTC U0184 set in any audio system module?**	**No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
AL2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ ACM ♦ APIM (if equipped) ♦ RETM (if equipped) • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** REFER to DTC Charts in this section. **No** GO to AL3 .
AL3 CHECK FOR DTC U0184 OR DTC U0184:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0184 or DTC U0184:00 set in more than one audio system module?**	**Yes** GO to AL4 . **No** If there is an observable symptom, GO to Symptom Chart - General Audio System to diagnose the observed symptom. If there is no observable symptom, DISREGARD the DTC.
AL4 CHECK FOR CORRECT ACM OPERATION	
• Ignition OFF. • Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Audio Control Module (ACM) in this section. CLEAR all continuous DTCs. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs.

Pinpoint Test AM: DTC U0193

Normal Operation

Certain audio system modules receive network messages from the Satellite Digital Audio Receiver System (SDARS) module via the Medium Speed Controller Area Network (MS-CAN).

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0193 (Lost Communication With Digital Audio Control Module (SDARS)) â set by the non-navigation Audio Front Control Module (ACM) and the Rear Entertainment Module (RETM) when network messages are missing from the SDARS module for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Audio system concern
- SDARS module

PINPOINT TEST AM: DTC U0193

Test Step	Result / Action to Take
AM1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON. • Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0193 set in any audio system module?**	**Yes** GO to AM2 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
AM2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ ACM ♦ RETM (if equipped) ♦ SDARS module • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** GO to the DTC Charts in this section. **No** GO to AM3 .
AM3 CHECK FOR DTC U0193 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0193 set in more than one audio system module?**	**Yes** GO to AM4 . **No** If there is an observable symptom, GO to Symptom Chart - General Audio System to diagnose the observed symptom. If there is no observable symptom, DISREGARD the DTC.

AM4 CHECK FOR CORRECT SDARS MODULE OPERATION	
• Ignition OFF. • Disconnect the SDARS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SDARS module connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SDARS module. REFER to Satellite Digital Audio Receiver System (SDARS) Module in this section. CLEAR all continuous DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs.

Pinpoint Test AN: DTC U0196 Or DTC U0196:00

Normal Operation

Several audio system modules receive network messages from the Rear Entertainment Module (RETM) via the Medium Speed Controller Area Network (MS-CAN).

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0196 (Lost Communication With Entertainment Control Module - Rear (AUX)) â set by the non-navigation Audio Front Control Module (ACM), the Accessory Protocol Interface Module (APIM) (V1), and the Satellite Digital Audio Receiver System (SDARS) module when network messages are missing from the RETM for greater than 5 seconds with the ignition in RUN.
- DTC U0196:00 (Lost Communication With Entertainment Control Module-Rear "A": No Sub Type Information) â set by the navigation ACM and the APIM (V2) when network messages are missing from the RETM for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Audio system concern
- RETM

PINPOINT TEST AN: DTC U0196 OR DTC U0196:00

Test Step	Result / Action to Take
AN1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules.	**Yes** GO to AN2 . **No**

• Ignition OFF. • Ignition ON. • Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0196 or DTC U0196:00 set in any audio system module?**	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
AN2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ ACM ♦ RETM ♦ SDARS module (if equipped) ♦ APIM (if equipped) • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** GO to the DTC Charts in this section. **No** GO to AN3 .
AN3 CHECK FOR DTC U0196 OR DTC U0196:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0196 or DTC U0196:00 set in more than one audio system module?**	**Yes** GO to AN4 . **No** If there is an observable symptom, GO to Symptom Chart - General Audio System to diagnose the observed symptom. If there is no observable symptom, DISREGARD the DTC.
AN4 CHECK FOR CORRECT RETM OPERATION	
• Ignition OFF. • Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and determine if the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Rear Entertainment Module (RETM) in this section. CLEAR all continuous DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs.

Pinpoint Test AO: DTC U0197 Or DTC U0197:00

Normal Operation

Several audio system modules receive network messages from the Accessory Protocol Interface Module (APIM) via the Medium Speed Controller Area Network (MS-CAN).

As more than one module receives each of these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0197 (Lost Communication With Telephone Control Module) â set by the non-navigation Audio Front Control Module (ACM) and the Satellite Digital Audio Receiver System (SDARS) module when network messages are missing from the APIM for greater than 5 seconds with the ignition in RUN.
- DTC U0197:00 (Lost Communication With Telephone Control Module: No Sub Type Information) â set by the navigation ACM when network messages are missing from the APIM for greater than 5 seconds with the ignition in RUN.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Audio system concern
- APIM

PINPOINT TEST AO: DTC U0197 OR DTC U0197:00

Test Step	Result / Action to Take
AO1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON. • Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0197 or DTC U0197:00 set in any audio system module?**	**Yes** GO to AO2 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
AO2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ ACM ♦ SDARS module (if equipped) ♦ APIM • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** GO to the DTC Charts in this section. **No** GO to AO3 .
AO3 CHECK FOR DTC U0197 OR DTC U0197:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0197 or DTC U0197:00 set in more than one audio system module?**	**Yes** GO to AO4 . **No** If there is an observable symptom, GO to Symptom Chart - General Audio System to diagnose the observed

	symptom. If there is no observable symptom, DISREGARD the DTC.
AO4 CHECK FOR CORRECT APIM OPERATION	
• Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Wait 2 minutes for the APIM to re-initalize. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Accessory Protocol Interface Module (APIM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs.

Pinpoint Test AP: DTC U0100:00

Normal Operation

The Accessory Protocol Interface Module (APIM) (V2 only) receives network messages from the PCM via the High Speed Controller Area Network (HS-CAN). These messages include the odometer reading and the fuel level.

As other modules outside of the audio system also receive these messages, all modules receiving a particular message should exhibit a symptom if the message is missing.

- DTC U0100:00 (Lost Communication With ECM /PCM "A": No Sub Type Information) â set by the APIM when it is missing messages from the PCM over the HS-CAN for greater than 5 seconds with the ignition in the RUN position.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- PCM

PINPOINT TEST AP: DTC U0100:00

Test Step	Result / Action to Take
AP1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON.	**Yes** GO to AP2 . **No** The system is operating correctly at this time. The

• Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0100 or DTC U0100:00 set in any modules?**	DTC may have been set due to an intermittent fault in the network wiring.
AP2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ APIM ♦ PCM ♦ Instrument Cluster (IC) • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** For the APIM , REFER to DTC Charts in this section. For all other modules, REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 . **No** GO to AP3 .
AP3 CHECK FOR DTC U0100 OR DTC U0100:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0100 or DTC U0100:00 set in more than one module?**	**Yes** GO to AP4 . **No** If there is an observable symptom, GO to Symptom Chart - General Audio System to diagnose the observed symptom. If there is no observable symptom, CHECK the wiring between the APIM and the PCM for an intermittent fault.
AP4 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • **Is the concern still present?**	**Yes** INSTALL a new PCM. Refer to the appropriate section in Group 303 for the procedure. CLEAR all continuous DTCs. REPEAT the APIM self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs. REPEAT the APIM self-test.

Pinpoint Test AQ: DTC U0151:00

Normal Operation

The Accessory Protocol Interface Module (APIM) (V2 only) receives the air bag deployment notification message from the Restraints Control Module (RCM) via the High Speed Controller Area Network (HS-CAN). The APIM uses this message to activate the emergency call system.

As other modules outside of the audio system also receive this message, all modules receiving it should exhibit a symptom if the message is missing.

- DTC U0151:00 (Lost Communication With Restraints Control Module: No Sub Type Information) â set by the APIM when it is missing the air bag deployment notification message from the RCM over the HS-CAN for greater than 5 seconds with the ignition in the RUN position.

This pinpoint test is intended to diagnose the following:

- Communication network concern
- Restraints system concern

PINPOINT TEST AQ: DTC U0151:00

Test Step	Result / Action to Take
AQ1 CHECK FOR LOST COMMUNICATION DTCs	
• Ignition ON. • Clear continuous DTCs from all modules. • Ignition OFF. • Ignition ON. • Wait at least 10 seconds. • Retrieve all continuous DTCs from all modules. • **Is DTC U0151 or DTC U0151:00 set in any modules?**	**Yes** GO to AQ2 . **No** The system is operating correctly at this time. The DTC may have been set due to an intermittent fault in the network wiring.
AQ2 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DTCs	
• Carry out the self-test for the following modules: ♦ APIM ♦ PCM ♦ RCM ♦ Instrument Cluster (IC) • **Is DTC B1317, B1318, U3003:16, or U3003:17 recorded in any module?**	**Yes** For the APIM , REFER to DTC Charts in this section. For all other modules, REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 . **No** GO to AQ3 .
AQ3 CHECK FOR DTC U0151 OR DTC U0151:00 SET IN MULTIPLE MODULES	
• Review the recorded results from the self-test. • **Is DTC U0151 or DTC U0151:00 set in more than one module?**	**Yes** GO to AQ4 . **No** If there is an observable audio system symptom, GO to Symptom Chart - General Audio System to diagnose the observed symptom. If there is an observable restraints system symptom, REFER to Section 501-20B to diagnose the symptom.

	If there is no observable symptom, CHECK the wiring between the APIM and the RCM for an intermittent fault.
AQ4 CHECK FOR CORRECT RCM OPERATION	
• Disconnect all the RCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the RCM connectors and make sure they seat correctly. • **Is the concern still present?**	**Yes** INSTALL a new RCM . REFER to Section 501-20B . CLEAR all continuous DTCs. REPEAT the APIM self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous DTCs. REPEAT the APIM self-test.

Accessory Protocol Interface Module (APIM) Software Level Check

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST3051-A	Universal Serial Bus (USB) Male-A to Male-A Cable CCMUSB2-AM-AM-10 or equivalent

NOTE: This procedure applies to checking the Accessory Protocol Interface Module (APIM) software level. To program the APIM , refer to Accessory Protocol Interface Module (APIM) Programming in Section 418-01 .

1. Turn the Audio Front Control Module (ACM) on.

2. Connect the scan tool to the Data Link Connector (DLC).

3. Connect one end of the Universal Serial Bus (USB) male-A to male-A cable to the scan tool.

4. Connect the other end of the USB male-A to male-A cable to the vehicle USB port.

5. From the technician service publication website, run On-Line Automotive Service Information System (OASIS) using Quick Start or by manually entering the Vehicle Identification Number (VIN).

6. From the OASIS tab, select the "Sync/APIM" bullet.

7. Select the "Read APIM" button to verify the current APIM software level.
   - The display shows both the Vehicle Interface Processor (VIP) and Consumer Interface Processor (CIP) software levels.

8. The scan tool displays the following information:
   - Last Recorded State - Hardware
     - VIN : vehicle identification number associated with the current APIM
     - Installed date: date the APIM was installed
     - Radio: currently identified ACM in the vehicle
     - HW Part No.: APIM hardware part number
     - Un-installed date: date (if any) the APIM was uninstalled
     - S/N: APIM serial number
   - Last Recorded State - Software
     - Date/Time: date and time of last recorded software installation
     - VIP : VIP software that was installed at that time
     - CIP : CIP software that was installed at that time
     - Description: a description of the content of the software revision
   - History - Software
     - Date/Time: date and time of any recorded software installation

- ♦ VIP : VIP software that was installed at that time
- ♦ CIP : CIP software that was installed at that time
- ♦ Description: a description of the content of the software revision

- Available Software for Programming
  - ♦ Select: allows the software package to be selected
  - ♦ Lineage: the original software release, if the software available is a revision
  - ♦ VIP : VIP software level that is available with the selection
  - ♦ CIP : CIP software level that is available with the selection
  - ♦ Description: a description of the content of the software revision

9. Click a CIP software level to view the device compatibility list associated with the CIP software level, if desired.

10. To exit the APIM software level check, disconnect the scan tool from the DLC and the USB port, or exit the OASIS screen.

Audio Control Module (ACM) Self-Diagnostic Mode

Audio Systems Without Navigation

1. Turn the Audio Front Control Module (ACM) on.

2. Operate the audio system in radio tuner (AM/FM) mode.

3. Press and hold preset buttons 3 and 6 for 3 seconds until the speaker walk test begins.
   - The display indicates each speaker as it is tested.

4. **NOTE:** If the speaker walk test is the only test required, this procedure can be stopped after Step 3 by turning the ACM off.

   Before the speaker walk test is complete, carry out any of the following actions:

Preset Button Press	Diagnostic Function	Display	Diagnostic Function Description
1	ACM Self-Test	SELF TEST	The ACM carries out a self-test. At the end of the self-test, the display either indicates SELF PASS or scrolls through any DTCs present. Note that the self-test may not indicate all DTCs that are present. If additional DTCs are suspected, retrieve continuous and on-demand DTCs using the scan tool.
2	View DTCs	NO DTCS, or scrolls through DTCs	The ACM displays any DTCs that are present. To scroll through the DTCs, press the TUNE UP button. If no DTCs are present, the display reads NO DTCS.
3	AM/FM Antenna Signal Strength	SIGNAL ###	The ACM displays the AM/FM antenna signal strength. To run this test, the audio system should be in AM radio tuner mode before entering the ACM self-diagnostic mode.
4	Software Levels	SOFT LEVELS	The ACM displays software levels for various components of the audio system. Knowing the software levels may not aid diagnostics. Press the TUNE UP button to scroll through the software levels.
5	Display Test	DISPLAY TEST, then all segments illuminate	All of the ACM display segments illuminate.
6	Retrieve ACM Part Number	RADIO CONFIG	The ACM displays the ACM part number and various configuration levels. Press the TUNE UP button to scroll to the desired function.

5. To exit the self-diagnostic mode, turn the ACM off.

Satellite Radio Electronic Serial Number (ESN) Retrieval - Vehicles Without Navigation

1. Operate the audio system in satellite radio mode.

2. Press and hold the AUX button and preset button 1, simultaneously.
   - The Satellite Digital Audio Receiver System (SDARS) module Electronic Serial Number (ESN) displays on the screen.

3. Record the SDARS module ESN .

4. Turn the audio system off.

Audio Systems With Navigation

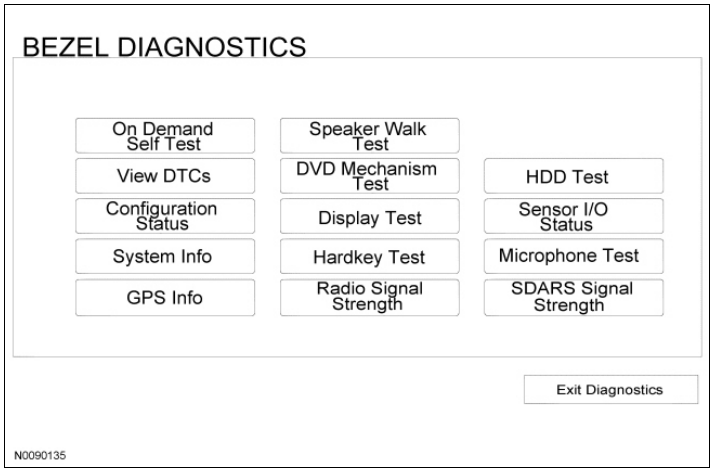
1. Turn the Audio Front Control Module (ACM) on.

2. Operate the audio system in radio tuner (AM/FM) mode.

3. Press and hold preset buttons 3 and 6 for 3 seconds until the speaker walk test begins.
   - The display indicates each speaker as it is tested.

4. **NOTE:** If the speaker walk test is the only test required, this procedure can be stopped after this step, or by allowing the speaker walk test to complete on its own.

   Before the speaker walk test is complete, press the "End Test" selection.



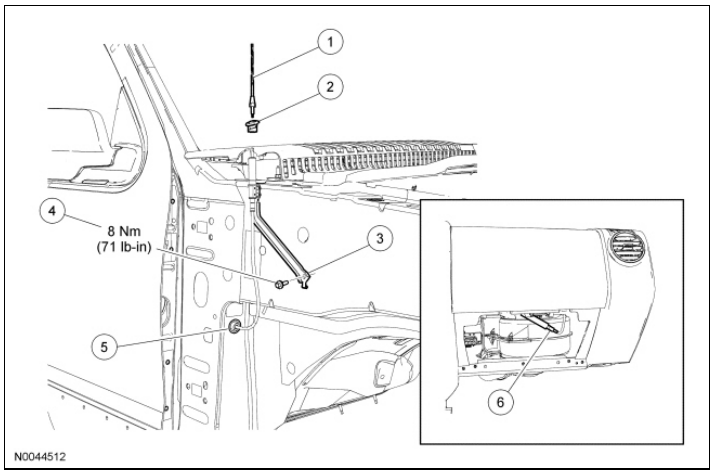
5. The following tests are available through the "BEZEL DIAGNOSTICS" menu:

Display Selection	Diagnostic Function Description
On Demand Self Test	The ACM carries out a self-test. At the end of the self-test, the display either indicates "Test Passed" or lists any DTCs present. Note that the self-test may not indicate all DTCs that are present. If DTCs are suspected, retrieve continuous and on-demand DTCs using the scan tool.
View DTCs	The ACM displays any DTCs that are present. If there is more than a full screen of DTCs present, to scroll through the DTCs, press the down arrow on the display. If no DTCs are present, the display reads NO DTCS. Press the "Clear DTCs" selection to clear any DTCs present.

Configuration Status	The display shows the ACM configuration. A "0" indicates the item is configured off, while a "1" indicates the item is configured on. If the ACM appears to be misconfigured, refer to Section 418-01 .
System Info	The ACM displays system information for various components of the audio system. The following items are most important for servicing the audio system: • Nav Radio Part Number - provides the ACM part number • ESN1 - provides the satellite radio Electronic Serial Number (ESN)
GPS Info	The current Global Positioning System (GPS) satellite information is shown, along with the current vehicle position. Pressing the "SV Status" selection provides additional information, if present.
Speaker Walk Test	The ACM carries out the speaker walk test.
DVD Mechanism Test	The ACM tests the internal CD/DVD drive mechanism.
Display Test	This test provides for testing of the touchscreen colors and the touchscreen sectors. Pressing any of the colors on the display causes the whole display to change to that color; pressing the display again returns to the Display Test menu. Pressing the "Touchscreen Activation Test" selection enters the touchscreen sector test. Press any area of the screen to test the touchscreen sector; press the "X" at the RH lower corner of the display to return to the Display Test menu.
Hardkey Test	This test provides for testing of the ACM buttons (not the touchscreen). When each button is pressed, the screen displays the button that is active. This test can also be used to isolate a stuck button.
Radio Signal Strength	The ACM displays the AM/FM antenna signal strength. To run this test, the audio system should be in AM radio tuner mode before entering the ACM self-diagnostic mode.
HDD Test	The ACM tests its internal hard drive.
Sensor I/O Status	The ACM displays inputs it is receiving from external sources. These inputs include: • Ignition - indicates ON (ignition in ACC or RUN) or OFF • Brake - indicates ON (vehicle in PARK) or OFF (vehicle not in PARK) • Illumination - indicates ON or OFF • ReverseGear - indicates ON (vehicle in REVERSE) or OFF (vehicle not in REVERSE)
Microphone Test	The ACM tests the microphone by supplying a test tone and monitoring the input from the microphone. If there is a concern with the microphone input, the ACM sets DTC B1D79:01. For diagnostics, refer to Diagnosis and Testing in this section.
SDARS Signal Strength	The ACM displays the satellite radio antenna signal strength.

6. To exit the self-diagnostic mode, press the "Exit Diagnostics" selection from the "BEZEL DIAGNOSTICS" menu.

Antenna - AM/FM



Item	Part Number	Description
1	18813	Antenna mast
2	18922	Antenna mast stanchion
3	18936	Antenna cable bracket
4	W705661	Antenna cable bracket bolt
5	18912	Antenna cable grommet
6	18812	Antenna cable connection

Removal and Installation

1. **NOTE:** To access the antenna cable-to-antenna lead-in cable connection, lower the glove compartment door.

   Disconnect the antenna cable from the antenna lead-in cable and release the pin-type retainers.

2. Remove the RH cowl side trim panel and the RH front door scuff plate trim panel. For additional information, refer to Section 501-05 .

3. Remove the antenna mast and the antenna mast stanchion.

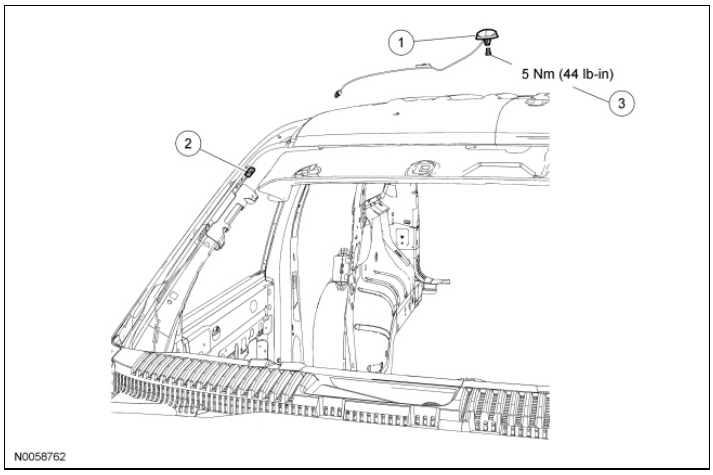
4. Remove the RH fender splash shield. For additional information, refer to Section 501-02 .

5. Release the antenna cable grommet.

6. Remove the antenna cable bracket bolt and the antenna cable assembly.
   - To install, tighten to 8 Nm (71 lb-in).

7. To install, reverse the removal procedure.

Antenna - Satellite Radio



Item	Part Number	Description
1	18C964	Satellite radio antenna
2	-	Satellite radio antenna electrical connector (part of 19A397)
3	-	Satellite radio antenna bolt (part of 18C964)

Removal and Installation

1. Remove the RH A-pillar trim panel. For additional information, refer to Section 501-05 .

2. Remove the 3 screws, the RH sun visor retaining clip, and the RH sun visor.
   - If equipped, disconnect the electrical connector.

3. Lower the front of the headliner enough to gain access to the satellite radio antenna electrical connector.

4. **NOTE:** Remove the satellite antenna and pigtail through the mounting opening in the roof panel.

   Remove the satellite antenna.

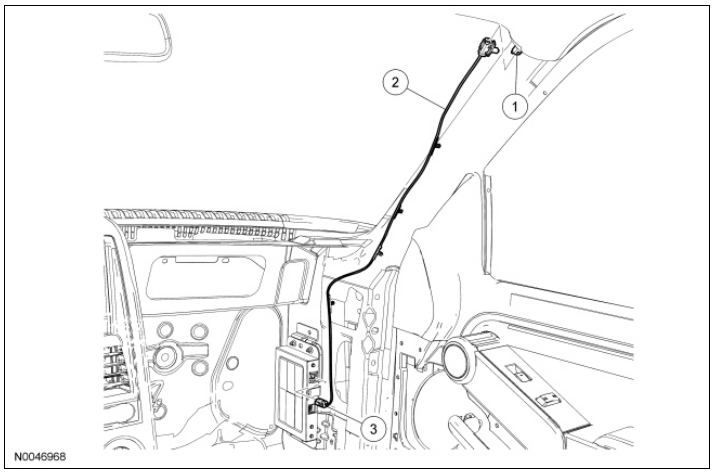
   - Disconnect the electrical connector.
   - Loosen the antenna bolt.
     - ♦ To install, tighten to 5 Nm (44 lb-in).
   - Compress the tabs and release the satellite antenna from the roof panel.

5. To install, reverse the removal procedure.

Antenna Cable - Satellite Radio

Vehicles Without Navigation

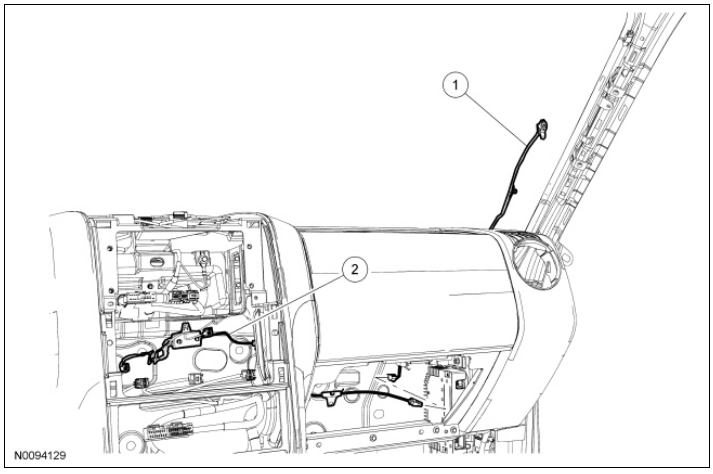
NOTE: Instrument panel shown removed for clarity.



Item	Part Number	Description
1	-	Upper satellite radio antenna electrical connector (part of 10E893)
2	-	Upper satellite radio antenna cable
3	-	Upper satellite radio antenna cable-to-Satellite Digital Audio Receiver System (SDARS) module electrical connector (part of 19A397)

Vehicles With Navigation

NOTE: Glove compartment shown removed for clarity.



Item	Part Number	Description
1	19A397	Upper satellite radio antenna cable
2	10E928	Lower satellite radio antenna cable

Removal and Installation

NOTE: Vehicles without navigation only have an upper satellite radio antenna cable.

Lower cable (vehicles with navigation)

NOTE: The lower satellite antenna cable is only serviceable by cutting the ends off the existing antenna cable and taping them to prevent NVH concerns. The new cable should be overlaid on the electrical harness and secured, as necessary.

1. Remove the Audio Front Control Module (ACM). For additional information, refer to Audio Control Module (ACM) in this section.

Upper cable (all vehicles)

2. Remove the RH A-pillar trim panel. For additional information, refer to Section 501-05 .

3. Disconnect the satellite antenna electrical connector.

Both cables

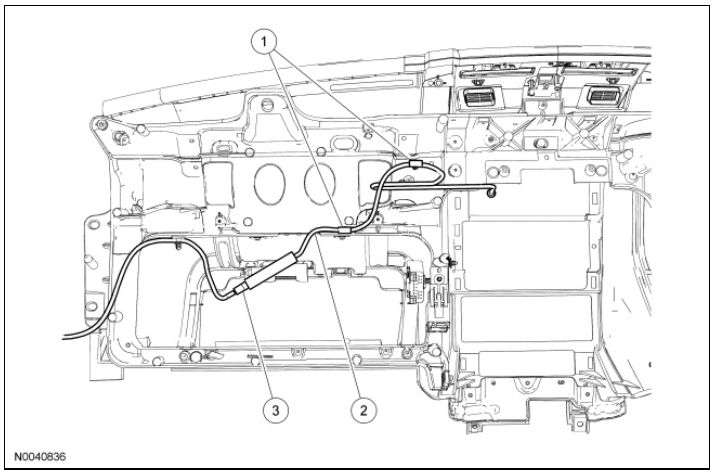
4. **NOTE:** Lower the glove compartment completely to access the connection.

   Disconnect the upper satellite radio antenna cable from the Satellite Digital Audio Receiver System (SDARS) module (vehicles without navigation) or the lower satellite radio antenna cable (vehicles with navigation).

5. Remove the satellite radio antenna cable.

6. To install, reverse the removal procedure.

Antenna Lead-In Cable



Item	Part Number	Description
1	-	Antenna lead-in cable pin-type retainers (part of 18812)
2	18812	Antenna lead-in cable
3	-	Antenna lead-in cable connection (part of 18812)

Removal and Installation

1. Remove the Audio Front Control Module (ACM). For additional information, refer to Audio Control Module (ACM) in this section.
2. Lower the glove compartment door.
3. **NOTE:** Release the pin-type retainers.

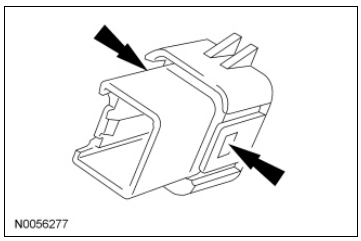
   Disconnect the antenna lead-in cable connection and remove the antenna lead-in cable.
4. To install, reverse the removal procedure.

Audio Input Jack

Removal and Installation

1. Remove the floor console finish panel. For additional information, refer to Section 501-12 .

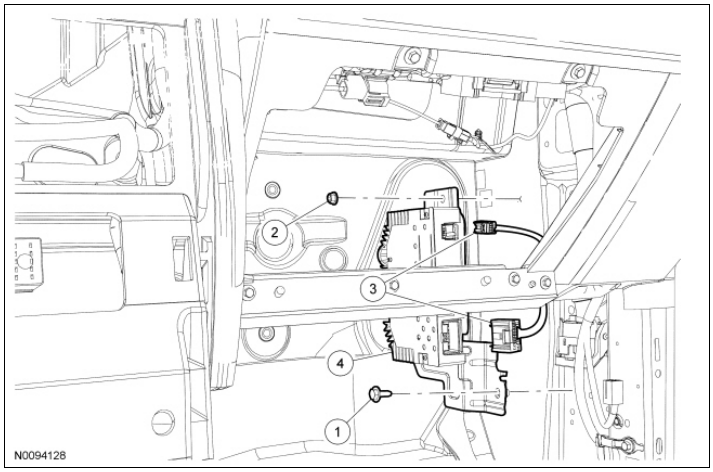
2. Release the tabs and remove the audio input jack.



3. To install, reverse the removal procedure.

Audio Amplifier

NOTE: Glove compartment shown removed for clarity.



Item	Part Number	Description
1	W707491-S	Audio amplifier bolt
2	W700101-S	Audio amplifier nut
3	-	Audio amplifier electrical connectors (part of 14A488)
4	18B849	Audio amplifier

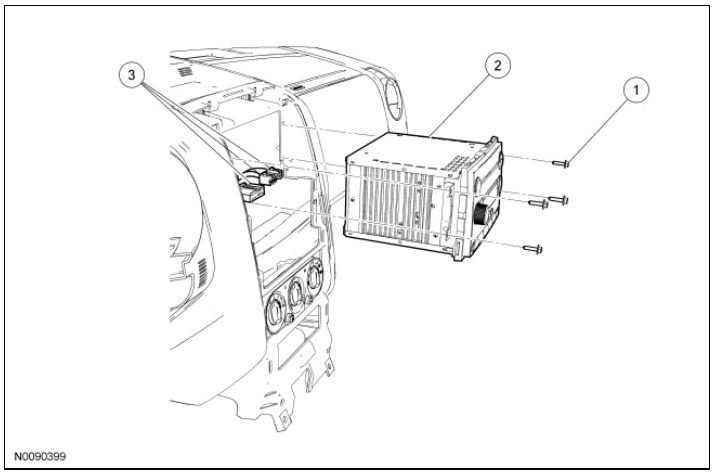
Removal and Installation

1. Remove the RH cowl side trim panel. For additional information, refer to Section 501-05 .
2. **NOTE:** Lower the glove compartment door to access the top nut.

   Remove the bolt, the nut, and the audio amplifier.

   - Disconnect the electrical connectors.
3. To install, reverse the removal procedure.

Audio Control Module (ACM)



Item	Part Number	Description
1	W707628	Audio Front Control Module (ACM) screws (4 required)
2	18C868	ACM
3	-	ACM electrical connectors (part of 14489)

Removal and Installation

NOTE: It is not necessary to remove the Audio Front Control Module (ACM) to retrieve the part number. For additional information, refer to Audio Control Module (ACM) Self-Diagnostic Mode in this section.

1. **NOTE:** Module configuration is required when a new ACM is being installed.

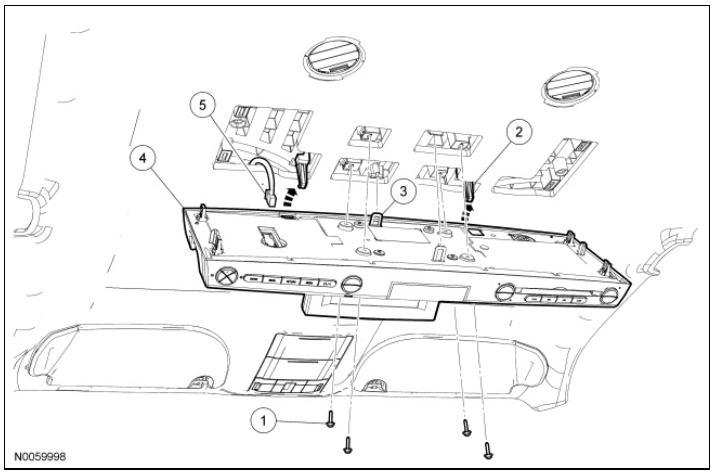
   Upload the ACM configuration information to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in Section 418-01 .

2. Remove the instrument panel center finish panel. For additional information, refer to Section 501-12 .

3. Remove the 4 screws and the ACM .
   - Disconnect the ACM electrical connectors.

4. To install, reverse the removal procedure.
   - Download the configuration information to the ACM . For additional information, refer to PMI in Section 418-01 .

Rear Entertainment Module (RETM)



Item	Part Number	Description
1	W704875-S	Rear Entertainment Module (RETM) screws (4 required)
2	-	J-hook (part of 10E957)
3	-	U-hook (part of 10E947)
4	10E947	RETM
5	-	RETM electrical connector (part of 15A657)

Removal

NOTE: Module configuration is required when a new Rear Entertainment Module (RETM) is being installed.

1. Upload the RETM configuration to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in Section 418-01 .

2. **NOTE:** Open the RETM display.

   Remove the 4 screws.

3. Remove the RETM .
   - Pull down on the sides of the RETM to disengage the clips from the bracket.
   - Using a suitable tool (such as a flat-bladed screwdriver), push the rear most U-hook forward and release the U-hooks.
   - Hang the RETM on the J-hooks and disconnect the electrical connector.
   - Remove the RETM from the J-hooks.

Installation

1. Hang the RETM on the J-hooks.

2. Connect the electrical connector.

3. Remove the RETM from the J-hooks.

4. **NOTE:** Tilt the RETM , as necessary, to align it correctly.

   Align the left side guide pin with the left side locating hole.

5. Lift up the right side of the RETM and engage the U-hooks.

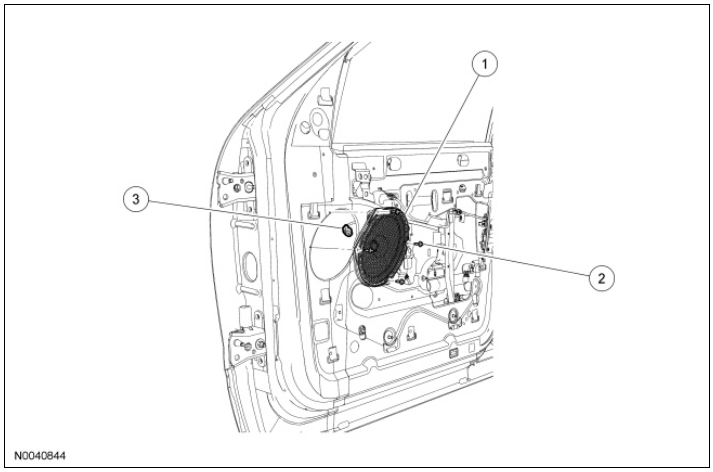
6. Install the 4 screws.

7. Push on the left and right sides of the RETM to engage the clips.

8. Download the RETM configuration from the scan tool. For additional information, refer to PMI in Section 418-01 .

Speaker - Door

NOTE: RH front shown, others similar.



Item	Part Number	Description
1	18808	Door speaker
2	W701930	Door speaker screws (4 required)
3	14A488	Door speaker electrical connector

Removal and Installation

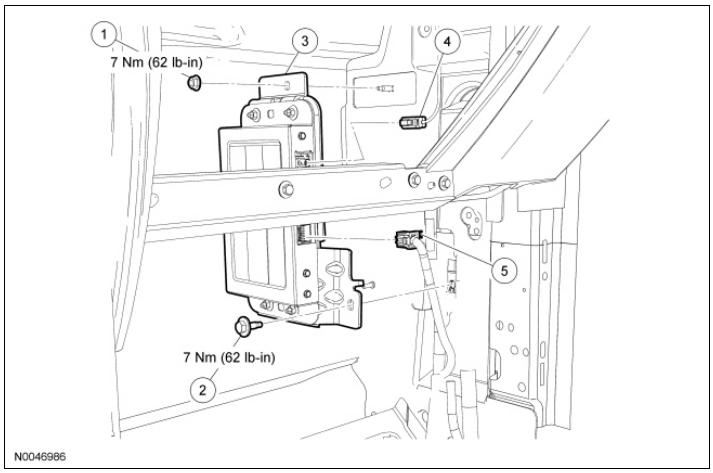
1. Remove the door trim panel. For additional information, refer to Section 501-05 .

2. Remove the 4 screws and the door speaker.
   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Satellite Digital Audio Receiver System (SDARS) Module

NOTE: This procedure applies to vehicles without navigation only. For vehicles with navigation, the satellite receiver is built-in to the Audio Front Control Module (ACM).



Item	Part Number	Description
1	-	Satellite Digital Audio Receiver System (SDARS) module nut
2	-	SDARS module bolt
3	18C960	SDARS module
4	19A397	Satellite radio antenna connector
5	-	SDARS module electrical connector (part of 14401)

Removal and Installation

1. **NOTE:** Module configuration is required when a new Satellite Digital Audio Receiver System (SDARS) module is being installed.

   Upload the SDARS module configuration information to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in Section 418-01 .

2. Remove the RH cowl side trim panel. For additional information, refer to Section 501-05 .

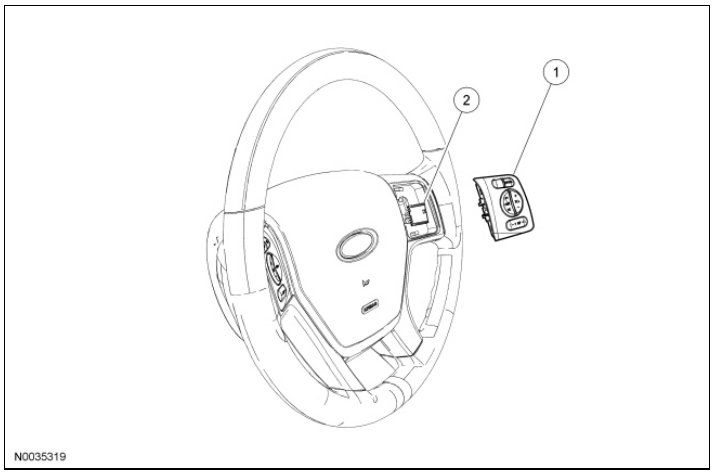
3. **NOTE:** Lower the glove compartment door to access the top nut.

   Remove the bolt, the nut, and the SDARS module.

   - Disconnect the satellite radio antenna connector and the electrical connector.
   - To install, tighten to 7 Nm (62 lb-in).

4. To install, reverse the removal procedure.
   - Download the configuration information to the SDARS module. For additional information, refer to PMI in Section 418-01 .

Steering Wheel Controls



Item	Part Number	Description
1	9C888	Steering wheel controls
2	3600	Steering wheel controls electrical connector

Removal and Installation

1. **NOTE:** It is not necessary to remove the driver air bag module during this procedure.

   NOTE: When removing the steering wheel controls, disengage the RH side of the controls first.

   Using a suitable tool (such as a trim removal tool), pry the steering wheel controls out of the steering wheel.

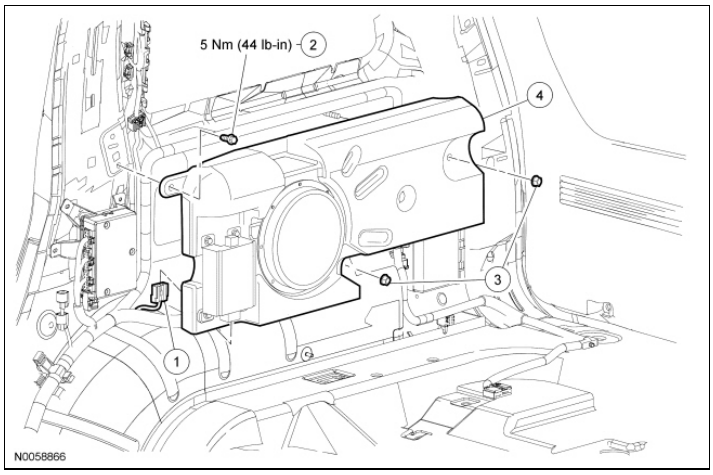
2. **NOTE:** Do not allow the electrical connector to fall back into the steering wheel.

   Remove the steering wheel controls.

   - Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Subwoofer Speaker - Explorer, Mountaineer



Item	Part Number	Description
1	14A488	Subwoofer amplifier electrical connector
2	W701695-S437	Subwoofer enclosure bolt
3	N806769-S441	Subwoofer enclosure nuts (2 required)
4	18C804	Subwoofer enclosure

Removal and Installation

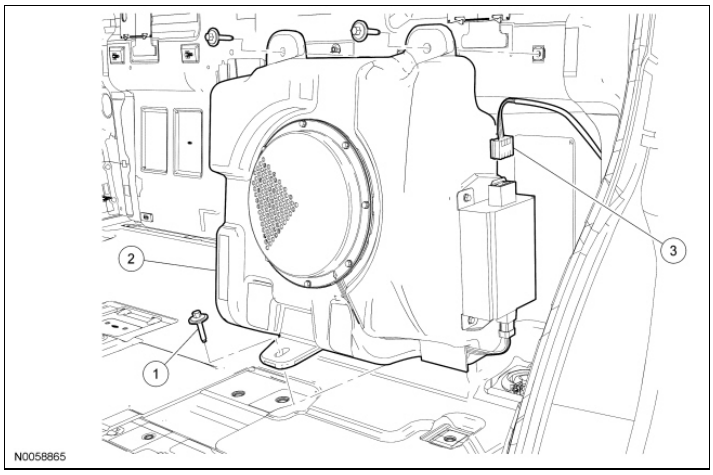
1. Remove the RH rear quarter trim panel. For additional information, refer to Section 501-05 .

2. Disconnect the electrical connector.

3. Remove the bolt, the 2 nuts and the subwoofer enclosure.
   - To install, tighten the bolt to 5 Nm (44 lb-in).

4. To install, reverse the removal procedure.

Subwoofer Speaker - Explorer Sport Trac



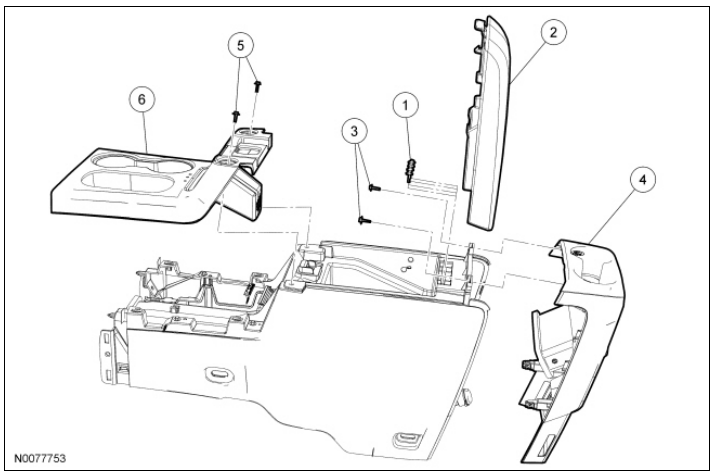
Item	Part Number	Description
1	W707332-S437	Subwoofer enclosure bolts (3 required)
2	18C804	Subwoofer speaker
3	-	Subwoofer amplifier electrical connector (part of 14A009)

Removal and Installation

1. Remove the rear trim panel. For additional information, refer to Section 501-05 .
2. Disconnect the electrical connector.
3. Remove the 3 bolts and the subwoofer enclosure.
4. To install, reverse the removal procedure.

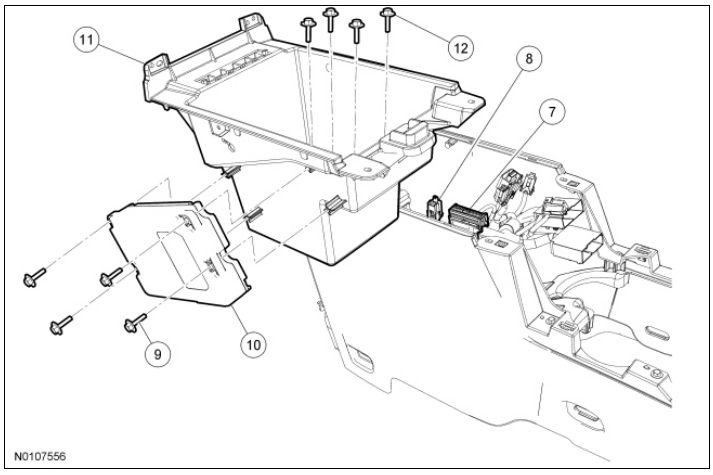
Accessory Protocol Interface Module (APIM)

Floor Console Components



Item	Part Number	Description
1	W707607-S	Front floor console stowage door screws (4 required)
2	78060244	Front floor console stowage door
3	W707607-S	Front floor console rear trim panel screws (2 required)
4	78045E24	Front floor console rear trim panel
5	W707607-S	Front floor console finish panel screws (2 required)
6	78045A76	Front floor console finish panel

Accessory Protocol Interface Module (APIM)



Item	Part Number	Description
7	-	Accessory Protocol Interface Module (APIM) electrical connector (part of 14B079)
8	-	

		Universal Serial Bus (USB) cable electrical connector (part of 14D202)
9	W707607-S	APIM screws (4 required)
10	14D212	APIM
11	-	Front floor console stowage bin (part of 78045A36)
12	W707607-S	Front floor console stowage bin screws (4 required)

Removal and Installation

1. **NOTE:** Replacing the Accessory Protocol Interface Module (APIM) with the correct part number is critical to retain feature levels and SYNC functionality. There are two different versions of the APIM (for SYNC V1 and V2) and the correct version must be installed.

   Retrieve and record the current APIM software and hardware level. For additional information, refer to Accessory Protocol Interface Module (APIM) Software Level Check in this section.

2. Remove the 4 screws and the front floor console stowage door.

3. Remove the 2 screws and the front floor console rear trim panel.
   - Pull straight back to disengage the clips.

4. Remove the 2 screws and the front floor console finish panel.
   - Pull straight up to disengage the clips.

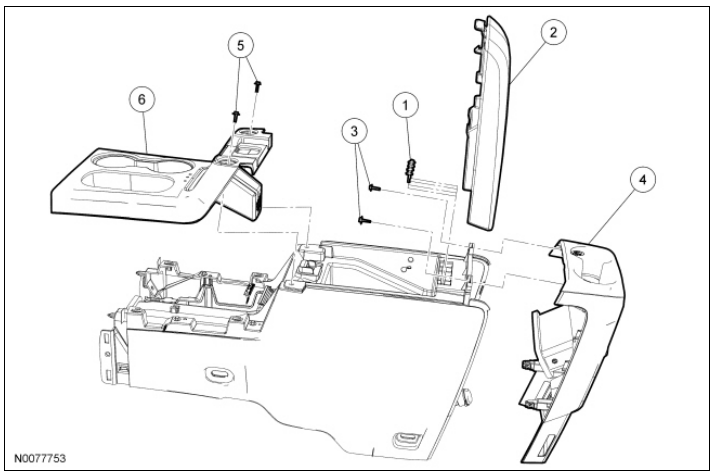
5. Remove the front floor console stowage bin.
   - Remove the 4 screws.
   - Disconnect the audio input jack electrical connector.
   - Disconnect the Universal Serial Bus (USB) port electrical connector.
   - Disconnect the APIM electrical connector.
   - Disconnect the USB cable electrical connector (at the APIM).

6. Remove the 4 screws and the APIM .

7. To install, reverse the removal procedure.
   - If a new APIM is being installed, program the APIM to the correct software level. For additional information, refer to Section 418-01 .

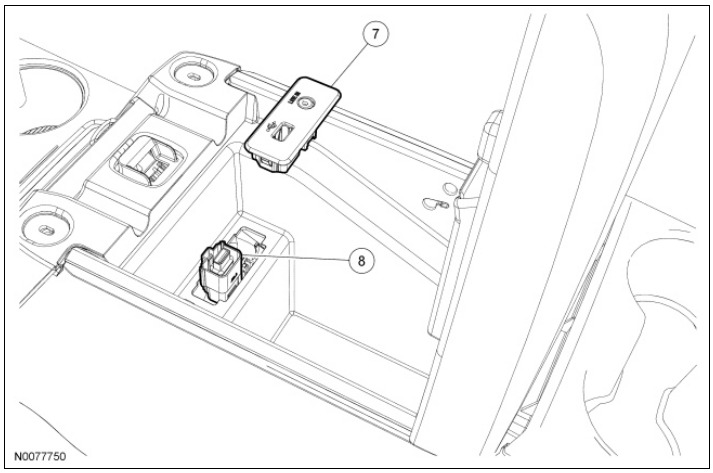
Universal Serial Bus (USB) Cable and Port

Floor Console Components



Item	Part Number	Description
1	W707607-S	Front floor console stowage door screws (4 required)
2	78060244	Front floor console stowage door
3	W707607-S	Front floor console rear trim panel screws (2 required)
4	78045E24	Front floor console rear trim panel
5	W707607-S	Front floor console finish panel screws (2 required)
6	78045A76	Front floor console finish panel

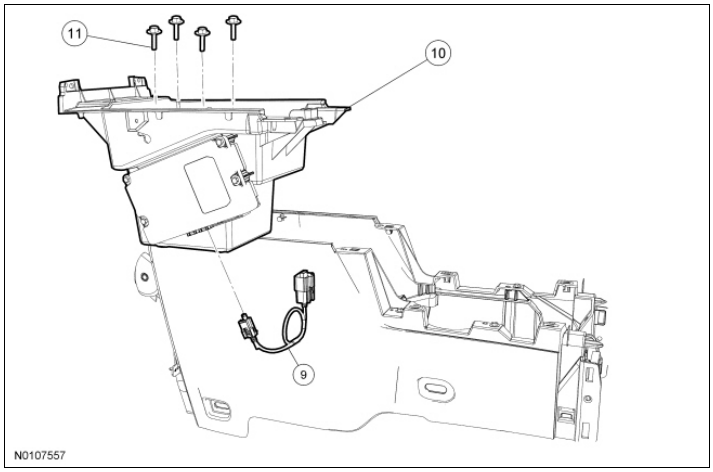
Universal Serial Bus (USB) Cable And Port-To-Bezel



Item	Part Number	Description
7	19C149	Audio input jack bezel
8	-	

		Universal Serial Bus (USB) port connector (part of 14D202)

USB Cable And Port-To-Accessory Protocol Interface Module (APIM)



Item	Part Number	Description
9	14D202	USB cable and port
10	-	Front floor console stowage bin (part of 78045A36)
11	W707607-S	Front floor console stowage bin screws (4 required)

Removal and Installation

1. Remove the 4 screws and the front floor console stowage door.

2. Remove the 2 screws and the front floor console rear trim panel.
   - Pull straight back to disengage the clips.

3. Remove the 2 screws and the front floor console finish panel.
   - Pull straight up to disengage the clips.

4. Using a suitable tool (such as a trim removal tool) pry the audio input jack bezel from the storage bin.
   - Disconnect the audio input jack electrical connector.

5. Disconnect the Universal Serial Bus (USB) port connector from the audio input jack bezel.

6. Remove the 4 screws and the front floor console stowage bin.

7. Remove the USB cable and port.
   - Disconnect the electrical connector.

8. To install, reverse the removal procedure.

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SECTION 501-08: Exterior Trim and Ornamentation

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SECTION 501-11: Glass, Frames and Mechanisms

SECTION 501-12: Instrument Panel and Console

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SECTION 204-02: Rear Suspension

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Exterior Lighting

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

Lamp Assembly Condensation

Exterior lamps are vented to accommodate normal changes in pressure. Condensation can be a natural by-product of this design. When moist air enters the lamp assembly through the vents, there is a possibility that condensation can occur if the temperature is cold. When normal condensation occurs, a thin film of mist can form on the interior of the lens. The thin mist eventually clears and exits through the vents during normal operation. Time to clear the lens of acceptable mist varies with ambient humidity and lamp types. Normal condensation clears from any lamp in 48 hours under dry conditions.

Do **not** replace a lamp assembly with acceptable levels of condensation such as:

- presence of thin mist (no streaks, drip marks or droplets are present)
- fine mist covers less than 50% of the lens

Examples of unacceptable moisture (usually caused by a lamp housing leak):

- water puddling inside the lamp
- large water droplets, drip marks or streaks present on the interior of the lens

Headlamps

The headlamp system is a dual-beam pattern system. It consists of a low and high beam, with a replaceable bulb. The headlamp assembly has the park/turn indicator lamp integrated into the headlamp assembly. The SJB supplies voltage to the headlamps when demanded.

Autolamps

The autolamp system provides light sensitive automatic on/off control of the exterior lamps. The autolamp system keeps the exterior lamps on for a pre-selected period of time after the ignition switch is turned to the OFF position. The pre-selected time lapse is adjustable up to approximately 3 minutes.

To program the time delay, refer to Autolamps Time Delay Adjustment in this section.

Vehicles equipped with autolamps also have a feature that turns on the exterior lamps when the windshield wipers are turned on. For additional information, refer to Section 501-16 .

Stoplamps

The high mounted stoplamp and rear stoplamps are supplied voltage when the brake pedal is applied.

Turn Signal/Hazard Lamps

The front turn signal lamps are located within the headlamp assemblies. When the multifunction switch is placed in the LH or RH TURN positions, the SJB routes voltage to the LH or RH turn signal lamps. The SJB then cycles the voltage on and off approximately 80 times per minute. If a front or rear turn bulb is

inoperative, the SJB cycles the voltage on and off approximately 160 times per minute for bulb outage indication.

The hazard switch is integral to the multifunction switch. When the hazard switch is engaged, the SJB supplies voltage to all the turn lamps. The SJB cycles the voltage on and off approximately 80 times per minute.

Parking Lamps

The SJB supplies voltage to the parking lamps when demanded. The front parking lamps are located in the headlamp assemblies. The rear parking lamps are located in the rear lamp assemblies.

Fog Lamps

The fog lamp switch is integral to the headlamp switch. When the fog lamp switch is engaged, the fog lamp relay is energized and routes voltage to the fog lamps. The fog lamps can be turned on when the ignition switch is in the RUN or ACC position, the low beam headlamps are on, and the high beam headlamps are off.

Reversing Lamps

When the transmission is placed in REVERSE (R), the SJB provides a ground for the reversing lamp relay coil (internal to the SJB). The reversing lamps receive voltage when the reversing lamp relay is energized. The reversing lamps are located within the rear lamp assemblies.

Trailer Tow

The SJB supplies voltage to the trailer tow stop/turn, parking and reversing lamps. When the vehicle's rear stop/turn lamp, parking lamps, or reversing lamps are illuminated, voltage is supplied to the trailer tow connector.

The trailer tow battery charge relay provides voltage to the trailer tow connector when the ignition switch is in the RUN or ACC position.

The vehicle comes equipped with circuitry to support trailer tow electric brakes.

Vehicles equipped with the trailer tow package are also equipped with a trailer sway control feature. For diagnostics and other information regarding this feature, refer to Section 206-09 .

Daytime Running Lamps (DRL)

The Daytime Running Lamps (DRL) system operates the low beam headlamps at a reduced intensity. The SJB supplies pulse width modulated voltage to illuminate the low beam headlamps at a reduced intensity when the following conditions are met:

- The headlamp switch is not in the HEADLAMPS ON position.
- The ignition switch is in the RUN position.
- The transmission is not in PARK (P).

The SJB can be configured to turn the DRL on for this vehicle. Refer to Section 418-01 for programmable parameter information.

Diagnostic Trouble Code (DTC) Chart

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	GO to Pinpoint Test D .
B1499	Lamp Turn Signal Left Circuit Failure	GO to Pinpoint Test M .
B1502	Lamp Turn Signal Left Circuit Short to Ground	GO to Pinpoint Test M .
B1503	Lamp Turn Signal Right Circuit Failure	GO to Pinpoint Test M .
B1506	Lamp Turn Signal Right Circuit Short to Ground	GO to Pinpoint Test M .
B1510	Flash to Pass Switch Circuit Short to Ground	GO to Pinpoint Test D .
B1570	Lamp Headlamp High-Beam Circuit Short to Ground	GO to Pinpoint Test C .
B1578	Lamp Park Input Circuit Short to Ground	GO to Pinpoint Test P .
B1696	Autolamp On Circuit Short to Ground	GO to Pinpoint Test G .
B1791	Autolamp Sensor Input Circuit Open	GO to Pinpoint Test G .
B1793	Autolamp Sensor Input Circuit Short to Ground	GO to Pinpoint Test F .
B1797	Lamp Headlamp Low-Beam Circuit Short to Ground	GO to Pinpoint Test B .
B2008	Wipers On Signal Circuit Short to Ground	GO to Pinpoint Test G .
B2030	Front Fog Lamp Relay Ckt Failure	GO to Pinpoint Test Q .
B2048	Left Rear Turn Lamp Circuit Short to Ground	For Explorer or Explorer Sport Trac, GO to Pinpoint Test I . For Mountaineer, GO to Pinpoint Test M .
B2049	Left Rear Turn Lamp Circuit Open	For Explorer or Explorer Sport Trac, if the lamp is inoperative, GO to Pinpoint Test I . For Explorer or Explorer Sport Trac, if the lamp is always on, GO to Pinpoint Test J . For Mountaineer, GO to Pinpoint Test M .
B2050	Right Rear Turn Lamp Circuit Short to Ground	For Explorer or Explorer Sport Trac, GO to Pinpoint Test I . For Mountaineer, GO to Pinpoint Test M .

B2051	Right Rear Turn Lamp Circuit Open	For Explorer or Explorer Sport Trac, if the lamp is inoperative, GO to Pinpoint Test I . For Explorer or Explorer Sport Trac, if the lamp is always on, GO to Pinpoint Test J . For Mountaineer, GO to Pinpoint Test M .
B2070	Trailer Tow Relay Coil(s) Circuit Failure	If the LH trailer stoplamp is inoperative, GO to Pinpoint Test Z . If the RH trailer stoplamp is inoperative, GO to Pinpoint Test AA .
B2071	Hazard Switch Signal Short to Ground	GO to Pinpoint Test N .
B2254	Front Fog Lamp Switch Failure	GO to Pinpoint Test S .
B2281	Right Turn Switch Short to Ground	GO to Pinpoint Test L .
B2282	Left Turn Switch Short to Ground	GO to Pinpoint Test L .
B2382	Backup Light Relay Circuit - Open	CLEAR the DTC. REPEAT the on-demand self-test. If DTC B2382 is retrieved again, INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.
B2407	Backup Light Relay Circuit - High	CLEAR the DTC. REPEAT the on-demand self-test. If DTC B2407 is retrieved again, INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.
B2501	LF Lamp Low Beam Circuit Failure	If the low beam is inoperative, GO to Pinpoint Test B . If the low beam is always on, GO to Pinpoint Test D .
B2503	RF Lamp Low Beam Circuit Failure	If the low beam is inoperative, GO to Pinpoint Test B . If the low beam is always on, GO to Pinpoint Test D .
B2505	LF Lamp High Beam Circuit Failure	If the high beam is inoperative, GO to Pinpoint Test C . If the high beam is always on, GO to Pinpoint Test D .
B2507	RF Lamp High Beam Circuit Failure	If the high beam is inoperative, GO to Pinpoint Test C . If the high beam is always on, GO to Pinpoint Test D .
B2512	Front Fog Lamp Relay Ckt Short to Battery	If the fog lamps are inoperative, GO to Pinpoint Test Q . If the fog lamps are always on, GO to Pinpoint Test S .
C1446	Brake Switch Circuit Failure	GO to Pinpoint Test J .
C1788	Stoplamp Relay Output Circuit Short to Ground	GO to Pinpoint Test I .
C1961	Park Lamp Relay Coil Circuit Failure	INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.
All other DTCs	-	REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

Headlamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB does not detect any of the inputs to the headlamp switch is active (routed to ground) for 5 seconds, the SJB turns on the exterior lights and keeps them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB does not detect any headlamp switch input if the ignition switch was already off). If the SJB detects multiple circuits short to ground, the SJB implements a planned strategy depending on the multiple inputs received. If either of these situations occur, the SJB should not be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

The SJB also monitors the multifunction switch for a flash-to-pass or high beam request. There are 2 voltage reference circuits which monitor this. When the multifunction switch is in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground.

When the SJB receives an input requesting the headlamps on, the SJB supplies voltage to the low beam and high beam bulbs as necessary.

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, a headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A continuous DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the FET circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (FET protection) and the circuit remains shorted, the FET protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each FET protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the FET and the ability of the FET to withstand it. A module lifetime level of fault events is established based upon the durability of the FET . If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful self-test proves that the fault has been repaired. After the self-test has successfully completed (no on-demand DTCs present), the continuous DTC automatically clears and the circuit function returns.

When the first or second level is reached, the continuous DTC (associated with the short circuit) sets along with DTC B106E. These DTCs can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch • Multifunction switch	• Battery Junction Box (BJB) fuse(s): ♦ 29 (15A) (RH headlamp) ♦ 34 (15A) (LH headlamp) • Bulb(s) • Wiring, terminals or connectors • Smart Junction Box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: Both High Beams Are Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

When the headlamp switch is placed in the HEADLAMPS ON position, the Smart Junction Box (SJB) monitors the high beam request circuit from the multifunction switch through circuit CLF17 (WH/OG). When the multifunction switch is placed in the HIGH BEAM position, the signal is routed to ground through circuit GD145 (BK/BU). The SJB then supplies voltage to the high beam headlamps.

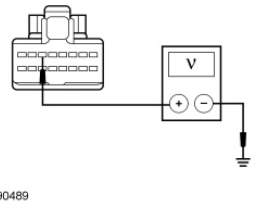
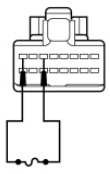
This pinpoint test is intended to diagnose the following:

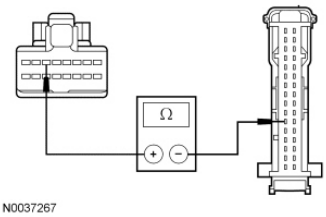
- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST A: BOTH HIGH BEAMS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
A1 CHECK FOR VOLTAGE TO THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Measure the voltage between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and ground.  N0090489 • **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** GO to A3 .
A2 CHECK THE MULTIFUNCTION SWITCH	
• Connect a fused jumper wire between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and the multifunction switch C202-8, circuit GD145 (BK/BU), harness side.  N0057365 • Place the headlamp switch in the HEADLAMPS ON position. • **Do the high beams illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation. **No** REMOVE the jumper wire. REPAIR circuit GD145 (BK/BU) for an open. TEST the system for normal operation.
A3 CHECK CIRCUIT CLF17 (WH/OG) FOR AN OPEN	

• Measure the resistance between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and the SJB C2280d-11, circuit CLF17 (WH/OG), harness side.  N0037267 • **Is the resistance less than 5 ohms?**	**Yes** GO to A4 . **No** REPAIR circuit CLF17 (WH/OG) for an open. TEST the system for normal operation.
A4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: One Low Beam Headlamp Is Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) receives voltage from the Battery Junction Box (BJB) through circuits SBB34 (YE/RD) (LH headlamp) and SBB29 (GY/RD) (RH headlamp). When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage through circuits CLF04 (BN/BU) (LH headlamp) and CLF05 (BU/GN) (RH headlamp) to the low beam headlamps. Ground is supplied on circuits GD120 (BK/GN) (LH headlamp) and GD123 (BK/GY) (RH headlamp).

- DTC B1797 (Lamp Headlamp Low-Beam Circuit Short to Ground) - a continuous and on-demand DTC that sets when the SJB detects a short to ground (high amperage draw) from the LH or RH low beam voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the low beam voltage supply.
- DTC B2501 (LF Lamp Low Beam Circuit Failure) - a continuous and on-demand DTC that sets when the SJB detects an open from the LH low beam voltage supply circuit.
- DTC B2503 (RF Lamp Low Beam Circuit Failure) - a continuous and on-demand DTC that sets when the SJB detects an open from the RH low beam voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Fuse

- Wiring, terminals or connectors
- SJB

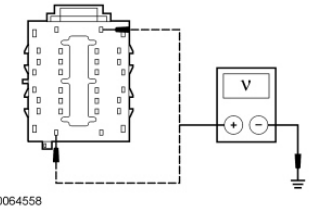
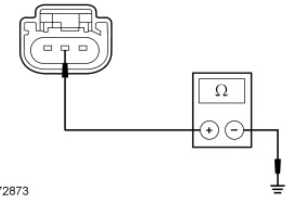
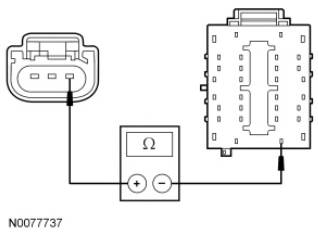
PINPOINT TEST B: ONE LOW BEAM HEADLAMP IS INOPERATIVE

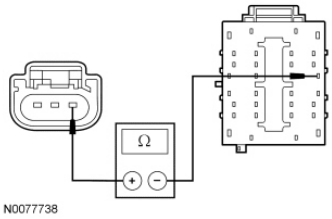
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Due to the varying wattage ratings and resulting current draw of certain aftermarket headlamp bulbs, the SJB may activate its short circuit protection strategy, resulting in the low beam output circuit becoming inoperative. Make sure that the bulbs meet Ford specifications. If the bulbs do not meet Ford specifications, install the correct bulbs. Run the on-demand self-test (required to clear certain DTCs and reset the SJB). Correct any unresolved DTCs. Clear all DTCs. Test the system for normal operation.

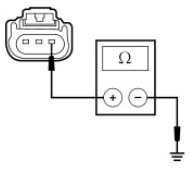
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
B1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded DTCs from the SJB self-test. • **Is DTC B1797 recorded?**	**Yes** GO to B6 . **No** GO to B2 .
B2 CHECK THE HIGH BEAM OPERATION	
• Ignition ON. • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position and observe the headlamp in question. • **Does the high beam in the headlamp in question illuminate?**	**Yes** GO to B5 . **No** TURN the headlamps off. GO to B3 .
B3 CHECK CIRCUIT SBB34 (YE/RD) (LH HEADLAMP) OR CIRCUIT SBB29 (GY/RD) (RH HEADLAMP) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280e. • Measure the voltage between the SJB C2280e-2 (LH headlamp), circuit SBB34 (YE/RD), harness side and ground; or between the SJB C2280e-31 (RH headlamp), circuit SBB29 (GY/RD), harness side and ground.	**Yes** GO to B4 . **No** VERIFY the BJB fuse 34 (20A) or fuse 29 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

 N0064558 • **Is the voltage greater than 10 volts?**	
B4 CHECK CIRCUIT GD120 (BK/GN) (LH HEADLAMP) OR CIRCUIT GD123 (BK/GY) (RH HEADLAMP) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Disconnect: Inoperative Headlamp. • Measure the resistance between the LH headlamp C1284-2 or C1021-2, circuit GD120 (BK/GN), harness side and ground; or between the RH headlamp C1285-2 or C1041-2, circuit GD123 (BK/GY), harness side and ground.  N0072873 • **Is the resistance less than 5 ohms?**	**Yes** GO to B7 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
B5 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR AN OPEN	
• Ignition OFF. • Disconnect: Inoperative Headlamp. • Disconnect: SJB C2280e. • If the LH low beam is inoperative, measure the resistance between the LH headlamp C1284-1 or C1021-3, circuit CLF04 (BN/BU), harness side and the SJB C2280e-3, circuit CLF04 (BN/BU), harness side.  N0077737 • If the RH low beam is inoperative, measure the resistance between the RH headlamp C1285-1 or C1041-3, circuit CLF05 (BU/GN), harness side and	**Yes** GO to B7 . **No** REPAIR the circuit in question. CLEAR any DTCs. REPEAT the self-test.

the SJB C2280e-20, circuit CLF05 (BU/GN), harness side.  N0077738 • **Is the resistance less than 5 ohms?**	
B6 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: Inoperative Headlamp. • Disconnect: SJB C2280e. • Measure the resistance between the inoperative headlamp, harness side and ground as follows:	**Yes** GO to B7 . **No** REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

Inoperative Low Beam	Vehicle	Headlamp Connector-Pin/Circuit
LH	Explorer Explorer Sport Trac	C1284-1 CLF04 (BN/BU)
RH	Explorer Explorer Sport Trac	C1285-1 CLF05 (BU/GN)
LH	Mountaineer	C1021-3 CLF04 (BN/BU)
RH	Mountaineer	C1041-3 CLF05 (BU/GN)



N0066278

• **Is the resistance greater than 10,000 ohms?**

B7 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: One High Beam Headlamp Is Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

When the Smart Junction Box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB sends voltage through circuits CLF02 (GY/BN) (LH headlamp) and CLF03 (VT/OG) (RH headlamp) to the high beam headlamps.

- DTC B1570 (Lamp Headlamp High-Beam Circuit Short to Ground) - a continuous and on-demand DTC that sets when the SJB detects a short to ground (high amperage draw) from the LH or RH high beam voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the high beam voltage supply.
- DTC B2505 (LF Lamp High Beam Circuit Failure) - a continuous and on-demand DTC that sets when the SJB detects an open from the LH high beam voltage supply circuit.
- DTC B2507 (RF Lamp High Beam Circuit Failure) - a continuous and on-demand DTC that sets when the SJB detects an open from the RH high beam voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST C: ONE HIGH BEAM HEADLAMP IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Due to the varying wattage ratings and resulting current draw of certain aftermarket headlamp bulbs, the SJB may activate its short circuit protection strategy, resulting in the low beam output circuit becoming inoperative. Make sure that the bulbs meet Ford specifications. If the bulbs do not meet Ford specifications, install the correct bulbs. Run the on-demand self-test (required to clear certain DTCs and reset the SJB). Correct any unresolved DTCs. Clear all DTCs. Test the system for normal operation.

Test Step	Result / Action to Take
C1 CHECK THE LOW BEAMS	

<table>
<tr><td>• NOTE: Make sure the multifunction switch is in the LOW BEAM position.
• Place the headlamp switch in the HEADLAMPS ON position.
• Is the low beam in the headlamp in question illuminated?</td><td>Yes
GO to C2 .

No
GO to Pinpoint Test B .</td></tr>
<tr><td>C2 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST</td><td></td></tr>
<tr><td>• Place the headlamp switch in the OFF position.
• Check the recorded results from the SJB self-test.
• Is DTC B1570 recorded?</td><td>Yes
GO to C3 .

No
GO to C4 .</td></tr>
<tr><td>C3 CHECK CIRCUIT CLF02 (GY/BN) (LH HEADLAMP) OR CIRCUIT CLF03 (VT/OG) (RH HEADLAMP) FOR A SHORT TO GROUND</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: Inoperative Headlamp.
• Disconnect: SJB C2280e.
• Measure the resistance between the inoperative rear lamp, harness side and ground as follows:

<table>
<tr><th>Inoperative Low Beam</th><th>Vehicle</th><th>Connector-Pin/Circuit</th></tr>
<tr><td>LH</td><td>Explorer

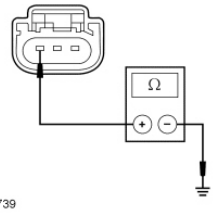
Explorer Sport Trac</td><td>C1284-3

CLF02 (GY/BN)</td></tr>
<tr><td>RH</td><td>Explorer

Explorer Sport Trac</td><td>C1285-3

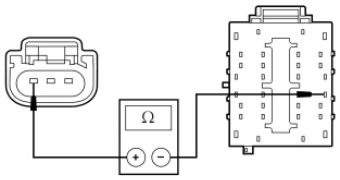
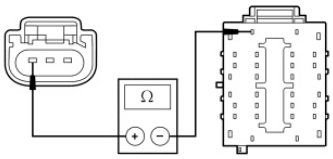
CLF03 (VT/OG)</td></tr>
<tr><td>LH</td><td>Mountaineer</td><td>C1021-1

CLF02 (GY/BN)</td></tr>
<tr><td>RH</td><td>Mountaineer</td><td>C1041-1

CLF03 (VT/OG)</td></tr>
</table>


• Is the resistance greater than 10,000 ohms?</td><td>Yes
GO to C5 .

No
REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.</td></tr>
</table>

C4 CHECK CIRCUIT CLF02 (GY/BN) (LH HEADLAMP) OR CIRCUIT CLF03 (VT/OG) (RH HEADLAMP) FOR AN OPEN	
• Ignition OFF. • Disconnect: Inoperative Headlamp. • Disconnect: SJB C2280e. • If the LH high beam is inoperative, measure the resistance between the LH headlamp C1284-3 or C1021-1, circuit CLF02 (GY/BN), harness side and the SJB C2280e-16, CLF02 (GY/BN), harness side.  N0077740 • If the RH high beam is inoperative, measure the resistance between the RH headlamp C1285-3 or C1041-1, circuit CLF03 (VT/OG), harness side and the SJB C2280e-30, CLF03 (VT/OG), harness side.  N0077741 • **Is the resistance less than 5 ohms?**	**Yes** GO to C5 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Headlamps Are On Continuously

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends reference signals to the headlamp switch through circuits CLF18 (BU/WH), CLF19 (VT/GN), CLF23 (WH/VT) and CLS34 (GY). When the headlamp switch is placed in the HEADLAMPS ON position, the voltage signal is routed to ground through circuit GD145 (BK/BU). If the SJB detects a fault with the headlamp switch inputs, the SJB turns the exterior lamps on by default.

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB sends voltage through circuits CLF04 (BN/BU) (LH headlamp) and CLF05 (BU/GN) (RH headlamp) to the low beam headlamps.

When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB sends voltage through circuits CLF02 (GY/BN) (LH headlamp) and CLF03 (VT/OG) (RH headlamp) to the high beam headlamps.

The SJB sends a reference signal to the multifunction switch through circuits CLF27 (GN/BN) and CLF17 (WH/OG). When the multifunction switch is placed in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground. When the SJB detects a request for the flash-to-pass, the SJB sends voltage to the high beam headlamps.

DTC Description	Fault Trigger Conditions
• B1472 - Lamp Headlamp Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the headlamps on request circuit or no input from the headlamp switch.
• B1510 - Flash-to-Pass Switch Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the flash-to-pass input circuit.
• B2501 - LF Lamp Low Beam Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to voltage from the LH low beam voltage supply circuit.
• B2503 - RF Lamp Low Beam Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to voltage from the RH low beam voltage supply circuit.
• B2505 - LF Lamp High Beam Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to voltage from the LH high beam voltage supply circuit.
• B2507 - RF Lamp High Beam Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects a short to voltage from the RH high beam voltage supply circuit.

This pinpoint test is intended to diagnose the following:

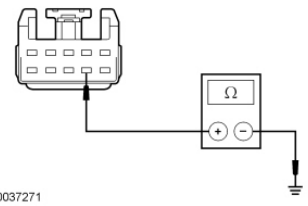
- Wiring, terminals or connectors
- Headlamp switch
- Multifunction switch
- SJB

PINPOINT TEST D: THE HEADLAMPS ARE ON CONTINUOUSLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

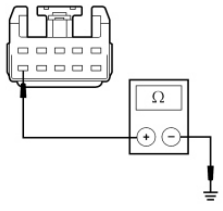
Test Step	Result / Action to Take
D1 VERIFY THE HEADLAMP OPERATION	
• Ignition ON. • Make sure the headlamp switch is in the OFF position and the multifunction switch is in the LOW BEAM position. • **Are the low beam headlamps illuminated?**	**Yes** GO to D2 . **No** GO to D9 .
D2 CHECK FOR AUTOLAMP DTCs	
• Check the recorded DTCs from the SJB self-test. • **Is DTC B1696, B1791, B1793 or B2008 recorded?**	**Yes** REFER to DTC Charts in this section. **No** GO to D3 .
D3 CHECK THE SJB HEADLAMP SWITCH PID	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB headlamp switch PIDs (P_LMP_SW, HEAD_L) while moving the headlamp switch through all positions. • **Do the headlamp switch positions agree with the PIDs?**	**Yes** GO to D8 . **No** GO to D4 .
D4 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to D5 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
D5 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the headlamp switch C205-7, circuit GD145 (BK/BU), harness side and ground.	**Yes** GO to D6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.



- **Is the resistance less than 5 ohms?**

D6 CHECK THE HEADLAMP SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Disconnect: SJB C2280d.
- Measure the resistance between the headlamp switch C205-10, circuit CLF18 (BU/WH), harness side and ground.



- **Is the resistance greater than 10,000 ohms?**

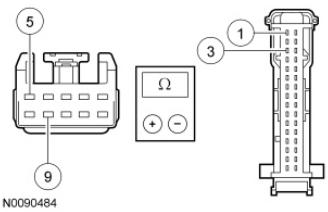
Yes
GO to D7 .

No
REPAIR circuit CLF18 (BU/WH) for an open. CLEAR the DTCs. REPEAT the self-test.

D7 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN

- Measure the resistance between the headlamp switch, harness side and the SJB , harness side as follows:

Headlamp Switch Connector-Pin	Connector-Pin	Circuit
C205-5	C2280d-3	CLS34 (GY)
C205-9	C2280d-1	CLF23 (WH/VT)

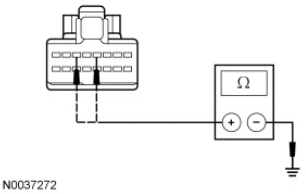


- **Are the resistances less than 5 ohms?**

Yes
GO to D13 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D8 CHECK CIRCUITS CLF04 (BN/BU) (LH HEADLAMP) AND CLF05 (BU/GN) (RH HEADLAMP) FOR A SHORT TO VOLTAGE

• Disconnect: SJB C2280e. • **Does the LH or RH headlamp continue to illuminate?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. **No** GO to D13 .
D9 CHECK THE SJB MULTIFUNCTION SWITCH PIDs	
• Enter the following diagnostic mode on the scan tool: SJB DataLogger. • **NOTE:** Make sure the multifunction switch is in the NEUTRAL position. • Monitor the SJB high beam and flash-to-pass PIDs (HBEAMSW, Pass). • **Do the PIDs indicate the multifunction switch HIGH BEAM or FLASH-TO-PASS position is active?**	**Yes** GO to D10 . **No** GO to D12 .
D10 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB high beam and flash-to-pass PIDs (HBEAMSW, Pass). • **Do the PIDs indicate the multifunction switch HIGH BEAM or FLASH-TO-PASS position is active?**	**Yes** GO to D11 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
D11 CHECK CIRCUIT CLF17 (WH/OG) (HIGH BEAM) AND CIRCUIT CLF27 (GN/BN) (FLASH-TO-PASS) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280d. • Measure the resistance between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and ground; and between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and ground.  N0037272 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D13 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
D12 CHECK CIRCUITS CLF02 (GY/BN) (LH HEADLAMP) AND CLF03 (VT/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF.	**Yes** REPAIR the circuit in question.

• Disconnect: SJB C2280e. • Ignition ON. • **Does the LH or RH headlamp continue to illuminate?**	CLEAR the DTCs. REPEAT the self-test. **No** GO to D13 .
D13 CHECK FOR CORRECT SJB OPERATION	
• Ignition OFF. • Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Flash-To-Pass Feature Is Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a reference signal to the multifunction switch through circuit CLF27 (GN/BN). When the multifunction switch is placed in the FLASH-TO-PASS position, the voltage signal is routed to ground. When the SJB detects a request for the flash-to-pass, the SJB sends voltage to the high beam headlamps.

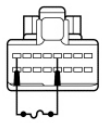
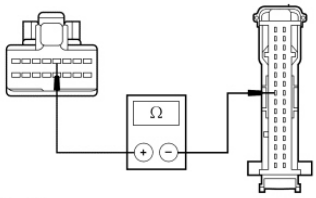
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST E: THE FLASH-TO-PASS FEATURE IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
E1 VERIFY THE HEADLAMP OPERATION	
• Ignition ON. • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position while observing the headlamps. • **Do the high beam headlamps illuminate?**	**Yes** GO to E2 . **No** GO to Pinpoint Test A .
E2 CHECK THE MULTIFUNCTION SWITCH	

• Ignition OFF. • Disconnect: Multifunction Switch C202. • Connect a fused jumper wire between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the multifunction switch C202-8, circuit GD145 (BK/BU), harness side.  N0037273 • **Do the high beam headlamps illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to E3 .
E3 CHECK CIRCUIT CLF27 (GN/BN) FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the SJB C2280d-8, circuit CLF27 (GN/BN), harness side.  N0037274 • **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** REPAIR the circuit. TEST the system for normal operation.
E4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Autolamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB monitors the headlamp switch position by sending multiple voltage reference signals to the headlamp switch. When the headlamp switch is in any given position, that input signal is routed to ground.

The SJB also monitors the light sensor with a voltage reference signal. The light sensor input to the SJB varies with the ambient light conditions.

When the SJB receives an input from the headlamp switch indicating a request for the autolamps, the SJB then monitors the light sensor for the ambient light condition. If the SJB determines the ambient light level is dark, the SJB supplies voltage to the exterior lamps.

Vehicles equipped with autolamps also have a feature that turns on the exterior lamps when the windshield wipers are on. When the SJB detects a ground signal from the windshield wiper motor, the SJB turns the exterior lamps on.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Wiring, terminals or connectors • Light sensor

	• Windshield wiper motor • Smart Junction Box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test F: The Autolamps Are Inoperative

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a reference signal to the headlamp switch through circuit CLF19 (VT/GN) and a signal to the light sensor through circuit VLF14 (BU/BN). Ground for the light sensor is provided by circuit GD145 (BK/BU). When the headlamp switch is placed in the AUTOLAMPS ON position, the voltage signal is routed to ground through circuit GD145 (BK/BU). When the SJB detects the headlamp switch in the AUTOLAMPS ON position, the SJB sends out voltage to the exterior lamps if the ambient light conditions are dark. The light sensor determines the amount of light based on the input received from the ambient sky conditions. When the ambient level has reached a point (determined by the internal programming of the SJB), the SJB sends voltage to the headlamps, parking, and license plate lamps.

- DTC B1793 (Autolamp Sensor Input Circuit Short to Ground) - a continuous and on-demand DTC that sets when the SJB detects a short to ground on the autolamp sensor input circuit.

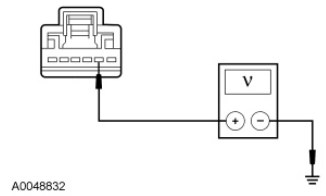
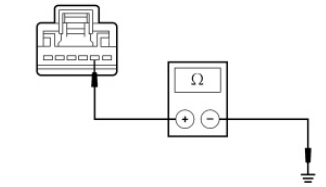
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Light sensor
- SJB

PINPOINT TEST F: THE AUTOLAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
F1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Was DTC B1793 recorded?**	**Yes** GO to F3 . **No** GO to F2 .
F2 CHECK THE MANUAL HEADLAMP OPERATION	
• Ignition OFF. • Place the headlamp switch in the HEADLAMPS ON position. • **Do the headlamps operate correctly?**	**Yes** GO to F3 . **No** REFER to Headlamps in this section.
F3 CHECK FOR VOLTAGE TO THE LIGHT SENSOR	
• Ignition OFF. • Disconnect: Light Sensor C286. • Ignition ON. • Place the headlamp switch in the AUTOLAMPS ON position.	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to F4 .

• Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  A0048832 • **Is the voltage approximately 5 volts?**	
F4 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280d. • Measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  N0037276 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to F5 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
F5 CHECK FOR CORRECT SJB OPERATION	
• Ignition OFF. • Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Autolamps Are On Continuously

Refer to Wiring Diagrams Cell 85 , Headlamps/Autolamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a reference signal to the headlamp switch through circuit CLF19 (VT/GN) for the autolamps request. The SJB also sends a reference signal to the light sensor through circuit VLF14 (BU/BN). Ground for the light sensor is sent through circuit GD145 (BK/BU). When the headlamp switch is placed in the AUTOLAMPS ON position, the voltage signal is routed to ground through circuit GD145 (BK/BU). When the SJB detects the headlamp switch in the AUTOLAMPS ON position, the SJB sends out voltage to the exterior lamps if the ambient light conditions are dark. The light sensor determines the amount of light based on the input received from the ambient sky conditions. When the ambient level has reached a point (determined by the internal programming of the SJB), the SJB sends voltage to the headlamps, parking, and license plate lamps.

The SJB also sends a reference signal to the windshield wiper motor through circuit CRW22 (WH/BU). When the windshield wiper motor is on, the reference signal is routed to ground.

If the SJB detects a fault with the headlamp switch inputs, the exterior lamps are faulted on.

- DTC B1696 (Autolamp On Circuit Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the autolamps on input circuit.
- DTC B1791 (Autolamp Sensor Input Circuit Open) - a continuous and on-demand DTC that sets when the SJB detects an open or short to voltage from the light sensor input circuit.
- DTC B2008 (Wipers On Signal Circuit Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the wipers on input circuit.

This pinpoint test is intended to diagnose the following:

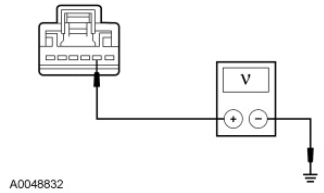
- Wiring, terminals or connectors
- Light sensor
- Headlamp switch
- Windshield wiper motor
- SJB

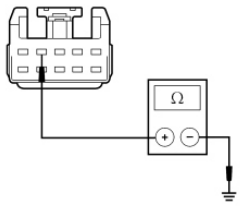
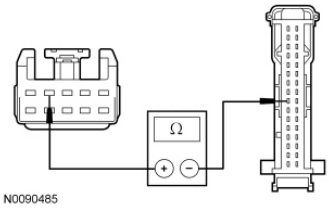
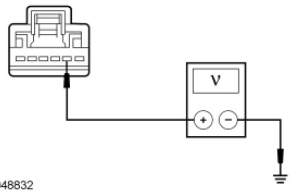
PINPOINT TEST G: THE AUTOLAMPS ARE ON CONTINUOUSLY

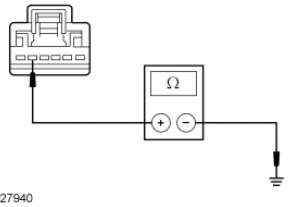
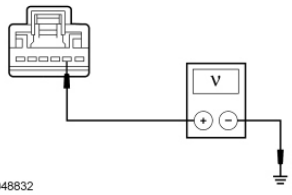
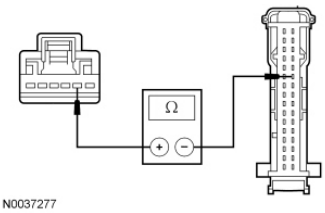
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

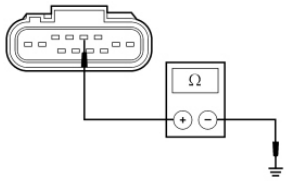
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
G1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Ignition OFF. • Check the recorded results from the SJB self-test. • **Were any DTCs recorded?**	**Yes** For DTC B1696, GO to G4 . For DTC B1791, GO to G7 . For DTC B2008, GO to G11 . For all other DTCs, REFER to the DTC Chart in this section.

	No GO to G2 .
G2 CHECK THE SJB HEADLAMP SWITCH PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB headlamp switch PID (AUTOLMP) while moving the headlamp switch from the OFF to the AUTOLAMPS ON position. • **Do the headlamp switch positions agree with the PID?**	**Yes** GO to G3 . **No** GO to G4 .
G3 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (NO DTC)	
• Ignition OFF. • Disconnect: Light Sensor C286. • Ignition ON. • Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  A0048832 • **Is the voltage approximately 5 volts?**	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. TEST the system for normal operation. **No** GO to G13 .
G4 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** If no DTC was recorded, GO to G6 . If DTC B1696 was recorded , GO to G5 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
G5 CHECK THE AUTOLAMP REQUEST INPUT CIRCUIT FOR A SHORT TO GROUND	
• Disconnect: SJB C2280d. • Measure the resistance between the headlamp switch C205-4, circuit CLF19 (VT/GN), harness side and ground.	**Yes** GO to G13 . **No** REPAIR circuit CLF19 (VT/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test.

 N0084274 • **Is the resistance greater than 10,000 ohms?**	
G6 CHECK THE AUTOLAMP REQUEST INPUT CIRCUIT FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the headlamp switch C205-4, circuit CLF19 (VT/GN), harness side and the SJB C2280d-9, circuit CLF19 (VT/GN), harness side.  N0090485 • **Is the resistance less than 5 ohms?**	**Yes** GO to G13 . **No** REPAIR circuit CLF19 (VT/GN) for an open. CLEAR the DTCs. REPEAT the self-test.
G7 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC B1791)	
• Disconnect: Light Sensor C286. • Ignition ON. • Place the headlamp switch in the AUTOLAMPS ON position. • Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  A0048832 • **Is the voltage approximately 5 volts?**	**Yes** GO to G8 . **No** GO to G9 .
G8 CHECK CIRCUIT GD145 (BK/BU) FOR AN OPEN	

• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the light sensor C286-5, circuit GD145 (BK/BU), harness side and ground.  A0027940 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new light sensor. REFER to Light Sensor in this section. TEST the system for normal operation. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G9 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280d. • Ignition ON. • Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.  A0048832 • **Is any voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to G10 .
G10 CHECK CIRCUIT VLF14 (BU/BN) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and the SJB C2280d-22, circuit VLF14 (BU/BN), harness side.  N0037277 • **Is the resistance less than 5 ohms?**	**Yes** GO to G13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G11 CHECK THE WINDSHIELD WIPER MOTOR	
• Disconnect: Windshield Wiper Motor C125.	**Yes** GO to G12 .

• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Repeat the SJB self-test. • **Is DTC B2008 still present?**	**No** INSTALL a new windshield wiper motor. REFER to Section 501-16 . CLEAR the DTCs. REPEAT the self-test.
G12 CHECK CIRCUIT CRW22 (WH/BU) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280e. • Measure the resistance between the windshield wiper motor C125-2, circuit CRW22 (WH/BU), harness side and ground.  N0046955 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to G13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
G13 CHECK FOR CORRECT SJB OPERATION	
• Ignition OFF. • Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Stoplamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB monitors the input from the stoplamp switch. When the brake pedal is applied, voltage is routed to the SJB . The SJB then supplies voltage to the stoplamps.

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, a headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A continuous DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the FET circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (FET protection) and the circuit remains shorted, the FET protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each FET protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the FET and the ability of the FET to withstand it. A module lifetime level of fault events is established based upon the durability of the FET . If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful self-test proves that the fault has been repaired. After the self-test has successfully completed (no on-demand DTCs present), the continuous DTC automatically clears and the circuit function returns.

When the first or second level is reached, the continuous DTC (associated with the short circuit) sets along with DTC B106E. These DTCs can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Stoplamp switch	• Smart Junction Box (SJB) fuse(s): ♦ 22 (15A) (stoplamp switch) ♦ 27 (15A) (rear stoplamps) (Mountaineer) • Bulb(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.

- Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .
9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .
10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test H: All The Stoplamps Are Inoperative

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The stoplamp switch is supplied voltage through circuit SBP22 (BN/RD) from the Smart Junction Box (SJB). When the brake pedal is applied, the stoplamp switch routes voltage to the SJB through circuit CCB08 (VT/WH) which then supplies voltage to all the stoplamps.

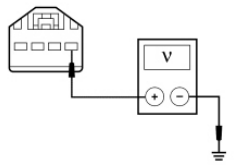
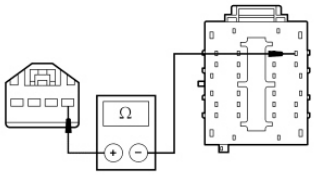
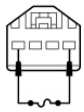
This pinpoint test is intended to diagnose the following:

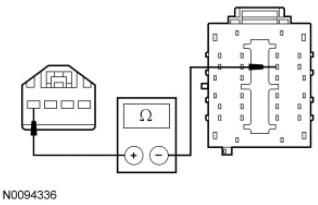
- Fuse
- Wiring, terminals or connectors
- Stoplamp switch
- SJB

PINPOINT TEST H: ALL THE STOPLAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
H1 CHECK CIRCUIT SBP22 (BN/RD) FOR VOLTAGE	

• Ignition OFF. • Disconnect: Stoplamp Switch C278. • Measure the voltage between the stoplamp switch C278-1, circuit SBP22 (BN/RD), harness side and ground.  N0038805 • **Is the voltage greater than 10 volts?**	**Yes** GO to H3 . **No** VERIFY the SJB fuse 22 (15A) is OK. If OK, GO to H2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
H2 CHECK CIRCUIT SBP22 (BN/RD) FOR AN OPEN	
• Disconnect: SJB C2280e. • Measure the resistance between the stoplamp switch C278-1, circuit SBP22 (BN/RD), harness side and the SJB C2280e-28, circuit SBP22 (BN/RD), harness side.  N0094335 • **Is the resistance less than 5 ohms?**	**Yes** GO to H5 . **No** REPAIR the circuit. TEST the system for normal operation.
H3 CHECK THE STOPLAMP SWITCH	
• Connect a fused jumper wire between the stoplamp switch C278-1, circuit SBP22 (BN/RD), harness side and the stoplamp switch C278-4, circuit CCB08 (VT/WH), harness side.  N0038807 • **Do the stoplamps illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new stoplamp switch. REFER to Stoplamp Switch in this section. TEST the system for normal operation. **No** REMOVE the jumper wire. GO to H4 .
H4 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN	

• Disconnect: SJB C2280e. • Measure the resistance between the stoplamp switch C278-4, circuit CCB08 (VT/WH), harness side and the SJB C2280e-23, circuit CCB08 (VT/WH), harness side.  N0094336 • **Is the resistance less than 5 ohms?**	**Yes** GO to H5 . **No** REPAIR the circuit. TEST the system for normal operation.
H5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: One Or More Stoplamps Are Inoperative

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation - All Vehicles

When the brake pedal is applied, the stoplamp switch routes voltage to the Smart Junction Box (SJB). The voltage is then routed out of the SJB to the high mounted stoplamp through circuit CCB08 (VT/WH).

Explorer

When the SJB detects the brake pedal is applied, the SJB provides voltage to the LH and RH rear stoplamps through circuits CLS18 (GY/BN) and CLS19 (VT/OG). Ground for the high mounted stoplamp and the LH rear stoplamp is provided through circuit GD149 (BK/GY). Ground for the RH rear stoplamp is provided through circuit GD151 (BK/GN).

Explorer Sport Trac

When the SJB detects the brake pedal is applied, the SJB provides voltage to the LH and RH rear stoplamps through circuits CLS18 (GY/BN) and CLS19 (VT/OG). Ground for the high mounted stoplamp is provided through circuit GD133 (BK). Ground for the LH and RH rear stoplamps is provided through circuit GD148 (BK/YE).

Mountaineer

When the SJB detects the brake pedal is applied, the SJB provides voltage to the LH and RH rear stoplamps through circuit CLS44 (VT/BN). Ground for the high mounted stoplamp and the LH rear stoplamp is provided

through circuit GD149 (BK/GY). Ground for the RH rear stoplamp is provided through circuit GD151 (BK/GN).

DTC Description	Fault Trigger Conditions
• B2048 - Left Rear Turn Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground from the LH rear turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the LH rear turn lamp voltage supply.
• B2049 - Left Rear Turn Lamp Circuit Open	A continuous and on-demand DTC that sets when the SJB detects an open from the LH rear turn lamp voltage supply circuit.
• B2050 - Right Rear Turn Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground from the RH rear turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the RH rear turn lamp voltage supply.
• B2051 - Right Rear Turn Lamp Circuit Open	A continuous and on-demand DTC that sets when the SJB detects an open from the RH rear turn lamp voltage supply circuit.
• C1788 - Stoplamp Relay Output Circuit Short to Ground	A continuous and on-demand DTC (Mountaineer only) that sets when the SJB detects a short to ground from the rear stoplamp (tricolor stop) voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the rear stoplamp voltage supply.

This pinpoint test is intended to diagnose the following:

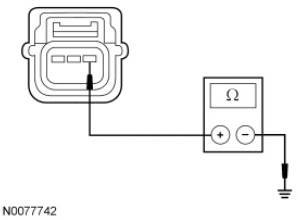
- Fuse
- Wiring, terminals or connectors
- High mounted stoplamp
- LED module
- SJB

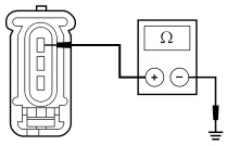
PINPOINT TEST I: ONE OR MORE STOPLAMPS ARE INOPERATIVE

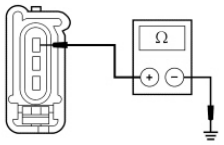
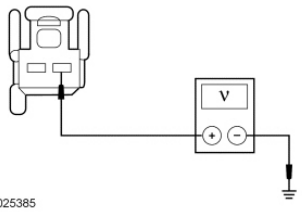
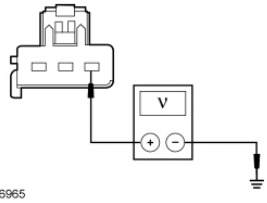
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

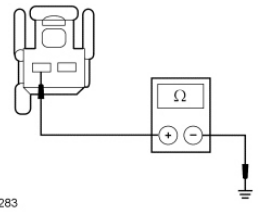
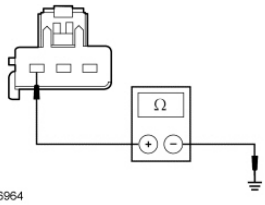
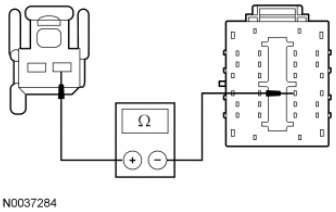
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

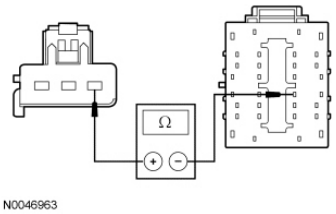
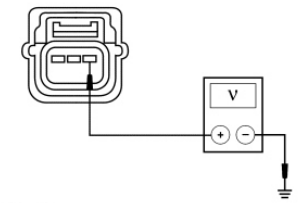
Test Step	Result / Action to Take

I1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC C1788, B2048 or B2050 recorded?**	**Yes** For DTC C1788, GO to I2 . For DTC B2048 or B2050, GO to I5 . **No** GO to I7 .
I2 CHECK THE LH LED MODULE FOR A SHORT TO GROUND	
• Disconnect: LH Rear Lamp C419. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs and repeat the SJB on-demand self-test. • **Is DTC C1788 still present?**	**Yes** GO to I3 . **No** INSTALL a new LED module. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
I3 CHECK THE RH LED MODULE FOR A SHORT TO GROUND	
• Disconnect: RH Rear Lamp C418. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs and repeat the SJB on-demand self-test. • **Is DTC C1788 still present?**	**Yes** GO to I4 . **No** INSTALL a new LED module. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
I4 CHECK CIRCUIT CLS44 (VT/BN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280a. • Measure the resistance between the LH rear lamp C419-1, circuit CLS44 (VT/BN), harness side and ground.  N0077742 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I15 . **No** VERIFY the SJB fuse 27 (15A) is OK. If OK, REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
I5 CHECK THE BULB HOLDER FOR A SHORT TO GROUND	

• Disconnect: Inoperative Stoplamp. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs and repeat the SJB on-demand self-test. • **Is DTC B2048 or B2050 still present?**	**Yes** GO to I6 . **No** INSTALL a new bulb holder in question. TEST the system for normal operation.
I6 CHECK CIRCUIT CLS18 (GY/BN) OR CLS19 (VT/OG) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280a. • For Explorer, measure the resistance between the inoperative rear lamp, harness side and ground as follows: **Inoperative Stoplamp / Connector-Pin / Circuit** LH rear / C4036-3 / CLS18 (GY/BN) RH rear / C4034-3 / CLS19 (VT/OG)  N0090486 • For Explorer Sport Trac, measure the resistance between the inoperative rear lamp, harness side and ground as follows: **Inoperative Stoplamp / Connector-Pin / Circuit** LH rear / C4035-3 / CLS18 (GY/BN) RH rear / C4032-3 / CLS19 (VT/OG)	**Yes** GO to I15 . **No** VERIFY the SJB fuse 22 (15A) is OK. If OK, REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

 N0090487 • **Is the resistance greater than 10,000 ohms?**	
I7 DETERMINE THE INOPERATIVE STOPLAMP	
• Ignition OFF. • Apply the brake pedal. • Verify the high mounted stoplamp operation. • **Is the high mounted stoplamp illuminated?**	**Yes** If one rear stoplamp is inoperative, GO to I11 . For Mountaineer, if both rear stoplamps are inoperative, GO to I13 . For Explorer Sport Trac, if both rear stoplamps are inoperative, GO to I14 . For Explorer, if both rear stoplamps are inoperative, GO to I15 . **No** GO to I8 .
I8 CHECK CIRCUIT CCB08 (VT/WH) FOR VOLTAGE	
• For Explorer or Mountaineer, while applying the brake pedal, measure the voltage between the high mounted stoplamp C475-1, circuit CCB08 (VT/WH), harness side and ground.  A0025385 • For Explorer Sport Trac, while applying the brake pedal, measure the voltage between the high mounted stoplamp C927-3, circuit CCB08 (VT/WH), harness side and ground.  N0046965 • **Is the voltage greater than 10 volts?**	**Yes** GO to I9 . **No** GO to I10 .

I9 CHECK THE HIGH MOUNTED STOPLAMP GROUND CIRCUIT FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Disconnect: High Mounted Stoplamp C475 (Explorer, Mountaineer) or C927 (Explorer Sport Trac). • For Explorer or Mountaineer, measure the resistance between the high mounted stoplamp C475-2, circuit GD149 (BK/GY), harness side and ground.  N0037283 • For Explorer Sport Trac, measure the resistance between the high mounted stoplamp C927-1, circuit GD133 (BK), harness side and ground.  N0046964 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new high mounted stoplamp. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
I10 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN	
• Disconnect: SJB C2280a. • For Explorer or Mountaineer, measure the resistance between the high mounted stoplamp C475-1, circuit CCB08 (VT/WH), harness side and the SJB C2280a-15, circuit CCB08 (VT/WH), harness side.  N0037284 • For Explorer Sport Trac, measure the resistance between the high mounted stoplamp C927-3, circuit CCB08 (VT/WH), harness side and the SJB C2280a-15, circuit CCB08 (VT/WH), harness side.	**Yes** GO to I15 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0046963 • **Is the resistance less than 5 ohms?**	
I11 CHECK THE REAR LAMP GROUND CIRCUIT FOR AN OPEN	
• Place the headlamp switch in the PARKING LAMPS ON position. • **Does the rear lamp in question illuminate?**	**Yes** For Mountaineer, TURN the parking lamps off. GO to I12 . For Explorer or Explorer Sport Trac, TURN the parking lamps off. GO to I13 . **No** REPAIR the ground circuit in question for an open. CLEAR the DTCs. REPEAT the self-test.
I12 CHECK CIRCUIT CLS44 (BU/RD) FOR AN OPEN	
• Disconnect: Inoperative Rear Lamp. • While applying the brake pedal, measure the voltage between the LH rear lamp (LED module) C419-1, circuit CLS44 (BU/RD), harness side and ground; or between the RH rear lamp (LED module) C418-1, circuit CLS44 (BU/RD), harness side and ground.  N0037285 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new LED module. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
I13 CHECK THE REAR STOPLAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Disconnect: Inoperative Rear Lamp. • Disconnect: SJB C2280a. • Measure the resistance between the inoperative rear lamp, harness side and the SJB , harness side as follows:	**Yes** GO to I15 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

Inoperative Stoplamp	Vehicle	Connector-Pin/Circuit	Connector-Pin/Circuit
LH rear	Explorer	C4036-3 CLS18 (GY/BN)	C2280a-25 CLS18 (GY/BN)
RH rear	Explorer	C4034-3 CLS19 (VT/OG)	C2280a-27 CLS19 (VT/OG)
LH rear	Explorer Sport Trac	C4035-3 CLS18 (GY/BN)	C2280a-25 CLS18 (GY/BN)
RH rear	Explorer Sport Trac	C4032-3 CLS19 (VT/OG)	C2280a-27 CLS19 (VT/OG)
LH rear	Mountaineer	C419-1 CLS44 (VT/BN)	C2280a-12 CLS44 (VT/BN)
RH rear	Mountaineer	C418-1 CLS44 (VT/BN)	C2280a-12 CLS44 (VT/BN)

- **Is the resistance less than 5 ohms?**

I14 CHECK CIRCUIT GD148 (BK/YE) FOR AN OPEN	
• Place the headlamp switch in the PARKING LAMPS ON position. • **Are both rear parking lamps inoperative?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to I15 .
I15 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Stoplamps Are On Continuously

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation - All Vehicles

When the brake pedal is applied, the stoplamp switch routes voltage to the Smart Junction Box (SJB), the brake shift interlock actuator, the Trailer Brake Control (TBC) module, the ABS module, and the PCM through circuit CCB08 (VT/WH). The voltage is then routed out of the SJB to the high mounted stoplamp through circuit CCB08 (VT/WH).

Explorer, Explorer Sport Trac

When the SJB detects the brake pedal is applied, the SJB provides voltage to the LH and RH rear stoplamps through circuits CLS18 (GY/BN) and CLS19 (VT/OG).

Mountaineer

When the SJB detects the brake pedal is applied, the SJB provides voltage to the LH and RH rear stoplamps through circuit CLS44 (VT/BN).

- DTC B1446 (Brake Switch Circuit Failure) - an on-demand DTC that sets when the SJB detects a short to voltage from the brake pedal applied input circuit.
- DTC B2049 (Left Rear Turn Lamp Circuit Open) - a continuous and on-demand DTC that sets when the SJB detects a short to voltage from the LH rear turn lamp voltage supply circuit.
- DTC B2051 (Right Rear Turn Lamp Circuit Open) - a continuous and on-demand DTC that sets when the SJB detects an open from the RH rear turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Stoplamp switch
- TBC module
- Brake shift interlock actuator
- ABS module
- PCM
- SJB

PINPOINT TEST J: THE STOPLAMPS ARE ON CONTINUOUSLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
J1 DETERMINE IF ALL THE STOPLAMPS ARE ILLUMINATED	
• Ignition OFF. • Observe the stoplamps with the brake pedal released. • **Are all of the stoplamps illuminated?**	**Yes** GO to J2 . **No** GO to J9 .

J2 CHECK THE STOPLAMP SWITCH	
• Disconnect: Stoplamp Switch C278. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J3 . **No** INSTALL a new stoplamp switch. REFER to Stoplamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
J3 CHECK THE BRAKE SHIFT INTERLOCK ACTUATOR	
• Disconnect: Brake Shift Interlock Actuator C2008. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J4 . **No** INSTALL a new brake shift interlock actuator. REFER to Section 307-05 . CLEAR the DTCs. REPEAT the self-test.
J4 CHECK THE ABS MODULE	
• Disconnect: ABS Module C155. • **Do the stoplamps continue to illuminate?**	**Yes** If equipped with a Trailer Brake Control (TBC) module, GO to J5 . If not equipped with a TBC module, GO to J6 . **No** GO to J10 .
J5 CHECK THE TBC MODULE	
• Disconnect: TBC Module C238. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J6 . **No** INSTALL a new TBC module. CLEAR the DTCs. REPEAT the self-test.
J6 CHECK THE PCM	
• Disconnect: PCM C175b. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J7 . **No** GO to J12 .
J7 CHECK CIRCUIT CCB08 (VT/WH) FOR A SHORT TO VOLTAGE (TO OTHER MODULES)	
• Disconnect: SJB C2280c. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J8 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J8 CHECK CIRCUIT CCB08 (VT/WH) FOR A SHORT TO VOLTAGE (FROM STOPLAMP SWITCH)	

• Disconnect: SJB C2280e. • **Do the stoplamps continue to illuminate?**	**Yes** GO to J9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
J9 CHECK CIRCUIT CCB08 (VT/WH) FOR A SHORT TO VOLTAGE (TO HIGH MOUNTED STOPLAMP)	
• Disconnect: SJB C2280a. • **Do the stoplamps continue to illuminate?**	**Yes** If the high mounted stoplamp continues to illuminate, REPAIR circuit CCB08 (VT/WH). CLEAR the DTCs. REPEAT the self-test. For Explorer or Explorer Sport Trac, if the LH rear lamp continues to illuminate, REPAIR circuit CLS18 (GY/BN). CLEAR the DTCs. REPEAT the self-test. If the RH rear lamp continues to illuminate, REPAIR circuit CLS19 (VT/OG). CLEAR the DTCs. REPEAT the self-test. For Mountaineer, if the rear lamps continue to illuminate, REPAIR circuit CLS44 (VT/BN). CLEAR the DTCs. REPEAT the self-test. **No** GO to J11 .
J10 CHECK FOR CORRECT ABS MODULE OPERATION	
• Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
J11 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	
J12 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Turn Signal and Hazard Lamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB monitors the multifunction switch position by sending multiple voltage reference signals to the multifunction switch. When the multifunction switch is in the LH or RH TURN positions, or the hazard lamp switch is engaged, that input signal is routed to ground.

When the SJB receives an input from the multifunction switch indicating a request for a turn signal or hazard lamps, the SJB cycles the voltage on and off approximately 80 times per minute to the appropriate turn lamps.

If a front or rear turn bulb is inoperative, the SJB cycles the voltage on and off approximately 160 times per minute for bulb outage indication.

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, a headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A continuous DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the FET circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (FET protection) and the circuit remains shorted, the FET protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each FET protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the FET and the ability of the FET to withstand it. A module lifetime level of fault events is established based upon the durability of the FET . If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful self-test proves that the fault has been repaired. After the self-test has successfully completed (no on-demand DTCs present), the continuous DTC automatically clears and the circuit function returns.

When the first or second level is reached, the continuous DTC (associated with the short circuit) sets along with DTC B106E. These DTCs can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the turn lamp system are for the LH front turn lamp output, the RH front turn lamp output, the LH rear turn lamp output (Mountaineer only) and the RH rear turn lamp output (Mountaineer only) circuits. For Explorer and Explorer Sport Trac, the rear turn lamps utilize the stoplamp circuitry.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Multifunction switch	• Bulb(s) • Wiring, terminals or connectors • Smart Junction Box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .

- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test K: The Turn Signal Lamps Are Inoperative

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends reference signals to the multifunction switch through circuits CLS39 (VT/WH) (LH turn input) and CLS41 (GY/YE) (RH turn input). When the multifunction switch is switched to the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB sends voltage to the appropriate turn lamps.

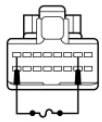
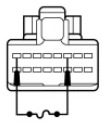
All the turn lamps are wired to the SJB . The timed on/off cycle is determined by the SJB and is set to flash approximately 80 times per minute if both the front and rear turn lamps operate correctly. If only an individual turn signal lamp operates, the SJB flashes the remaining turn lamp approximately 160 times per minute for bulb outage indication.

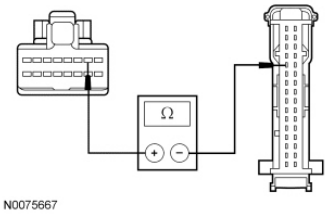
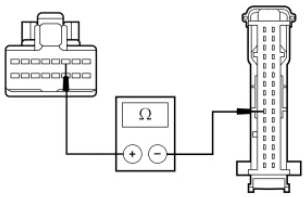
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST K: THE TURN SIGNAL LAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
K1 CHECK FOR CORRECT HIGH BEAM OPERATION	
• Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position while observing the high beam headlamps. • **Do the high beams illuminate?**	**Yes** PLACE the headlamp switch in the OFF position. GO to K2 . **No** REFER to Headlamps in this section.
K2 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • For an inoperative LH turn signal, connect a fused jumper wire between the multifunction switch C202-2, circuit CLS39 (VT/WH), harness side and the multifunction switch C202-8, circuit GD145 (BK/BU), harness side.  N0069012 • For an inoperative RH turn signal, connect a fused jumper wire between the multifunction switch C202-3, circuit CLS41 (GY/YE), harness side and the multifunction switch C202-3, circuit GD145 (BK/BU), harness side.  N0069013 • Ignition ON. • **Do the turn signals in question flash on and off?**	**Yes** REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to K3 .
K3 CHECK CIRCUIT CLS39 (VT/WH) (LH TURN SIGNAL) OR CLS41 (GY/YE) (RH TURN SIGNAL) FOR AN OPEN	

• Ignition OFF. • Disconnect: SJB C2280d. • Ignition ON. • For the LH turn lamps, measure the resistance between the multifunction switch C202-2. circuit CLS39 (VT/WH), harness side and the SJB C2280d-5, circuit CLS39 (VT/WH), harness side.  N0075667 • For the RH turn lamps, measure the resistance between the multifunction switch C202-3, circuit CLS41 (GY/YE), harness side and the SJB C2280d-10, circuit CLS41 (GY/YE), harness side.  N0075668 • **Is the resistance less than 5 ohms?**	**Yes** GO to K4 . **No** REPAIR the circuit. TEST the system for normal operation.
K4 CHECK FOR CORRECT SJB OPERATION	
• Ignition OFF. • Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Turn Signal Lamps Are Always On

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends voltage reference signals to the multifunction switch through circuits CLS39 (VT/WH) (LH turn input) and CLS41 (GY/YE) (RH turn input). When the multifunction switch is switched to the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the

multifunction switch in the LH or RH TURN position, the SJB sends voltage to the appropriate turn lamps.

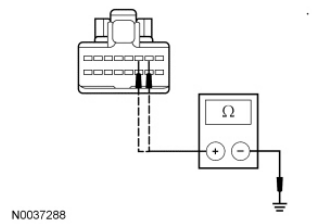
- DTC B2281 (Right Turn Switch Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the RH turn signal input circuit.
- DTC B2282 (Left Turn Switch Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the LH turn signal input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST L: THE TURN SIGNAL LAMPS ARE ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
L1 CHECK THE MULTIFUNCTION SWITCH	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Ignition ON. • **Do the turn lamps continue to flash on and off?**	**Yes** GO to L2 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . CLEAR the DTCs. REPEAT the self-test.
L2 CHECK CIRCUIT CLS39 (VT/WH) (LH TURN SIGNALS) OR CIRCUIT CLS41 (GY/YE) (RH TURN SIGNALS) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280d. • Measure the resistance between the multifunction switch C202-2 (LH turn lamps), circuit CLS39 (VT/WH), harness side and ground; or between the multifunction switch C202-3 (RH turn lamps), circuit CLS41 (GY/YE), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to L3 . **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
L3 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test M: One Turn Signal/Hazard Lamp Is Inoperative/Always On

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation - Explorer, Explorer Sport Trac

When the Smart Junction Box (SJB) detects the multifunction switch in the LH TURN position, the SJB provides voltage through circuit CLS21 (BU/GN) to the LH front turn lamp. When the SJB detects the multifunction switch in the RH TURN position, the SJB provides voltage through circuit CLS25 (YE/VT) to the RH front turn lamp. Circuits GD120 (BK/GN) and GD123 (BK/GY) provide ground for the LH and RH front turn lamps. The rear turn lamps are controlled utilizing the rear stoplamp circuits.

Mountaineer

When the SJB detects the multifunction switch in the LH TURN position, the SJB provides voltage through circuit CLS21 (BU/GN) to the LH front turn and LH side repeater lamps, and through circuit CLS18 (GY/BN) to the LH rear turn lamp. When the SJB detects the multifunction switch in the RH TURN position, the SJB provides voltage through circuit CLS25 (YE/VT) to the RH front turn and RH side repeater lamps, and through circuit CLS19 (VT/OG) to the RH rear turn lamp. Circuits GD120 (BK/GN) and GD123 (BK/GY) provide ground for the LH front turn/side repeater lamps and the RH front turn/side repeater lamps. Circuits GD149 (BK/GY) and GD151 (BK/GN) provide ground for the LH and RH rear turn lamps.

DTC Description	Fault Trigger Conditions
• B1499 - Lamp Turn Signal Left Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects an open or short to voltage from the LH front turn lamp voltage supply circuit.
• B1502 - Lamp Turn Signal Left Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground from the LH front turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the LH front turn lamp voltage supply.
• B1503 - Lamp Turn Signal Right Circuit Failure	A continuous and on-demand DTC that sets when the SJB detects an open or short to voltage from the RH front turn lamp voltage supply circuit.

• B1506 - Lamp Turn Signal Right Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground from the RH front turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the RH front turn lamp voltage supply.
• B2048 - Left Rear Turn Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground from the LH rear turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the LH rear turn lamp voltage supply.
• B2049 - Left Rear Turn Lamp Circuit Open	A continuous and on-demand DTC that sets when the SJB detects an open or short to voltage from the LH rear turn lamp voltage supply circuit.
• B2050 - Right Rear Turn Lamp Circuit Short to Ground	A continuous and on-demand DTC that sets when the SJB detects a short to ground from the RH rear turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the RH rear turn lamp voltage supply.
• B2051 - Right Rear Turn Lamp Circuit Open	A continuous and on-demand DTC that sets when the SJB detects an open or short to voltage from the RH rear turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Bulb holder
- SJB

PINPOINT TEST M: ONE TURN SIGNAL/HAZARD LAMP IS INOPERATIVE/ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
M1 DETERMINE IF A TURN LAMP IS ALWAYS ON	
• Ignition ON. • Observe the turn lamps. • **Is any turn lamp always on?**	**Yes** GO to M2 . **No** GO to M3 .
M2 CHECK THE TURN LAMP VOLTAGE SUPPLY CIRCUITRY FOR A SHORT TO VOLTAGE	

• Ignition OFF. • Disconnect: SJB C2280a (Rear Lamp) or C2280e (Front/Side Repeater Lamp). • Ignition ON. • **Does the turn lamp in question continue to illuminate?**	**Yes** REPAIR circuit CLS21 (BU/GN) (LH front turn lamp), circuit CLS25 (YE/VT) (RH front turn lamp), circuit CLS18 (GY/BN) (LH rear turn lamp), or circuit CLS19 (VT/OG) (RH rear turn lamp) as necessary. CLEAR the DTCs. REPEAT the self-test. **No** GO to M9 .
M3 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC B1502, B1507, B2048 or B2050 recorded?**	**Yes** For a front lamp or side repeater on a Mountaineer, GO to M4 . For all other lamps, GO to M5 . **No** GO to M7 .
M4 CHECK THE SIDE REPEATER BULB HOLDER FOR A SHORT TO GROUND	
• Disconnect: Inoperative Side Repeater Lamp. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs and repeat the SJB on-demand self-test. • **Is DTC B1502 or B1507 still present?**	**Yes** GO to M5 . **No** INSTALL a new side repeater bulb holder in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
M5 CHECK THE BULB HOLDER FOR A SHORT TO GROUND	
• Disconnect: Inoperative Turn Lamp. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs and repeat the SJB on-demand self-test. • **Is DTC B1502, B1507, B2048 or B2050 still present?**	**Yes** GO to M6 . **No** INSTALL a new bulb holder in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
M6 CHECK THE TURN LAMP VOLTAGE SUPPLY CIRCUITRY FOR A SHORT TO GROUND	

NOTE: For the front turn or side repeater lamps on a Mountaineer, both lamps must be disconnected for accurate test results.

- Disconnect: SJB C2280a (Rear Lamp) or C2280e (Front/Side Repeater Lamp).
- Measure the resistance between the inoperative turn lamp, harness side and ground as follows:

Inoperative Turn Lamp	Connector-Pin	Circuit
LH front (Explorer, Explorer Sport Trac)	C1023-3	CLS21 (BU/GN)
RH front (Explorer, Explorer Sport Trac)	C1043-3	CLS25 (YE/VT)
LH front (Mountaineer)	C1115-3	CLS21(BU/GN)
RH front (Mountaineer)	C1116-3	CLS25 (YE/VT)
LH side repeater (Mountaineer)	C1108-1	CLS21 (BU/GN)
RH side repeater (Mountaineer)	C1109-1	CLS25 (YE/VT)
LH rear (Mountaineer)	C413-1	CLS18 (GY/BN)
RH rear (Mountaineer)	C416-1	CLS19 (VT/OG)

- **Is the resistance greater than 10,000 ohms?**

Yes
GO to M10 .

No
REPAIR the circuit in question. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.

M7 CHECK FOR VOLTAGE TO THE INOPERATIVE LAMP WITH THE HAZARD FLASHER LAMP SWITCH ENGAGED

- Ignition OFF.
- Disconnect: Inoperative Turn Lamp.
- Measure the voltage between the inoperative turn lamp, harness side and ground as follows:

	Connector-Pin	Circuit

Yes
GO to M8 .

No
GO to M9 .

Inoperative Turn Lamp		
LH front (Explorer, Explorer Sport Trac)	C1023-3	CLS21 (BU/GN)
RH front (Explorer, Explorer Sport Trac)	C1043-3	CLS25 (YE/VT)
LH front (Mountaineer)	C1115-3	CLS21(BU/GN)
RH front (Mountaineer)	C1116-3	GD123 (YE/VT)
LH side repeater (Mountaineer)	C1108-1	CLS21 (BU/GN)
RH side repeater (Mountaineer)	C1109-1	CLS25 (YE/VT)
LH rear (Mountaineer)	C413-1	CLS18 (GY/BN)
RH rear (Mountaineer)	C416-1	CLS19 (VT/OG)

- **Does the voltage alternate from 0 to greater than 10 volts?**

M8 CHECK THE TURN LAMP GROUND CIRCUITRY FOR AN OPEN

- Disconnect: Negative Battery Cable.
- Measure the resistance between the inoperative turn lamp, harness side and ground as follows:

Inoperative Turn Lamp	Connector-Pin	Circuit
LH front (Explorer, Explorer Sport Trac)	C1023-1	GD120 (BK/GN)
RH front (Explorer, Explorer Sport Trac)	C1043-1	GD123 (BK/GY)
LH front (Mountaineer)	C1115-1	GD120 (BK/GN)
	C1116-1	

Yes
INSTALL a new bulb holder in question. CLEAR the DTCs. REPEAT the self-test.

No
REPAIR the ground circuit in question for an open. CLEAR the DTCs. REPEAT the self-test.

RH front (Mountaineer)		GD123 (BK/GY)
LH side repeater (Mountaineer)	C1108-2	GD120 (BK/GN)
RH side repeater (Mountaineer)	C1109-2	GD123 (BK/GY)
LH rear (Mountaineer)	C413-3	GD149 (BK/GY)
RH rear (Mountaineer)	C416-3	GD151 (BK/GN)

- **Is the resistance less than 5 ohms?**

M9 CHECK THE TURN LAMP VOLTAGE SUPPLY CIRCUITRY FOR AN OPEN

- Disconnect: SJB C2280a (Rear Lamp) or C2280e (Front/Side Repeater Lamp).
- Measure the resistance between the inoperative turn lamp, harness side and the SJB , harness side as follows:

Inoperative Turn Lamp Connector-Pin	SJB Connector-Pin	Circuit
LH front (Explorer, Explorer Sport Trac) C1023-3	C2280e-24	CLS21 (BU/GN)
RH front (Explorer, Explorer Sport Trac) C1043-3	C2280e-27	CLS25 (YE/VT)
LH front (Mountaineer) C1115-3	C2280e-24	CLS21 (BU/GN)
RH front (Mountaineer) C1116-3	C2280e-27	CLS25 (YE/VT)
LH side repeater (Mountaineer) C1108-1	C2280e-24	CLS21 (BU/GN)
RH side repeater (Mountaineer) C1109-1	C2280e-27	CLS25 (YE/VT)
LH rear (Mountaineer) C413-1	C2280a-25	CLS18 (GY/BN)

Yes
GO to M9 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

RH rear (Mountaineer) C416-1	C2280a-27	CLS19 (VT/OG)

- **Is the resistance less than 5 ohms?**

M10 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Hazard Lamps Are Inoperative/Always On

Refer to Wiring Diagrams Cell 90 , Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a voltage reference signal to the multifunction switch through circuit CLS32 (BN/YE). When the hazard switch is switched on, the voltage signal is routed to ground. When the SJB detects a request for the hazard lamps, the SJB sends voltage to the appropriate turn lamps.

- DTC B2071 (Hazard Switch Signal Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the hazard switch input circuit.

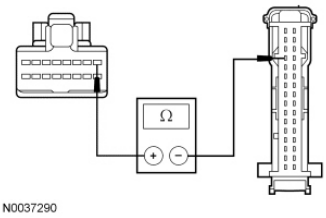
This pinpoint test is intended to diagnose the following:

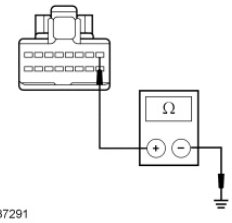
- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST N: THE HAZARD LAMPS ARE INOPERATIVE/ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
N1 CHECK FOR CORRECT HIGH BEAM OPERATION	
• Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the HIGH BEAM position while observing the high beam headlamps.	**Yes** PLACE the headlamp switch in the OFF position. GO to N2 . **No**

• **Do the high beams illuminate?**	REFER to Headlamps in this section.
N2 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Is DTC B2071 present?**	**Yes** GO to N5 . **No** GO to N3 .
N3 CHECK THE MULTIFUNCTION SWITCH (HAZARD LAMPS INOPERATIVE)	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Carry out the multifunction switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the multifunction switch OK?**	**Yes** GO to N4 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
N4 CHECK CIRCUIT CLS32 (BN/YE) FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the multifunction switch C202-1, circuit CLS32 (BN/YE), harness side and the SJB C2280d-4, circuit CLS32 (BN/YE), harness side.  N0037290 • **Is the resistance less than 5 ohms?**	**Yes** GO to N7 . **No** REPAIR the circuit. TEST the system for normal operation.
N5 CHECK THE MULTIFUNCTION SWITCH (HAZARD LAMPS ALWAYS ON)	
• Ignition OFF. • Disconnect: Multifunction Switch C202. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs and repeat the SJB on-demand self-test. • **Is DTC B2071 still present?**	**Yes** GO to N6 . **No** INSTALL a new multifunction switch. REFER to Section 211-05 . TEST the system for normal operation.
N6 CHECK CIRCUIT CLS32 (BN/YE) FOR A SHORT TO GROUND	

• Ignition OFF. • Disconnect: SJB C2280d. • Measure the resistance between the multifunction switch C202-1, circuit CLS32 (BN/YE), harness side and ground.  N0037291 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to N7 . **No** REPAIR the circuit. TEST the system for normal operation.
N7 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Parking, Rear and License Plate Lamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB monitors the headlamp switch position by sending multiple voltage reference signals to the headlamp switch. When the headlamp switch is in any given position, that input signal is routed to ground.

When the SJB receives an input from the headlamp switch indicating a request for the parking lamps, the SJB energizes the parking lamp relay (internal to the SJB), which supplies voltage to the exterior lamps.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Headlamp switch	• Smart Junction Box (SJB) fuse 26 (15A) • Bulb(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test O: One Or More Parking, Rear or License Plate Lamps Is Inoperative

Refer to Wiring Diagrams Cell 92 , Parking, Rear and License Lamps for schematic and connector information.

Normal Operation - Explorer, Mountaineer

When the headlamp switch is switched to the PARKING LAMPS ON position, the Smart Junction Box (SJB) provides a ground for the parking lamp relay coil (integrated into the SJB).

When the parking lamp relay is energized, voltage is routed through circuit CBP26 (BU/WH) to the rear and front parking lamps. Ground is provided to the LH rear parking and license plate lamps through circuit GD149 (BK/GY). Ground for the RH rear parking lamp is provided through circuit GD151 (BK/GN). Ground is provided to the LH front parking lamps through circuit GD120 (BK/GN). Ground is provided to the RH front parking lamps through circuit GD123 (BK/GY).

Explorer Sport Trac

When the headlamp switch is switched to the PARKING LAMPS ON position, the SJB provides a ground for the parking lamp relay coil (integrated into the SJB).

When the parking lamp relay is energized, voltage is sent through circuit CBP26 (BU/WH) to the rear and front parking lamps. Ground is provided to the LH and RH rear parking and license plate lamps through circuit GD148 (BK/YE). Ground is provided to the LH front parking lamps through circuit GD120 (BK/GN). Ground is provided to the RH front parking lamps through circuit GD123 (BK/GY).

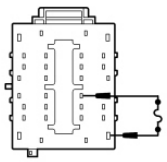
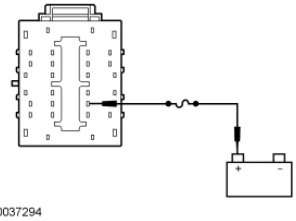
This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Bulb holder
- LED module
- SJB

PINPOINT TEST O: ONE OR MORE PARKING, REAR OR LICENSE PLATE LAMPS IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
O1 CHECK THE STOPLAMPS AND TURN LAMPS	
• Ignition ON. • Operate the turn signals and apply the brake pedal while observing the exterior lamps. • **Do the stoplamps and turn lamps operate correctly?**	**Yes** GO to O2 . **No** REFER to Stoplamps or Turn Signal and Hazard Lamps in this section.
O2 DETERMINE IF ALL THE PARKING LAMPS ARE INOPERATIVE	
• Ignition OFF. • Place the headlamp switch to the PARKING LAMPS ON position. • **Are all the parking lamps inoperative?**	**Yes** VERIFY the SJB fuse 26 (15A) is OK. If OK, GO to O7 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. **No**

	PLACE the headlamp switch in the OFF position. If all front parking lamps are inoperative, GO to O3 . If all rear parking and license plate lamps are inoperative, GO to O4 . If an individual parking or license plate lamp is inoperative, GO to O5 .
O3 CHECK CIRCUIT CBP26 (BU/WH) FOR AN OPEN (FRONT LAMPS)	
• Disconnect: SJB C2280e. • Connect a fused jumper wire between the SJB C2280e-4, circuit SBB02 (YE/RD), harness side and the SJB C2280e-15, circuit CBP26 (BU/WH), harness side.  N0064562 • **Do the front parking lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to O7 . **No** REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.
O4 CHECK CIRCUIT CBP26 (BU/WH) FOR AN OPEN (REAR LAMPS)	
• Disconnect: SJB C2280a. • Connect a fused jumper wire between the positive battery terminal and the SJB C2280a-11, circuit CBP26 (BU/WH), harness side.  N0037294 • **Do the rear parking lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to O7 . **No** REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.
O5 CHECK FOR VOLTAGE TO THE INOPERATIVE PARKING LAMP	

- Disconnect: Inoperative Lamp.
- Place the headlamp switch in the PARKING LAMPS ON position.
- Measure the voltage between the inoperative lamp, harness side and ground as follows:

Yes
GO to O6 .

No
REPAIR circuit CBP26 (BU/WH for an open. TEST the system for normal operation.

Explorer, Explorer Sport Trac

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-2	CBP26 (BU/WH)
RH front	C1043-2	CBP26 (BU/WH)
LH front side marker	C1127-2	CBP26 (BU/WH)
RH front side marker	C1126-2	CBP26 (BU/WH)
LH rear (Explorer)	C4036-2	CBP26 (BU/WH)
RH rear (Explorer)	C4034-2	CBP26 (BU/WH)
LH rear (Explorer Sport Trac)	C4035-2	CBP26 (BU/WH)
RH rear (Explorer Sport Trac)	C4032-2	CBP26 (BU/WH)
LH rear (redundant) (Explorer)	C412-2	CBP26 (BU/WH)
RH rear (redundant) (Explorer)	C415-2	CBP26 (BU/WH)
LH license plate (Explorer)	C454-2	CBP26 (BK)
RH license plate (Explorer)	C464-2	CBP26 (BK)
LH license plate (Explorer Sport Trac)	C452-1	CBP26 (BU/WH)
RH license plate (Explorer Sport Trac)	C462-1	CBP26 (BU/WH)

Mountaineer

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1115-2	CBP26 (BU/WH)
RH front	C1116-2	CBP26 (BU/WH)
LH front side marker	C1127-1	CBP26 (BU/WH)

RH front side marker	C1126-1	CBP26 (BU/WH)
LH rear	C419-3	CBP26 (BU/WH)
RH rear	C418-3	CBP26 (BU/WH)
LH rear side marker	C481-1	CBP26 (BU/WH)
RH rear side marker	C482-1	CBP26 (BU/WH)
LH license plate	C454-2	CBP26 (BK)
RH license plate	C464-2	CBP26 (BK)

- **Is the voltage greater than 10 volts?**

O6 CHECK FOR VOLTAGE TO THE INOPERATIVE PARKING LAMP USING THE CONNECTOR GROUND CIRCUIT

- Measure the voltage between the inoperative lamp connector pins, harness side as follows:

Explorer, Explorer Sport Trac

Inoperative Lamp	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C1023-2 CBP26 (BU/WH)	C1023-1 GD120 (BK/GN)
RH front	C1043-2 CBP26 (BU/WH)	C1043-1 GD123 (BK/GY)
LH front side marker	C1127-2 CBP26 (BU/WH)	C1127-1 GD120 (BK/GN)
RH front side marker	C1126-2 CBP26 (BU/WH)	C1126-1 GD123 (BK/GY)
LH rear (Explorer)	C4036-2 CBP26 (BU/WH)	C4036-1 GD149 (BK/GY)
RH rear (Explorer)	C4034-2 CBP26 (BU/WH)	C4034-1 GD151 (BK/GN)
LH rear (Explorer Sport Trac)	C4035-2 CBP26 (BU/WH)	C4035-1 GD148 (BK/YE)
RH rear (Explorer Sport Trac)	C4032-2 CBP26 (BU/WH0	C4032-1 GD148 (BK/YE)
LH rear (redundant) (Explorer)	C412-2 CBP26 (BU/WH)	C412-1 GD149 (BK/GY)

Yes
INSTALL a new bulb holder or LED module in question. TEST the system for normal operation.

No
REPAIR the ground circuit in question for an open. TEST the system for normal operation.

RH rear (redundant) (Explorer)	C415-2 CBP26 (BU/WH)	C415-1 GD151 (BK/GN)
LH license plate (Explorer)	C454-2 CBP26 (BK)	C454-1 GD149 (BK)
RH license plate (Explorer)	C464-2 CBP26 (BK)	C464-1 GD149 (BK)
LH license plate (Explorer Sport Trac)	C452-1 CBP26 (BU/WH)	C452-2 GD148 (BK/YE)
RH license plate (Explorer Sport Trac)	C462-1 CBP26 (BU/WH)	C462-2 GD148 (BK/YE)

Mountaineer

Inoperative Lamp	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C1115-2 CBP26 (BU/WH)	C1115-1 GD120 (BK/GN)
RH front	C1116-2 CBP26 (BU/WH)	C1116-1 GD123 (BK/GY)
LH front side marker	C1127-1 CBP26 (BU/WH)	C1127-2 GD120 (BK/GN)
RH front side marker	C1126-1 CBP26 (BU/WH)	C1126-2 GD123 (BK/GY)
LH rear	C419-3 CBP26 (BU/WH)	C419-2 GD149 (BK/GY)
RH rear	C418-3 CBP26 (BU/WH)	C418-2 GD151 (BK/GN)
LH rear side marker	C481-1 CBP26 (BU/WH)	C481-2 GD149 (BK/GY)
RH rear side marker	C482-1 CBP26 (BU/WH)	C482-2 GD151 (BK/GN)
LH license plate	C454-2 CBP26 (BK)	C454-1 GD149 (BK)

RH license plate	C464-2 CBP26 (BK)	C464-1 GD149 (BK)

- **Is the voltage greater than 10 volts?**

O7 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test P: The Parking, Rear Or License Plate Lamps Are On Continuously

Refer to Wiring Diagrams Cell 92 , Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

The SJB sends a reference signal to the headlamp switch through circuit CLS34 (GY) to monitor for a parking lamp on request. When the headlamp switch is placed in the PARKING LAMPS ON position, the voltage signal is routed to ground. The SJB then energizes an internal relay, routing voltage through circuit CBP26 (BU/WH) to the rear and front parking lamps.

- DTC B1578 (Lamp Park Input Circuit Short to Ground) - an on-demand DTC that sets when the SJB detects a short to ground from the parking lamp request input circuit.

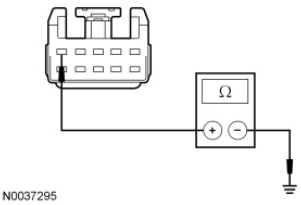
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp switch
- SJB

PINPOINT TEST P: THE PARKING, REAR OR LICENSE PLATE LAMPS ARE ON CONTINUOUSLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
P1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test.	**Yes** GO to P2 .

• **Is DTC B1578 present?**	**No** GO to P4 .
P2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to P3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
P3 CHECK CIRCUIT CLS34 (GY) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280d. • Measure the resistance between the headlamp switch C205-5, circuit CLS34 (GY), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to P6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
P4 CHECK CIRCUIT CBP26 (BU/WH) FOR A SHORT TO VOLTAGE (TO REAR LAMPS)	
• Disconnect: SJB C2280a. • **Do any parking lamps continue to illuminate?**	**Yes** If the rear parking lamps continue to illuminate, REPAIR circuit CBP26 (BU/WH) for a short to voltage. TEST the system for normal operation. If the front parking lamps continue to illuminate, GO to P5 . **No** REPAIR circuit CAT17 (BN) for a short to voltage. TEST the system for normal operation.
P5 CHECK CIRCUIT CBP26 (BU/WH) FOR A SHORT TO VOLTAGE (TO FRONT LAMPS)	
• Disconnect: SJB C2280e. • **Do the front parking lamps continue to illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to P6 .
P6 CHECK FOR CORRECT SJB OPERATION	

• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Fog Lamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB monitors the headlamp switch position by sending a voltage reference signal to the headlamp switch. When the fog lamp switch is engaged, the voltage reference signal is routed to ground.

When the low beam headlamps are on and the SJB receives an input from the headlamp switch indicating a request for the fog lamps, the SJB provides voltage to the fog lamp relay. When the fog lamp relay is energized, voltage is routed to the fog lamps.

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, a headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A continuous DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the FET circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (FET protection) and the circuit remains shorted, the FET protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each FET protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the FET and the ability of the FET to withstand it. A module lifetime level of fault events is established based upon the durability of the FET . If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful self-test proves that the fault has been repaired. After the

self-test has successfully completed (no on-demand DTCs present), the continuous DTC automatically clears and the circuit function returns.

When the first or second level is reached, the continuous DTC (associated with the short circuit) sets along with DTC B106E. These DTCs can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the fog lamp system are the LH fog lamp relay/fog lamps on indicator output circuits.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Battery Junction Box (BJB) fuse 31 (15A) (fog lamps) • Bulb(s) • Wiring, terminals or connectors • Fog lamp relay • Headlamp switch • Smart Junction Box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.

- Check the scan tool connection to the VCM .
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test Q: The Fog Lamps Are Inoperative

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a reference signal to the headlamp switch through circuit CLF21 (GY/VT). When the fog lamp switch is engaged, the voltage signal is routed to ground.

Voltage is supplied to the switched side of the fog lamp relay from the Battery Junction Box (BJB) fuse 31 (15A) through circuit SBB31 (WH/RD).

When the SJB detects the fog lamp on request, the SJB provides a voltage to the fog lamp relay coil through circuit CLF28 (BN/WH). The fog lamp relay coil ground is provided through circuit GD120 (BK/GN). When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps. The fog lamps share a common ground through circuit GD123 (BK/GY).

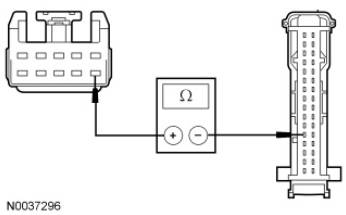
- DTC B2030 (Front Fog Lamp Relay Ckt Failure) - a continuous and on-demand DTC that sets when the SJB detects a short to ground from the fog lamp relay coil ground controlled circuit. The self-test must be run after the repair in order for the SJB to enable the output for the fog lamp voltage supply.
- DTC B2512 (Front Fog Lamp Relay Ckt Short to Battery) - a continuous and on-demand DTC that sets when the SJB detects an open from the fog lamp relay coil voltage supply circuit.

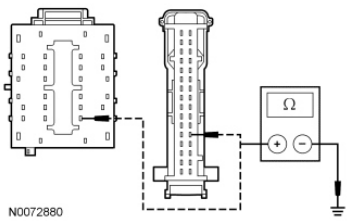
This pinpoint test is intended to diagnose the following:

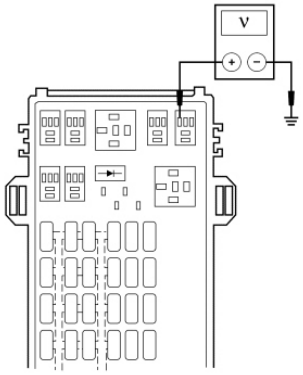
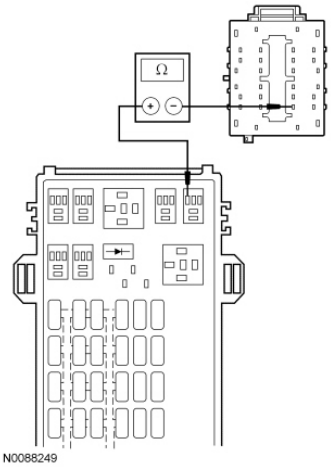
- Fuse
- Wiring, terminals or connectors
- Fog lamp relay
- Headlamp switch
- SJB

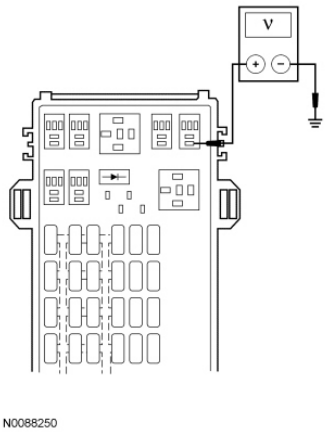
PINPOINT TEST Q: THE FOG LAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
Q1 CHECK THE HEADLAMP SWITCH PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB headlamp switch PID (FOG SW) while engaging the fog lamp switch. • **Does the PID agree with the headlamp switch position?**	**Yes** GO to Q4 . **No** GO to Q2 .
Q2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to Q3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
Q3 CHECK CIRCUIT CLF21 (GY/VT) FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the headlamp switch C205-6, circuit CLF21 (GY/VT), harness side and the SJB C2280d-12, circuit CLF21 (GY/VT), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to Q13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
Q4 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test.	**Yes** For DTC B2030, GO to Q5 .

• **Is DTC B2030 or B2512 present?**	For DTC B2512, GO to Q8 . **No** GO to Q11 .
Q5 CHECK THE FOG LAMP RELAY (DTC B2030)	
• Disconnect: Fog Lamp Relay. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • **NOTE:** DTC B2512 may be present and should be ignored. • Repeat the SJB self-test. • **Is DTC B2030 retrieved again?**	**Yes** GO to Q6 . **No** INSTALL a new fog lamp relay. CLEAR the DTCs. REPEAT the self-test.
Q6 CHECK THE HEADLAMP SWITCH (DTC B2030)	
• Disconnect: Headlamp Switch C205. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • **NOTE:** Other DTCs will be present and should be ignored. • Repeat the SJB self-test. • **Is DTC B2030 retrieved again?**	**Yes** GO to Q7 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
Q7 CHECK CIRCUIT CLF28 (BN/WH) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280d and C2280e. • Measure the resistance between the SJB C2280e-7, circuit CLF28 (BN/WH), harness side and ground; and between the SJB C2280d-28, circuit CLF28 (BN/WH), harness side and ground.  • **Are resistances greater than 10,000 ohms?**	**Yes** GO to Q13 . **No** REPAIR the circuit in question for a short to ground. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
Q8 CHECK THE FOG LAMP RELAY (DTC B2512)	
• Disconnect: Fog Lamp Relay. • Substitute a known good relay. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Command the SJB fog lamp active command (FOG_LMP) on and then off. • **Do the fog lamps illuminate when commanded on?**	**Yes** REMOVE the known good relay. INSTALL a new fog lamp relay. CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the known good relay. GO to Q9 .

Q9 CHECK CIRCUIT CLF28 (BN/WH) FOR VOLTAGE	
• Measure the voltage between the fog lamp relay pin 2, circuit CLF28 (BN/WH), BJB face side and ground.  N0088248 • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Command the SJB fog lamp active command (FOG_LMP) on and then off. • **Is the voltage greater than 10 volts when the fog lamps are commanded on?**	**Yes** REPAIR circuit GD120 (BK/GN) for an open. CLEAR the DTCs. REPEAT the self-test. **No** GO to Q10 .
Q10 CHECK CIRCUIT CLF28 (BN/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280e. • Measure the resistance between the fog lamp relay pin 2, circuit CLF28 (BN/WH), BJB face side and the SJB C2280e-7, circuit CLF28 (BN/WH), harness side.  N0088249 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
Q11 CHECK THE FOG LAMP RELAY (NO DTCs)	

• Disconnect: Fog Lamp Relay. • Substitute a known good relay. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Command the SJB fog lamp active command (FOG_LMP) on and then off. • **Do the fog lamps illuminate when commanded on?**	**Yes** REMOVE the known good relay. INSTALL a new fog lamp relay. TEST the system for normal operation. **No** REMOVE the known good relay. GO to Q12 .
Q12 CHECK CIRCUIT SBB31 (WH/RD) FOR AN OPEN	
• Ignition OFF. • Measure the voltage between the fog lamp relay pin 3, circuit SBB31 (WH/RD), BJB face side and ground.  N0088250 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit CLF12 (BN/YE) for an open. TEST the system for normal operation. **No** VERIFY the BJB fuse 31 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
Q13 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test R: An Individual Fog Lamp Is Inoperative

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

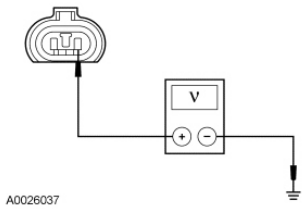
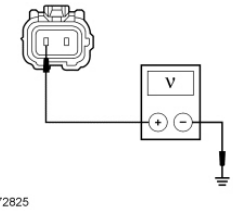
When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps. Ground for the fog lamps is provided through circuit GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

PINPOINT TEST R: AN INDIVIDUAL FOG LAMP IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
R1 CHECK FOR VOLTAGE TO THE FOG LAMP	
NOTE: Make sure the fog lamp bulb is good before continuing diagnostics. • Ignition OFF. • Disconnect: Inoperative Fog Lamp. • Ignition ON. • Place the headlamp switch in the PARKING LAMPS ON position and engage the fog lamp switch. • For all except the Adrenalin package, measure the voltage between the LH fog lamp C152-1, circuit CLF12 (BN/YE), harness side and ground; or between the RH fog lamp C162-1, circuit CLF12 (BN/YE), harness side and ground.  A0026037 • For the Adrenalin package, measure the voltage between the LH fog lamp C1322-A, circuit CLF12 (BN/YE), harness side and ground; or between the RH fog lamp C1323-A, circuit CLF12 (BN/YE), harness side and ground.  N0072825 • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit GD123 (BK/GY) for an open. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR circuit CLF12 (BN/YE) for an open. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test S: The Fog Lamps Are On Continuously

Refer to Wiring Diagrams Cell 86 , Fog Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) sends a reference signal to the headlamp switch through circuit CLF21 (GY/VT). When the fog lamp switch is engaged, the voltage signal is routed to ground.

When the SJB detects the fog lamp on request, the SJB provides a voltage to the fog lamp relay coil through circuit CLF28 (BN/WH). The fog lamp relay coil ground is provided through circuit GD120 (BK/GN). When the fog lamp relay is energized, voltage is sent through circuit CLF12 (BN/YE) to the fog lamps.

- DTC B2254 (Front Fog Lamp Switch Failure) - an on-demand DTC that sets when the SJB detects a short to ground from the fog lamps on input circuit.
- DTC B2512 (Front Fog Lamp Relay Ckt Short to Battery) - a continuous and on-demand DTC that sets when the SJB detects a short to voltage from the fog lamp relay coil voltage supply circuit.

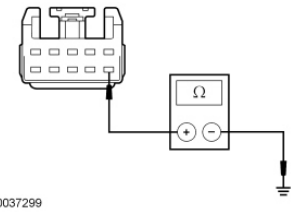
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Fog lamp relay
- Headlamp switch
- SJB

PINPOINT TEST S: THE FOG LAMPS ARE ON CONTINUOUSLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
S1 CHECK THE HEADLAMP SWITCH PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • **NOTE:** Make sure the headlamp switch is in the OFF position. • Monitor the SJB headlamp switch PID (FOG SW). • **Does the PID agree with the headlamp switch position?**	**Yes** GO to S4 . **No** GO to S2 .
S2 CHECK THE HEADLAMP SWITCH	
• Ignition OFF. • Disconnect: Headlamp Switch C205. • Carry out the headlamp switch component test. Refer to Wiring Diagrams Cell 149 for component testing. • **Is the headlamp switch OK?**	**Yes** GO to S3 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
S3 CHECK CIRCUIT CLF21 (GY/VT) FOR A SHORT TO GROUND	

• Disconnect: SJB C2280d. • Measure the resistance between the headlamp switch C205-6, circuit CLF21 (GY/VT), harness side and ground.  N0037299 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to S9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
S4 CHECK CIRCUIT CLF12 (BN/YE) FOR A SHORT TO VOLTAGE	
• Disconnect: Fog Lamp Relay. • **Do the fog lamps continue to illuminate?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to S5 .
S5 CHECK THE FOG LAMP RELAY	
• Substitute a known good relay. • **Do the fog lamps continue to illuminate?**	**Yes** REMOVE the known good relay. INSTALL the original fog lamp relay. GO to S6 . **No** REMOVE the known good relay. INSTALL a new fog lamp relay. CLEAR the DTCs. REPEAT the self-test.
S6 CHECK THE HEADLAMP SWITCH FOR A SHORT TO VOLTAGE	
• Disconnect: Headlamp Switch C205. • **Do the fog lamps continue to illuminate?**	**Yes** GO to S7 . **No** INSTALL a new headlamp switch. REFER to Headlamp Switch in this section. CLEAR the DTCs. REPEAT the self-test.
S7 CHECK CIRCUIT CLF28 (BN/WH) FOR A SHORT TO VOLTAGE (TO HEADLAMP SWITCH)	
• Disconnect: SJB C2280d. • **Do the fog lamps continue to illuminate?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to S8 .
S8 CHECK CIRCUIT CLF28 (BN/WH) FOR A SHORT TO VOLTAGE (TO FOG LAMP RELAY)	

• Disconnect: SJB C2280e. • **Do the fog lamps continue to illuminate?**	**Yes** GO to S9 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
S9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Reversing Lamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB receives transmission gear status from the PCM through the Instrument Cluster (IC) gateway, over the communication network. When a message is sent over the communication network stating the transmission is in REVERSE (R), the SJB energizes an internal relay which supplies voltage to the reversing lamps.

The PCM sets DTCs if there are any concerns with the input from the TR sensor.

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Smart Junction Box (SJB) fuse 15 (10A) • Bulb(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test T: Both Reversing Lamps Are Inoperative

Refer to Wiring Diagrams Cell 93 , Reversing Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) receives the transmission gear status from the powertrain control module (PCM) (5R55S transmission), or the Transmission Control Module (TCM) (6R60 transmission), through the instrument cluster gateway, over the communication network. When the transmission is placed in REVERSE (R), the PCM sends a message over the communication network indicating the transmission is in reverse. The SJB then provides ground to an internal relay, which routes voltage to circuit CBP15 (BN/BU) to the reversing lamps.

The PCM or TCM sets DTCs if there are any concerns with the input from the Transmission Range (TR) sensor.

This pinpoint test is intended to diagnose the following:

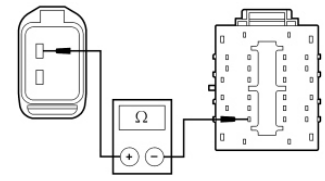
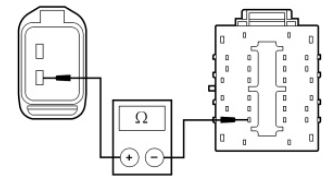
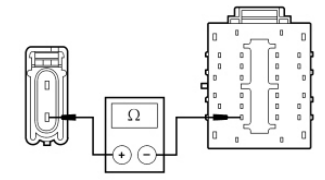
- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST T: BOTH REVERSING LAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Make sure the stoplamps operate correctly before continuing diagnostics.

Test Step	Result / Action to Take
T1 CARRY OUT THE PCM OR TCM SELF-TEST	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: PCM or TCM Self-Test. • Carry out the PCM (5R55S transmission) or the TCM (6R60 transmission) self-test. • **Are any PCM or TCM Transmission Range (TR) sensor DTCs present?**	**Yes** REFER to Section 307-01A or Section 307-01B . **No** GO to T2 .
T2 RETRIEVE THE RESULTS FROM THE SJB SELF-TEST	
• Review the recorded results from the SJB self-test. • **Are any DTCs present?**	**Yes** REFER to Section 419-10 . **No** VERIFY the SJB fuse 15 (10A) is OK. If OK, GO to T3 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
T3 CHECK CIRCUIT CBP15 (BN/BU) FOR AN OPEN	

• Disconnect: LH Reversing Lamp. • Disconnect: SJB C2280a. • For Explorer, measure the resistance between the LH reversing lamp C487-2, circuit CBP15 (BN/BU), harness side and the SJB C2280a-6, circuit CBP15 (BN/BU), harness side.  N0072883 • For Mountaineer, measure the resistance between the LH reversing lamp C487-1, circuit CBP15 (BN/BU), harness side and the SJB C2280a-6, circuit CBP15 (BN/BU), harness side.  N0072884 • For Explorer Sport Trac, measure the resistance between the LH reversing lamp C451-3, circuit CBP15 (BN/BU), harness side and the SJB C2280a-6, circuit CBP15 (BN/BU), harness side.  N0046967 • **Is the resistance less than 5 ohms?**	**Yes** GO to T4 . **No** REPAIR the circuit. CLEAR the DTC. REPEAT the self-test.
T4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

• Operate the system and verify the concern is still present. • **Is the concern still present?**	CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test U: An Individual Reversing Lamp Is Inoperative

Refer to Wiring Diagrams Cell 93 , Reversing Lamps for schematic and connector information.

Normal Operation

When the transmission is placed in REVERSE (R), voltage is routed through circuit CBP15 (BN/BU) to the reversing lamps. The reversing lamps are ground through circuit GD148 (BK/YE) (Explorer Sport Trac), circuit GD149 (BK/GY) (LH reversing lamp, Explorer/Mountaineer), or circuit GD151 (BK/GN) (RH reversing lamp, Explorer/Mountaineer).

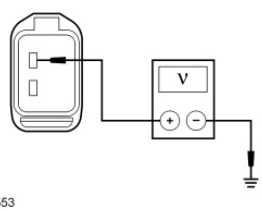
This pinpoint test is intended to diagnose the following:

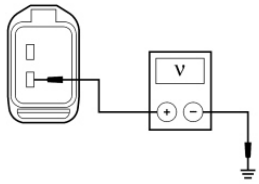
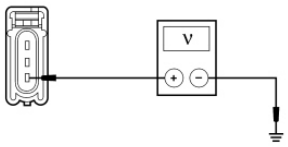
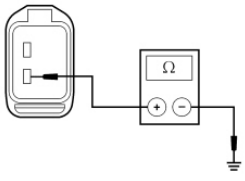
- Wiring, terminals or connectors
- Bulb holder

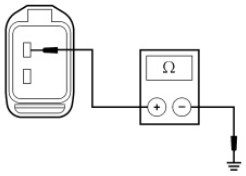
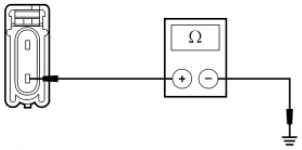
PINPOINT TEST U: AN INDIVIDUAL REVERSING LAMP IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
U1 CHECK FOR VOLTAGE TO THE REVERSING LAMP	
• Ignition OFF. • Disconnect: Inoperative Reversing Lamp. • Apply the parking brake. • Ignition ON. • Select REVERSE. • For Explorer, measure the voltage between the LH reversing lamp C487-2, circuit CBP15 (BN/BU), harness side and ground; or between the RH reversing lamp C488-2, circuit CBP15 (BN/BU), harness side and ground.  A0057553 • For Mountaineer, measure the voltage between the LH reversing lamp C487-1, circuit CBP15 (BN/BU), harness side and ground;	**Yes** GO to U2 . **No** REPAIR circuit CBP15 (BN/BU) for an open. TEST the system for normal operation.

or between the RH reversing lamp C488-1, circuit CBP15 (BN/BU), harness side and ground.  A0057554 • For Explorer Sport Trac, measure the voltage between the LH reversing lamp C451-3, circuit CBP15 (BN/BU), harness side and ground; or between the RH reversing lamp C461-3, circuit CBP15 (BN/BU), harness side and ground.  N0088216 • **Is the voltage greater than 10 volts?**	
U2 CHECK THE REVERSING LAMP GROUND CIRCUIT FOR AN OPEN	
• Select PARK. • Disconnect: Negative Battery Cable. • Ignition OFF. • For Explorer, measure the resistance between the LH reversing lamp C487-1, circuit GD149 (BK/GY), harness side and ground; or between the RH reversing lamp C488-1, circuit GD151 (BK/GN), harness side and ground.  N0072885 • For Mountaineer, measure the resistance between the LH reversing lamp C487-2, circuit GD149 (BK/GY), harness side and ground; or between the RH reversing lamp C488-2, circuit GD151 (BK/GN), harness side and ground.	**Yes** INSTALL a new bulb holder. TEST the system for normal operation. **No** REPAIR the ground circuit in question for an open. TEST the system for normal operation.

 N0072886 • For Explorer Sport Trac, measure the resistance between the LH reversing lamp C451-1, circuit GD148 (BK/YE), harness side and ground; or between the RH reversing lamp C461-1, circuit GD148 (BK/YE), harness side and ground.  A0088192 • **Is the resistance less than 5 ohms?**	

Pinpoint Test V: The Reversing Lamps Are On Continuously

Refer to Wiring Diagrams Cell 93 , Reversing Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) receives the transmission gear status from the PCM (5R55S transmission), or the Transmission Control Module (TCM) (6R60 transmission), through the Instrument Cluster (IC) gateway, over the communication network. When the transmission is placed in REVERSE (R), the PCM sends a message over the communication network indicating the transmission is in reverse. The SJB then provides ground to an internal relay, which routes voltage to circuit CBP15 (BN/BU) to the reversing lamps and the rear view mirror, and through circuit CAT16 (GY/BN) to the trailer tow connector.

The PCM sets DTCs if there are any concerns with the input from the Transmission Range (TR) sensor.

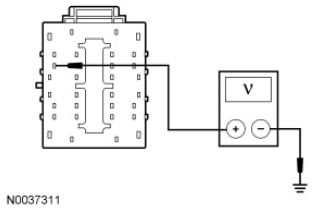
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior rear view mirror
- SJB

PINPOINT TEST V: THE REVERSING LAMPS ARE ON CONTINUOUSLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
V1 CARRY OUT THE PCM OR TCM SELF-TEST	

• Ignition ON. • Enter the following diagnostic mode on the scan tool: PCM or TCM Self-Test. • Carry out the PCM (5R55S transmission) or the TCM (6R60 transmission) self-test. • **Are any PCM or TCM Transmission Range (TR) sensor DTCs present?**	**Yes** REFER to Section 307-01A or Section 307-01B . **No** GO to V2 .
V2 CHECK THE INTERIOR REAR VIEW MIRROR	
• Ignition OFF. • Disconnect: Interior Rear View Mirror C911 or C9012. • Ignition ON. • **Do the reversing lamps continue to illuminate?**	**Yes** GO to V3 . **No** INSTALL a new interior rear view mirror. REFER to Section 501-09 . TEST the system for normal operation.
V3 CHECK CIRCUIT CBP15 (BN/BU) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280a. • Ignition ON. • **Do the reversing lamps continue to illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to V4 .
V4 CHECK CIRCUIT CAT16 (GY/BN) FOR A SHORT TO VOLTAGE	
• Measure the voltage between the SJB C2280a-21, circuit CAT16 (GY/BN), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to V5 .
V5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

• **Is the concern still present?**	

Trailer Lamps

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB uses existing inputs to determine if voltage needs to be supplied to the individual trailer stop/turn lamps. The SJB has separate drivers that provide voltage for the trailer stop/turn lamps. The trailer parking and reversing lamps share the vehicle lighting outputs.

The vehicle is supplied with wiring to support an aftermarket .

The trailer tow battery charging is controlled by a relay. When the ignition switch is in the RUN or ACC position, the trailer tow battery charge relay is energized, which routes voltage to the trailer tow connector.

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, a headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A continuous DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the FET circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (FET protection) and the circuit remains shorted, the FET protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each FET protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the FET and the ability of the FET to withstand it. A module lifetime level of fault events is established based upon the durability of the FET . If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful self-test proves that the fault has been repaired. After the self-test has successfully completed (no on-demand DTCs present), the continuous DTC automatically clears and the circuit function returns.

When the first or second level is reached, the continuous DTC (associated with the short circuit) sets along with DTC B106E. These DTCs can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the trailer lamp system are the LH and RH trailer stop/turn output circuits.

Inspection and Verification

1. Verify the customer concern.
2. Verify the exterior lighting system of the vehicle is operating correctly. If not, refer to the appropriate pinpoint test in this section.
3. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Battery Junction Box (BJB) fuse(s): ♦ 13 (30A) (trailer tow battery charge relay - switched) ♦ 17 (30A) • Smart Junction Box (SJB) fuse(s): ♦ 7 (15A) (trailer stop/turn lamps) ♦ 12 (5A) (trailer tow battery charge relay coil) ♦ 16 (10A) (trailer reversing lamps) ♦ 25 (15A) (trailer parking lamps) • Circuity • Trailer • SJB

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

5. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

6. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

8. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

9. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

10. If the DTCs retrieved are related to the concern, go to Diagnostic Trouble Code (DTC) Chart in this section. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

11. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart
NOTE: When diagnosing the trailer tow lamps, begin by verifying that the vehicle lamp systems are all functioning correctly with the trailer disconnected.

Condition	Possible Sources	Action
• All the trailer lamps are inoperative	• Wiring, terminals or connectors • Trailer tow connector • Trailer	• GO to Pinpoint Test W .
• The trailer lamps are inoperative - parking lamps	• Fuse • Wiring, terminals or connectors	

- Trailer tow connector
- Trailer
- Smart Junction Box (SJB)

- GO to Pinpoint Test X .

- The trailer lamps are inoperative - reversing lamps

- Fuse
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer
- SJB

- GO to Pinpoint Test Y .

- The individual trailer lamp is inoperative - LH stop/turn lamp

- **NOTE:** The SJB can only support 2 stop/turn lamp bulbs per side.

  Wiring, terminals or connectors

- Trailer tow connector
- Trailer
- SJB

- GO to Pinpoint Test Z .

- The individual trailer lamp is inoperative - RH stop/turn lamp

- **NOTE:** The SJB can only support 2 stop/turn lamp bulbs per side.

  Wiring, terminals or connectors

- Trailer tow connector
- Trailer
- SJB

- GO to Pinpoint Test AA .

- The individual trailer lamp is inoperative - both stop/turn lamps

- Fuse
- SJB

- VERIFY the SJB fuse 7 (15A) is OK. If OK, INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

- The trailer lamps are on continuously

- Wiring, terminals or connectors
- Trailer
- SJB

- GO to Pinpoint Test AB .

- The trailer battery charging is inoperative/does not operate correctly

- Fuse
- Wiring, terminals or connectors
- Trailer battery charge relay
- Trailer tow connector
- Trailer
- SJB

- GO to Pinpoint Test AC .

- The trailer electric brakes are inoperative/do not operate correctly

- Fuse
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer

- GO to Pinpoint Test AD .

Pinpoint Tests

Pinpoint Test W: All the Trailer Lamps Are Inoperative

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

Ground for all the trailer lamps is provided through circuit RAT08 (WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Trailer tow connector
- Trailer

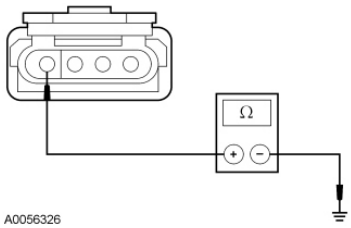
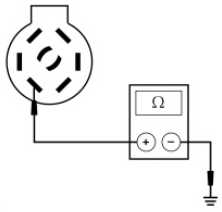
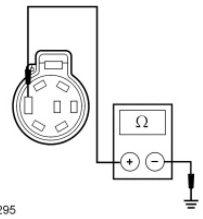
PINPOINT TEST W: ALL THE TRAILER LAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take

W1 CHECK CIRCUIT RAT08 (WH) FOR AN OPEN TO THE TRAILER TOW CONNECTOR	
• Disconnect the trailer from the vehicle. • Disconnect: Negative Battery Cable. • For the 4-pin connector, measure the resistance between the trailer tow C439-4, circuit RAT08 (WH), harness side and ground.  A0056326 • For the 7-pin connector, measure the resistance between the trailer tow connector pin 2, circuit RAT08 (WH), component side and ground.  N0068878 • **Is the resistance less than 5 ohms?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** For the 4-pin connector, REPAIR the circuit. TEST the system for normal operation. For the 7-pin connector, GO to W2 .
W2 CHECK CIRCUIT RAT08 (WH) FOR AN OPEN	
• Disconnect: Trailer Tow C473. • Measure the resistance between the trailer tow C473-2, circuit RAT08 (WH), harness side and ground.  N0066295 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test X: The Trailer Lamps Are Inoperative - Parking Lamps

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

When the vehicle parking lamps are on, the Smart Junction Box (SJB) provides voltage to the trailer parking lamps through circuit CAT17 (BN).

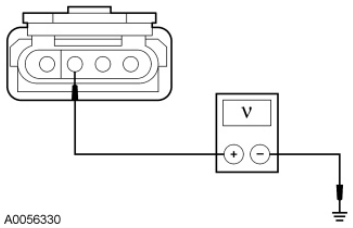
This pinpoint test is intended to diagnose the following:

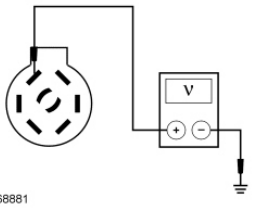
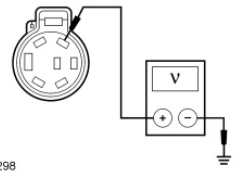
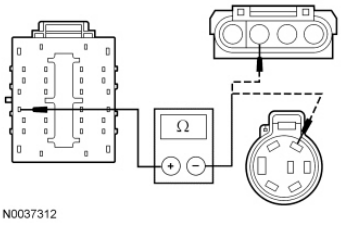
- Fuse
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer
- SJB

PINPOINT TEST X: THE TRAILER LAMPS ARE INOPERATIVE - PARKING LAMPS

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

Test Step	Result / Action to Take
X1 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR	
• Ignition OFF. • Disconnect the trailer from the vehicle. • Place the headlamp switch in the PARKING LAMPS ON position. • For the 4-pin connector, measure the voltage between the trailer tow C439-3, circuit CAT17 (BN), harness side and ground.  A0056330 • For the 7-pin connector, measure the voltage between the trailer tow connector pin 6, circuit CAT17 (BN), component side and ground.	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the SJB fuse 25 (15A) is OK. If OK for the 4-pin connector, GO to X3 . If OK for the 7-pin connector, GO to X2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

 • **Is the voltage greater than 10 volts?**	
X2 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (7-PIN)	
• Disconnect: Trailer Tow C473. • Measure the voltage between the trailer tow C473-6, circuit CAT17 (BN), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** GO to X3 .
X3 CHECK CIRCUIT CAT17 (BN) FOR AN OPEN	
• Place the headlamp switch in the OFF position. • Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-13, circuit CAT17 (BN), harness side and the trailer tow C439-3 (4-pin connector) or C473-6 (7-pin connector), circuit CAT17 (BN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to X4 . **No** REPAIR the circuit. TEST the system for normal operation.
X4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The

	concern may have been caused by a loose or corroded connector.

Pinpoint Test Y: The Trailer Lamps Are Inoperative - Reversing Lamps

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

Voltage to the trailer reversing lamps is supplied by the Smart Junction Box (SJB) through circuit CAT16 (GY/BN).

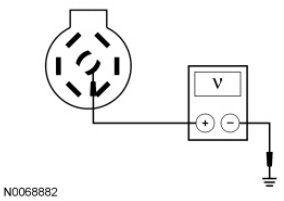
This pinpoint test is intended to diagnose the following:

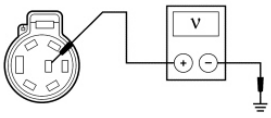
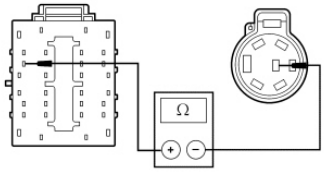
- Fuse
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer
- SJB

PINPOINT TEST Y: THE TRAILER LAMPS ARE INOPERATIVE - REVERSING LAMPS

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

Test Step	Result / Action to Take
Y1 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR	
• Ignition OFF. • Disconnect the trailer from the vehicle. • Apply the parking brake. • Ignition ON. • Select REVERSE. • Measure the voltage between the trailer tow connector pin 7, circuit CAT16 (GY/BN), component side and ground.  	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the SJB fuse 16 (10A) is OK. If OK, GO to Y2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

• **Is the voltage greater than 10 volts?**	
Y2 CHECK FOR VOLTAGE ON CIRCUIT CAT16 (GY/BN)	
• Disconnect: Trailer Tow C473. • Measure the voltage between the trailer tow C473-7, circuit CAT16 (GY/BN), harness side and ground.  A0025848 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** GO to Y3 .
Y3 CHECK CIRCUIT CAT16 (GY/BN) FOR AN OPEN	
• Select PARK. • Ignition OFF. • Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-21, circuit CAT16 (GY/BN), harness side and the trailer tow C473-7, circuit CAT16 (GY/BN), harness side.  N0037313 • **Is the resistance less than 5 ohms?**	**Yes** GO to Y4 . **No** REPAIR the circuit. TEST the system for normal operation.
Y4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Z: The Individual Trailer Lamp Is Inoperative - LH Stop/Turn Lamp

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

Voltage to the LH trailer stop/turn lamp is supplied by the Smart Junction Box (SJB) through circuit CAT06 (YE).

- DTC B2070 (Trailer Tow Relay Coil(s) Circuit Failure) - a continuous DTC that sets when the SJB detects a short to ground from the LH trailer stop/turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the LH trailer stop/turn lamp voltage supply. A trailer equipped with too many LH stop/turn bulbs may also set the DTC.

This pinpoint test is intended to diagnose the following:

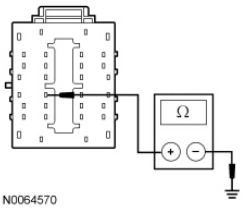
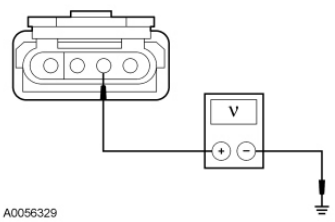
- Trailer equipped with too many bulbs
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer
- SJB

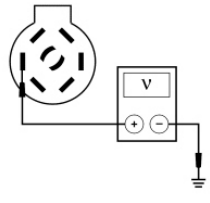
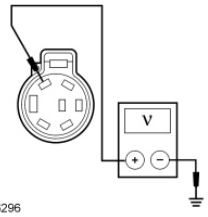
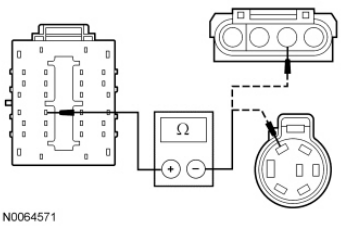
PINPOINT TEST Z: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE - LH STOP/TURN LAMP

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

Test Step	Result / Action to Take
Z1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Was DTC B2070 present?**	**Yes** GO to Z2 . **No** GO to Z6 .
Z2 CLEAR THE DTCs AND REPEAT THE ON-DEMAND SELF-TEST WITH THE TRAILER DISCONNECTED	
• Disconnect the trailer from the vehicle. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the continuous DTCs. Repeat the on-demand self-test. • **Is DTC B2070 still present?**	**Yes** For the 4-pin connector, GO to Z5 . For the 7-pin connector, GO to Z4 . **No** GO to Z3 .
Z3 CHECK THE NUMBER OF BULBS ON THE TRAILER	
• Inspect the trailer for more than 2 LH stop/turn lamp bulbs. • **Are more than 2 LH stop/turn lamp bulbs present?**	**Yes** INFORM the customer that the vehicle can only support 2 stop/turn lamp bulbs per side. Any additional stop/turn lamp bulbs need to be removed from the trailer or an

	adapter kit installed for the trailer tow lamps to operate correctly. **No** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
Z4 CHECK THE TRAILER TOW CONNECTOR	
• Disconnect: Trailer Tow C473. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the continuous DTCs. Repeat the on-demand self-test. • **Is DTC B2070 still present?**	**Yes** GO to Z5 . **No** INSTALL a new trailer tow connector. TEST the system for normal operation.
Z5 CHECK CIRCUIT CAT06 (YE) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-14, circuit CAT06 (YE), harness side and ground.  N0064570 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Z9 . **No** REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
Z6 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR	
• Disconnect the trailer from the vehicle. • Ignition OFF. • For the 4-pin connector, while applying the brake pedal, measure the voltage between the trailer tow C439-2, circuit CAT06 (YE), harness side and ground.  A0056329 • For the 7-pin connector, while applying the brake pedal, measure the voltage between the trailer tow	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. TEST the system for normal operation. **No** For the 4-pin connector, GO to Z8 . For the 7-pin connector, GO to Z7 .

connector pin 1, circuit CAT06 (YE), component side and ground.  N0068879 • **Is the voltage greater than 10 volts?**	
Z7 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (7-PIN)	
• Disconnect: Trailer Tow C473. • While applying the brake pedal, measure the voltage between the trailer tow C473-1, circuit CAT06 (YE), harness side and ground.  N0066296 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** GO to Z8 .
Z8 CHECK CIRCUIT CAT06 (YE) FOR AN OPEN	
• Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-14, circuit CAT06 (YE), harness side and the trailer tow C439-2 (4-pin) or C473-1 (7-pin), circuit CAT06 (YE), harness side.  N0064571 • **Is the resistance less than 5 ohms?**	**Yes** GO to Z9 . **No** REPAIR the circuit. TEST the system for normal operation.
Z9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.

♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AA: The Individual Trailer Lamp Is Inoperative - RH Stop/Turn Lamp

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

Voltage to the RH trailer stop/turn lamp is supplied by the Smart Junction Box (SJB) through circuit CAT09 (GN).

- DTC B2070 (Trailer Tow Relay Coil(s) Circuit Failure) - a continuous DTC that sets when the SJB detects a short to ground from the RH trailer stop/turn lamp voltage supply circuit. The self-test must be run after the repair in order for the SJB to enable the output for the RH trailer stop/turn lamp voltage supply. A trailer equipped with too many RH stop/turn bulbs may also set the DTC.

This pinpoint test is intended to diagnose the following:

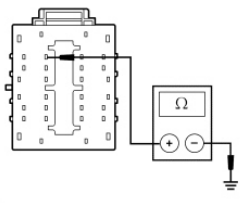
- Trailer equipped with too many bulbs
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer
- SJB

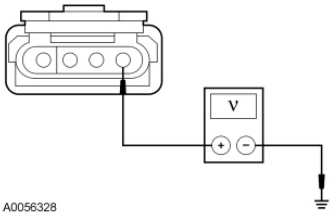
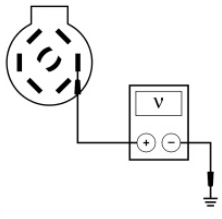
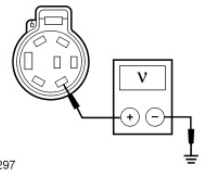
PINPOINT TEST AA: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE - RH STOP/TURN LAMP

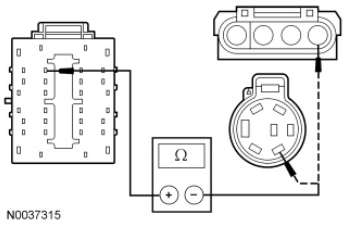
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

Test Step	Result / Action to Take
AA1 CHECK THE RECORDED DTCs FROM THE SJB SELF-TEST	
• Check the recorded results from the SJB self-test. • **Was DTC B2070 present?**	**Yes** GO to AA2 . **No** GO to AA6 .
AA2 CLEAR THE DTCs AND REPEAT THE ON-DEMAND SELF-TEST WITH THE TRAILER DISCONNECTED	
	Yes

• Disconnect the trailer from the vehicle. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the continuous DTCs. Repeat the on-demand self-test. • **Is DTC B2070 still present?**	For the 4-pin connector, GO to AA5 . For the 7-pin connector, GO to AA4 . **No** GO to AA3 .
AA3 CHECK THE NUMBER OF BULBS ON THE TRAILER	
• Inspect the trailer for more than 2 RH stop/turn lamp bulbs. • **Are more than 2 RH stop/turn lamp bulbs present?**	**Yes** INFORM the customer that the vehicle can only support 2 stop/turn lamp bulbs per side. Any additional stop/turn lamp bulbs need to be removed from the trailer or an adapter kit installed for the trailer tow lamps to operate correctly. **No** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
AA4 CHECK THE TRAILER TOW CONNECTOR	
• Disconnect: Trailer Tow 473. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the continuous DTCs. Repeat the on-demand self-test. • **Is DTC B2070 still present?**	**Yes** GO to AA5 . **No** INSTALL a new trailer tow connector. TEST the system for normal operation.
AA5 CHECK CIRCUIT CAT09 (GN) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-26, circuit CAT09 (GN), harness side and ground.  N0064572 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AA9 . **No** REPAIR the circuit. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
AA6 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR	

• Ignition OFF. • Disconnect the trailer from the vehicle. • For the 4-pin connector, while applying the brake pedal, measure the voltage between the trailer tow C439-1, circuit CAT09 (GN), harness side and ground.  A0056328 • For the 7-pin connector, while applying the brake pedal, measure the voltage between the trailer tow connector pin 4, circuit CAT09 (GN), component side and ground.  N0068880 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. TEST the system for normal operation. **No** For the 4-pin connector, GO to AA8 . For the 7-pin connector, GO to AA7 .
AA7 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (7-PIN)	
• Disconnect: Trailer Tow C473. • While applying the brake pedal, measure the voltage between the trailer tow C473-4, circuit CAT09 (GN), harness side and ground.  N0066297 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** GO to AA8 .
AA8 CHECK CIRCUIT CAT09 (GN) FOR AN OPEN	

• Disconnect: SJB C2280a. • Measure the resistance between the SJB C2280a-26, circuit CAT09 (GN), harness side and the trailer tow C439-1 (4-pin) or C473-4 (7-pin), circuit CAT09 (GN), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to AA9 . **No** REPAIR the circuit. TEST the system for normal operation.
AA9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AB: The Trailer Lamps Are On Continuously

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

Voltage to the trailer tow lamps is controlled by the Smart Junction Box (SJB). Circuits CAT06 (YE) and CAT09 (GN) supply voltage to the trailer tow LH and RH stoplamps.

The trailer tow parking lamps share the same voltage supply with the vehicle parking lamps.

This pinpoint test is intended to diagnose the following:

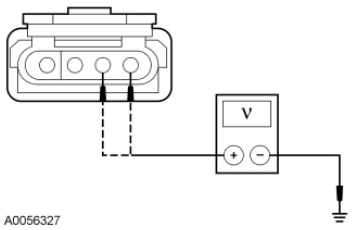
- Wiring, terminals or connectors
- Trailer
- SJB

PINPOINT TEST AB: THE TRAILER LAMPS ARE ON CONTINUOUSLY

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>AB1 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTOR</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect the trailer from the vehicle.
• Ignition ON.
• Measure the voltage between the trailer tow connector, harness side and ground as follows:

<table><tr><th>Suspect Trailer Stoplamp</th><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>LH</td><td>C439-2 (4-pin)</td><td>CAT06 (YE)</td></tr><tr><td>RH</td><td>C439-1 (4-pin)</td><td>CAT09 (GN)</td></tr></table>
 

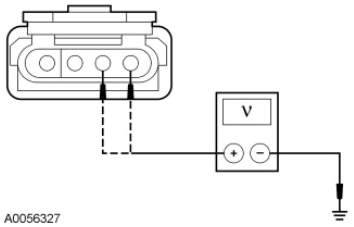
• Is any voltage present?</td><td>Yes
GO to AB2 .

No
The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.</td></tr>
<tr><td>AB2 CHECK THE SJB</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: SJB C2280a.
• Ignition ON.
• Measure the voltage between the trailer tow connector, harness side and ground as follows:

<table><tr><th>Suspect Trailer Stoplamp</th><th>Connector-Pin</th><th>Circuit</th></tr><tr><td>LH</td><td>C439-2 (4-pin)</td><td>CAT06 (YE)</td></tr></table></td><td>Yes
REPAIR the circuit in question. TEST the system for normal operation.

No
GO to AB3 .</td></tr>
</table>

RH	C439-1 (4-pin)	CAT09 (GN)



- **Is any voltage present?**

AB3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CLEAR any DTCs. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AC: The Trailer Battery Charging Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

The trailer battery charge relay coil receives voltage from the Smart Junction Box (SJB) fuse 12 (5A) through circuit CBP12 (GN/WH) when the ignition switch is in the RUN or ACC position. Ground for the trailer battery charge relay coil is supplied through circuit GD120 (BK/GN). The Battery Junction Box (BJB) fuse 13 (30A) supplies voltage to the trailer battery charge relay switch through circuit SSB13 (GY/RD). When the trailer battery charge relay is energized, the voltage is routed to the trailer tow connector through circuit CAT14 (OG).

This pinpoint test is intended to diagnose the following:

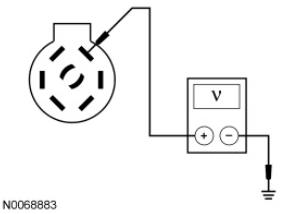
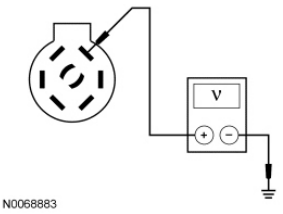
- Fuse
- Wiring, terminals or connectors
- Trailer battery charge relay
- Trailer tow connector
- Trailer
- SJB

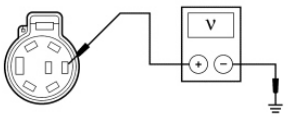
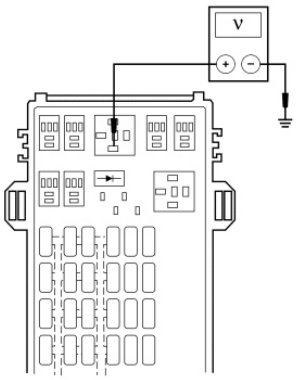
PINPOINT TEST AC: THE TRAILER BATTERY CHARGING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

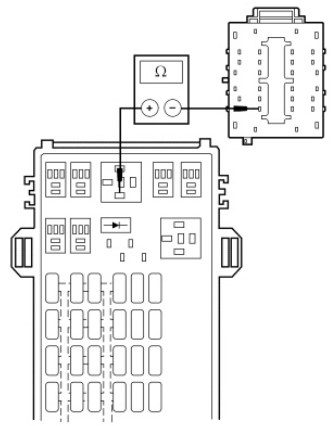
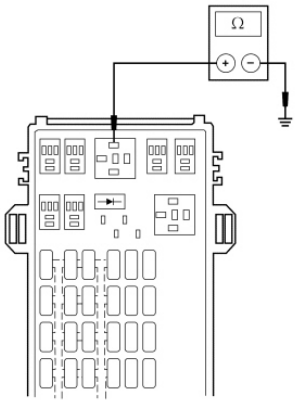
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

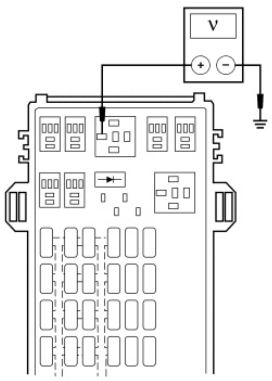
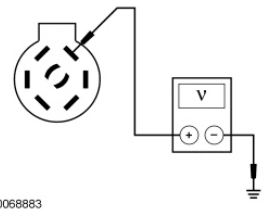
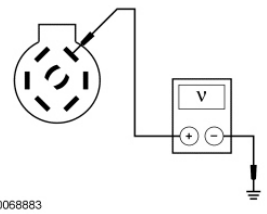
NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

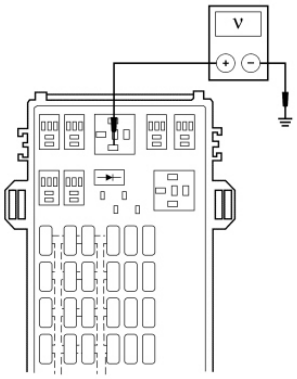
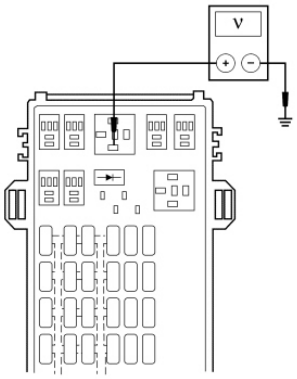
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AC1 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTION (BATTERY CHARGE INOPERATIVE)	
• Ignition OFF. • Disconnect the trailer from the vehicle. • Ignition ON. • Measure the voltage between the trailer tow connector pin 5, circuit CAT14 (OG), component side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to AC8 . **No** VERIFY the BJB fuse 13 (30A) is OK. If OK, GO to AC2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
AC2 CHECK THE TRAILER BATTERY CHARGE RELAY (INOPERATIVE)	
• Ignition OFF. • Disconnect: Trailer Battery Charge Relay. • Substitute the trailer battery charge relay with a known good relay. • Ignition ON. • Measure the voltage between the trailer tow connector pin 5, circuit CAT14 (OG), component side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** REMOVE the known good relay. INSTALL a new trailer battery charge relay. TEST the system for normal operation. **No** REMOVE the known good relay. INSTALL the original relay. GO to AC3 .
AC3 CHECK THE TRAILER TOW CONNECTOR	

• Ignition OFF. • Disconnect: Trailer Tow C473. • Ignition ON. • Measure the voltage between the trailer tow C473-5, circuit CAT14 (OG) and ground.  A0025428 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** GO to AC4 .
AC4 CHECK FOR VOLTAGE TO THE TRAILER BATTERY CHARGE RELAY COIL	
• Ignition OFF. • Disconnect: Trailer Battery Charge Relay. • Ignition ON. • Measure the voltage between the trailer battery charge relay pin 86, circuit CBP12 (GN/WH), BJB face side and ground.  N0088251 • **Is the voltage greater than 10 volts?**	**Yes** GO to AC6 . **No** VERIFY the SJB fuse 12 (5A) is OK. If OK, GO to AC5 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
AC5 CHECK CIRCUIT CBP12 (GN/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280e. • Measure the resistance between trailer battery charge relay pin 86, circuit CBP12 (GN/WH), BJB face side and the SJB C2280e-6, circuit CBP12 (GN/WH), harness side.	**Yes** GO to AC12 . **No** REPAIR the circuit. TEST the system for normal operation.

 N0088252 • **Is the resistance less than 5 ohms?**	
AC6 CHECK CIRCUIT GD120 (BK/GN) FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the trailer battery charge relay pin 85, circuit GD120 (BK/GN), BJB face side and ground.  N0088253 • **Is the resistance less than 5 ohms?**	**Yes** GO to AC7 . **No** REPAIR the circuit. TEST the system for normal operation.
AC7 CHECK FOR VOLTAGE TO THE TRAILER BATTERY CHARGE RELAY	
• Measure the voltage between the trailer battery charge relay pin 30, circuit SSB13 (GY/RD), BJB face side and ground.	**Yes** REPAIR circuit CAT14 (OG) for an open. TEST the system for normal operation. **No** REPAIR circuit SSB13 (GY/RD) for an open. TEST the system for normal operation.

 N0088254 • **Is the voltage greater than 10 volts?**	
AC8 CHECK FOR VOLTAGE AT THE TRAILER TOW CONNECTOR (BATTERY CHARGE ALWAYS ON)	
• Ignition OFF. • Measure the voltage between the trailer tow connector pin 5, circuit CAT14 (OG), component side and ground.  N0068883 • **Is any voltage present?**	**Yes** GO to AC9 . **No** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
AC9 CHECK CIRCUIT CAT14 (OG) FOR A SHORT TO VOLTAGE	
• Disconnect: Trailer Battery Charge Relay. • Measure the voltage between the trailer tow connector pin 5, circuit CAT14 (OG), component side and ground.  N0068883 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to AC10 .
AC10 CHECK THE TRAILER BATTERY CHARGE RELAY (ALWAYS ON)	

• Measure the voltage between the trailer battery charge relay pin 86, circuit CBP12 (GN/WH), BJB face side and ground.  N0088251 • **Is any voltage present?**	**Yes** GO to AC11 . **No** INSTALL a new trailer battery charge relay. TEST the system for normal operation.
AC11 CHECK CIRCUIT CBP12 (GN/WH) FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280e. • Measure the voltage between the trailer battery charge relay pin 86, circuit CBP12 (GN/WH), harness side and ground.  N0088251 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to AC12 .
AC12 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CLEAR any DTCs. REPEAT the self-test. **No** The system is operating correctly at

• Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AD: The Trailer Electric Brakes Are Inoperative/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 95 , Trailer/Camper Adapter for schematic and connector information.

Normal Operation

The is provided voltage at all times by the Battery Junction Box (BJB) fuse 17 (30A) through circuit SBB17 (RD). Ground for the TBC module is provided through circuit GD138 (BK/WH). The TBC module receives voltage from the stoplamp switch through circuit CCB08 (VT/WH) when the brake pedal is applied. When requested, the TBC module provides voltage to the trailer tow connector through circuit CAT19 (BU).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- TBC module
- Trailer tow connector
- Trailer

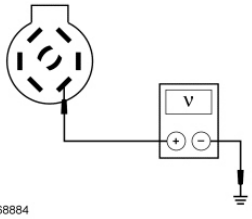
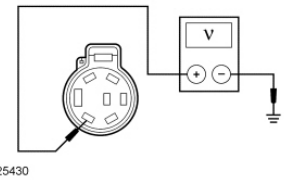
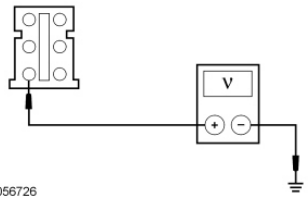
PINPOINT TEST AD: THE TRAILER ELECTRIC BRAKES ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

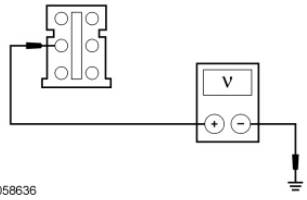
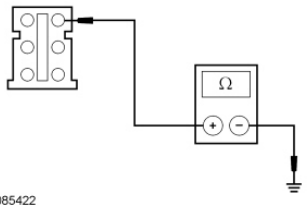
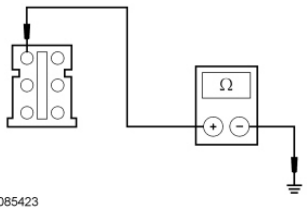
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

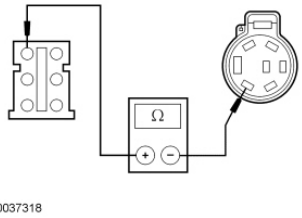
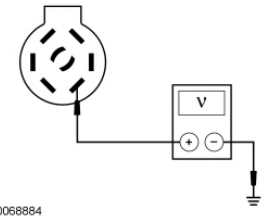
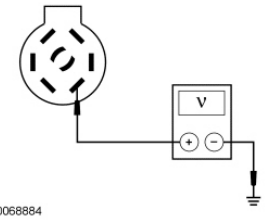
NOTE: Before beginning diagnostics, visually inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
AD1 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (INOPERATIVE CONDITION)	
• Ignition OFF. • Disconnect the trailer from the vehicle. • While applying the brake pedal, measure the voltage between the trailer tow connector pin 3, circuit CAT19 (BU), component side and ground.	**Yes** GO to AD8 . **No** GO to AD2 .

 N0068884 • **Is the voltage greater than 10 volts?**	
AD2 CHECK THE TRAILER TOW CONNECTOR	
• Disconnect: Trailer Tow C473. • While applying the brake pedal, measure the voltage between the trailer tow C473-3, circuit CAT19 (BU), harness side and ground.  A0025430 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new trailer tow connector. TEST the system for normal operation. **No** GO to AD3 .
AD3 CHECK CIRCUIT SBB17 (RD) FOR AN OPEN	
• Disconnect: C238. • Measure the voltage between the TBC module C238-1, circuit SBB17 (RD), harness side and ground.  A0056726 • **Is the voltage greater than 10 volts?**	**Yes** GO to AD4 . **No** VERIFY the BJB fuse 17 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
AD4 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN	
• While applying the brake pedal, measure the voltage between the TBC module C238-2, circuit CCB08 (VT/WH), harness side and ground.	**Yes** GO to AD5 . **No** REPAIR the circuit. TEST the system for normal operation.

 A0058636 • **Is the voltage greater than 10 volts?**	
AD5 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the TBC module C238-6, circuit GD138 (BK/WH), harness side and ground.  A0085422 • **Is the resistance less than 5 ohms?**	**Yes** GO to AD6 . **No** REPAIR the circuit. TEST the system for normal operation.
AD6 CHECK CIRCUIT CAT19 (BU) FOR A SHORT TO GROUND	
• Measure the resistance between the TBC module C238-3, circuit CAT19 (BU), harness side and ground.  A0085423 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to AD7 . **No** REPAIR the circuit. TEST the system for normal operation.
AD7 CHECK CIRCUIT CAT19 (BU) FOR AN OPEN	
• Measure the resistance between the TBC module C238-3, circuit CAT19 (BU), harness side and the trailer tow C473-3, circuit CAT19 (BU), harness side.	**Yes** INSTALL a new TBC module. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

 N0037318 • **Is the resistance less than 5 ohms?**	
AD8 CHECK FOR VOLTAGE TO THE TRAILER TOW CONNECTOR (DOES NOT OPERATE CORRECTLY)	
• With the brake pedal released, measure the voltage between the trailer tow connector pin 3, circuit CAT19 (BU), component side and ground.  N0068884 • **Is any voltage present?**	**Yes** GO to AD9 . **No** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
AD9 CHECK CIRCUIT CAT19 (BU) FOR A SHORT TO VOLTAGE	
• Disconnect: TBC Module C238. • Measure the voltage between the trailer tow connector pin 3, circuit CAT19 (BU), component side and ground.  N0068884 • **Is any voltage present?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new TBC module. TEST the system for normal operation.

Daytime Running Lamps (DRL)

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The Daytime Running Lamps (DRL) feature operates the low beam headlamps at a reduced intensity when the ignition switch is in the RUN position, the headlamps are not on from any other input, and the transmission is not in PARK (P).

The SJB controls the DRL by using various inputs to determine whether or not the DRL should be illuminated. These inputs include:

- Ignition switch position
- Headlamp switch position
- Headlamps on or off
- Transmission gear selection

The SJB can be configured to turn the DRL on for this vehicle. Refer to Section 418-01 for programmable parameter information.

Inspection and Verification

1. Verify the customer concern.

2. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is **not** in the HIGH BEAM position.

3. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

4. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM .
- Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

5. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

6. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

7. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test AE: The Daytime Running Lamps (DRL) Are Inoperative

Normal Operation

When the ignition switch is in the RUN position, the headlamps are not on (from the autolamp system or manual control from the headlamp switch) and the transmission is not in PARK (P), the Smart Junction Box (SJB) provides a pulse-width modulated voltage to the low beam headlamps. This illuminates the headlamps at a reduced intensity.

This pinpoint test is intended to diagnose the following:

- Exterior lighting system input/output
- Ignition switch input
- Transmission gear input
- SJB

PINPOINT TEST AE: THE DRL ARE INOPERATIVE

Test Step	Result / Action to Take
AE1 VERIFY THE DRL OPERATION	
• Ignition ON. • Place the headlamp switch in the OFF position. • Place the gear selector lever in any gear other than PARK (P).	**Yes** The system is operating correctly. INFORM the customer of the conditions required for the DRL to operate correctly.

• **Are the DRL illuminated?**	**No** GO to AE2 .
AE2 CHECK THE OPERATION OF THE HEADLAMPS	
• Place the headlamp switch in the HEADLAMPS ON position and observe the headlamps. • **Do the headlamps operate correctly?**	**Yes** GO to AE3 . **No** REFER to Headlamps in this section.
AE3 CHECK THE IGNITION SWITCH INPUT	
• Place the headlamp switch in the OFF position. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB ignition switch PIDs (IGN_A_ECU, IGN_O_ECU, IGN_R_ECU, IGN_S_ECU) while cycling the ignition switch through all its positions. • **Do the PIDs agree with the ignition switch positions?**	**Yes** GO to AE4 . **No** REFER to Section 211-05 to diagnose the input from the ignition switch.
AE4 CHECK THE TRANSMISSION GEAR INPUT	
• Enter the following diagnostic mode on the scan tool: PCM or TCM DataLogger. • Monitor the PCM or TCM transmission gear status PID (TR) while placing the gear selector lever through all its positions. • **Does the PID agree with the gear selection?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** REFER to Section 307-01A or Section 307-01B to diagnose the transmission range input.

Headlamp Adjustment

Special Tool(s)

 ST3041-A	Vision 100 Headlamp Aimer 196-00005 or equivalent

Headlamp Aiming

1. The headlamp aiming procedure depends on what type of beam pattern the headlamp is equipped with. Vehicles may come equipped with visually optically aligned left (VOL) or visually optically aligned right (VOR) headlamps. To identify the headlamp beam pattern, look on the headlamp lens. Molded in small letters on the headlamp lens is one of the following:
    - VOL and SAE
    - VOR and SAE

2. Once the headlamp beam pattern is identified, aim the headlamps using one of the following methods as applicable.
    - Photometric aimers can aim VOL- and VOR- headlamps. This is the preferred method of headlamp aiming.
    - Visual or screen method aiming can be used to aim VOL- and VOR- headlamps.
    - Mechanical aimers cannot be used with VOR- or VOL-type headlamps. Aerodynamic lamps that can be aimed mechanically have 3 nibs molded into the lens of the lamp.

Photometric Aiming

1. For the photometric aiming procedure, refer to the appropriate photometric headlamp aimer instruction manual.

Screen Method Aiming

All headlamp types

NOTE: Horizontal aim is not adjustable for VOL or VOR headlamps.

NOTE: Consult your state vehicle inspection manual for recommended tolerance ranges for visual aiming.

NOTE: The radiator sight shield may need to be positioned or removed for access to the adjusters.

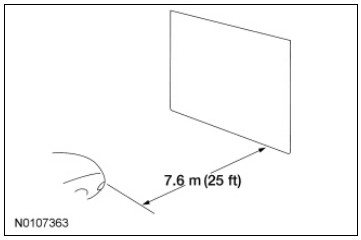
NOTE: Consult the vehicles Owners Literature for the location of the headlamp adjusters.

1. Before starting headlamp adjustment:
    - check that the vehicle is on level ground.
    - check the tire inflation.

- check that no other load is in the vehicle other than a half tank of fuel.
- check that the headlamps are clean.
- check for correct headlamp operation.
- if the vehicle is equipped with air suspension, make sure that the switch is on.

2. **NOTE:** The vertical wall or screen must be a minimum of 2.4 m (8 ft) wide.

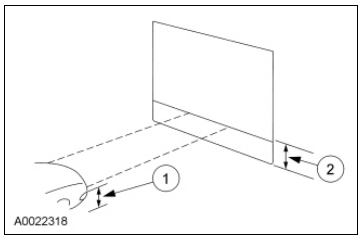
   Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.



3. **NOTE:** The center of the lamp is marked either on the lens (circle, crosshair or other mark) or on the bulb shield internal to the lamp (crosshair or other mark).

   Mark a horizontal reference line on the vertical wall or screen.

   1. Measure the center of the headlamp height to ground and record the measurement.
   2. Make a 2.4 m (8 ft) horizontal mark (using masking tape) on the vertical wall or screen at the same distance from the ground as previously recorded.



4. **NOTE:** This procedure should be done in a dark environment to effectively see the headlamp beam pattern.

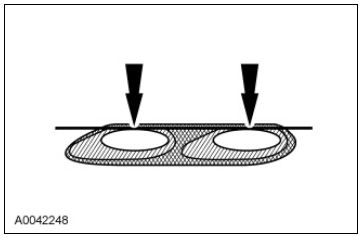
   Turn on the low beam headlamps to illuminate the wall or screen and open the hood.

5. On the wall or screen, locate the high intensity area of the beam pattern.

VOR-type headlamps

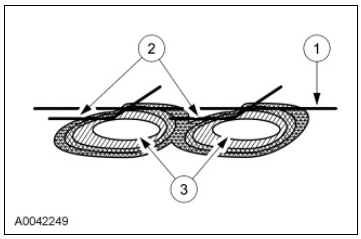
6. **NOTE:** The appearance of the VOR beam pattern may vary between vehicles.

   Identify at the top edge of this high intensity area a distinct horizontal cutoff in the beam pattern. If the top edge of this cutoff is not even with the horizontal reference line, the headlamp beam needs to be adjusted using the headlamp adjusting screw.



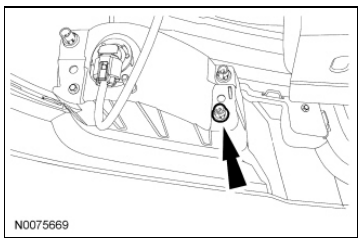
VOL-type headlamps

7. For VOL-type headlamps, there is a distinct cutoff in the left portion of the beam pattern. The edge of this cutoff should be positioned 50.2 mm (2 in) below the horizontal reference line. Adjust the headlamp as necessary using the headlamp adjusting screw.
    1. Horizontal reference line.
    2. Top edge of the beam pattern.
    3. High intensity zone.

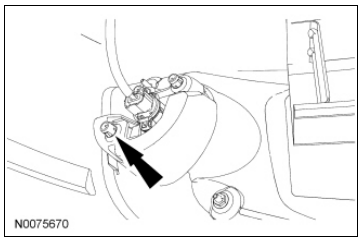


Front Fog Lamp Adjustment

Fog Lamp Adjustment Screw Location - Base Fog Lamp



Fog Lamp Adjustment Screw Location - Adrenalin Package



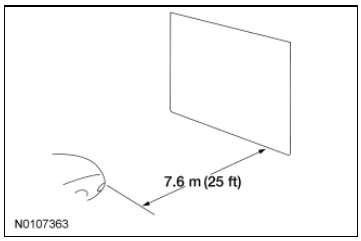
1. **NOTE:** Horizontal aim is not required for this vehicle and is not adjustable. Consult your state vehicle inspection center for recommended tolerance ranges for visual aiming.

   Before starting the fog lamp assembly adjustment:

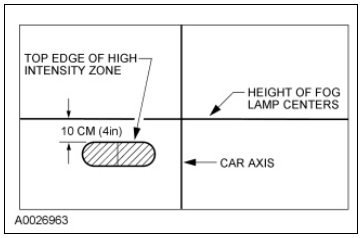
   - check the tire inflation.
   - make sure there are no other loads in the vehicle other than a half tank of fuel.
   - make sure the vehicle is on level ground.
   - make sure the fog lamps and headlamps are clean.
   - make sure the headlamps are operating and are correctly aimed.

2. **NOTE:** The vertical wall screen must be a minimum of 2.4 m (8 ft) wide.

   Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.



3. The correct visual aim for the fog lamps is with the top edge of the high-intensity zone 10 cm (4 in) below the horizontal center of the fog lamps.



4. If necessary, rotate the adjusting screw until the fog lamp beam is within specification.

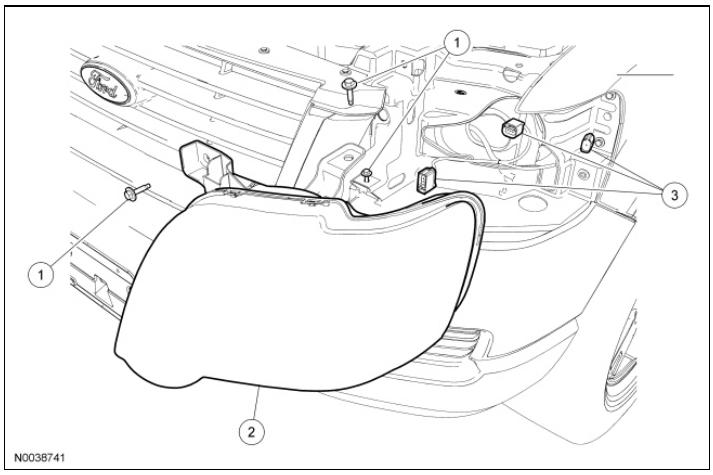
Autolamps Time Delay Adjustment

NOTE: Steps 2 through 5 must be carried out within a 10-second period.

1. Start with the ignition switch OFF position and the headlamp switch in the AUTOLAMPS ON position.
2. Place the headlamp switch in the OFF position.
3. Place the ignition switch in the RUN position.
4. Place the ignition switch in the OFF position.
5. Place the headlamp switch in the AUTOLAMPS ON position. The exterior lamps turn on at this point.
6. Wait the desired amount of time and place the headlamp switch in the OFF position (maximum of 3 minutes). The exterior lamps turn off and the autolamp time delay is now set.

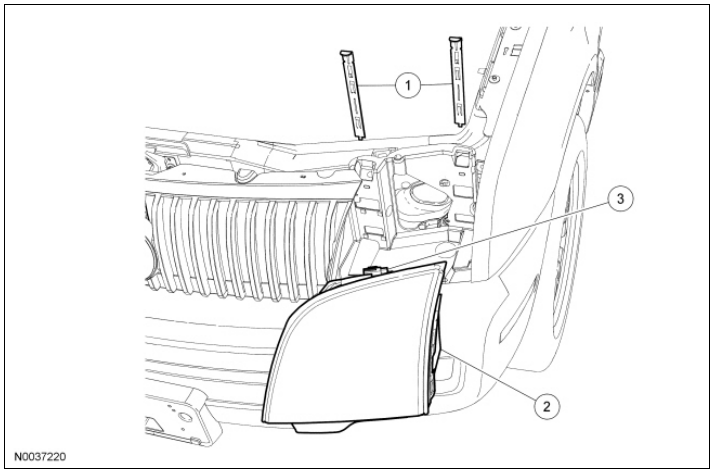
Headlamp Assembly

Explorer, Explorer Sport Trac



Item	Part Number	Description
1	W505425	Headlamp assembly bolts (3 required)
2	13006/13005	Headlamp assembly (LH/RH)
3	-	Headlamp assembly electrical connectors (part of 14398)

Mountaineer



Item	Part Number	Description
1	13N020	Headlamp assembly retainers (2 required)
2	13006/13005	Headlamp assembly (LH/RH)
3	-	Headlamp assembly electrical connector (part of 14398)

Removal and Installation

NOTE: Make sure the headlamp switch and ignition switch are in the OFF position.

Explorer, Explorer Sport Trac

1. Loosen the lower headlamp assembly bolt.

2. Remove the 2 upper bolts and the headlamp assembly.
    - Disconnect the electrical connectors.

Mountaineer

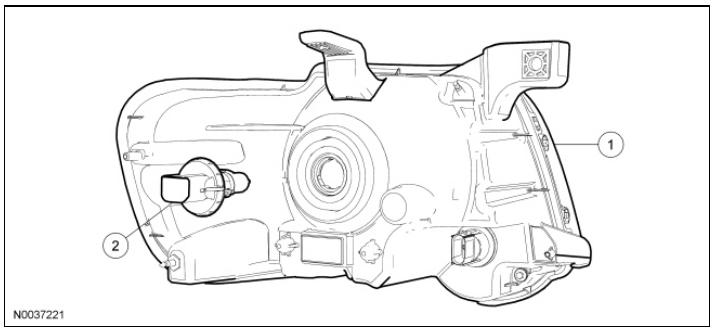
3. Remove the 2 retainers and the headlamp assembly.
    - Disconnect the electrical connector.

All vehicles

4. To install, reverse the removal procedure.

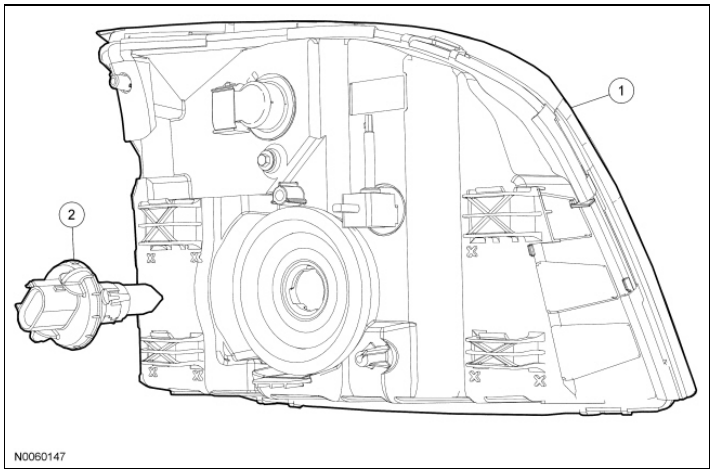
Headlamp Bulb

Explorer, Explorer Sport Trac



Item	Part Number	Description
1	13006/13005	Headlamp assembly (LH/RH)
2	13N021	Headlamp bulb

Mountaineer



Item	Part Number	Description
1	13006/13005	Headlamp assembly (LH/RH)
2	13N021	Headlamp bulb

Removal and Installation

⚠ WARNING: The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

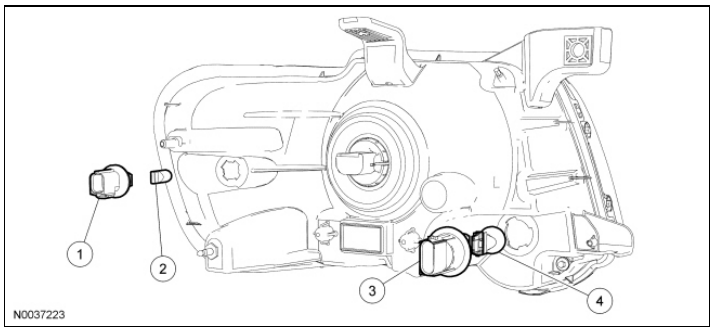
NOTE: The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp assembly where they can settle on the lens and reflector. Never turn on

the headlamps with the bulb removed from the headlamp assembly.

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.
2. Rotate the headlamp bulb one-eighth turn counterclockwise and remove the headlamp bulb.
3. To install, reverse the removal procedure.

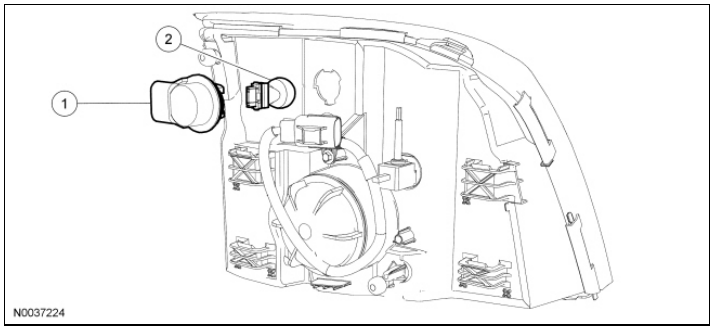
Parking Lamp Bulb - Front

Explorer, Explorer Sport Trac



Item	Part Number	Description
1	13411	Parking lamp bulb socket
2	13466	Parking lamp bulb
3	13411	Parking/turn lamp bulb socket
4	13466	Parking/turn lamp bulb

Mountaineer



Item	Part Number	Description
1	-	Parking/turn lamp bulb socket
2	13466	Parking/turn lamp bulb

Removal and Installation

1. Remove the headlamp assembly. For additional information, refer to Headlamp Assembly in this section.

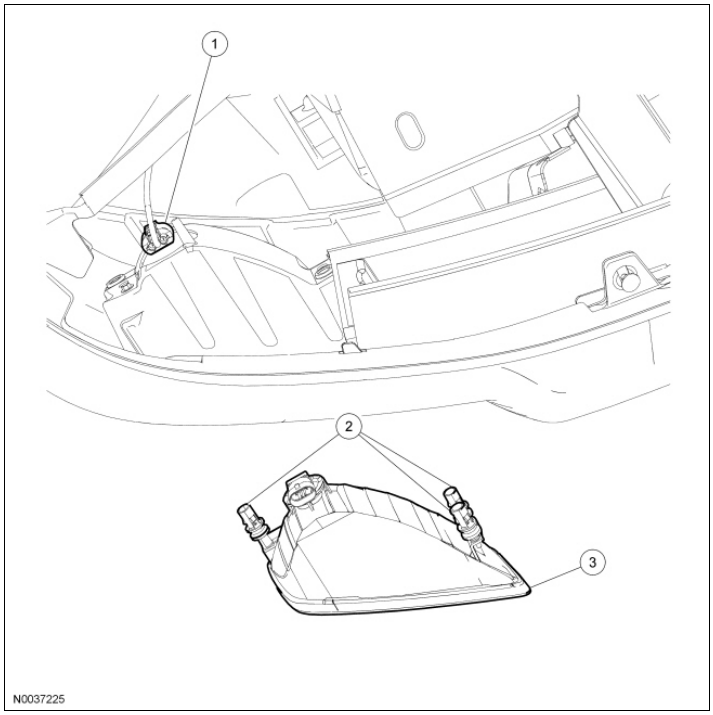
2. Remove the parking lamp bulb socket from the headlamp assembly.
   - Remove the parking lamp bulb from the socket.

3. To install, reverse the removal procedure.

Fog Lamp

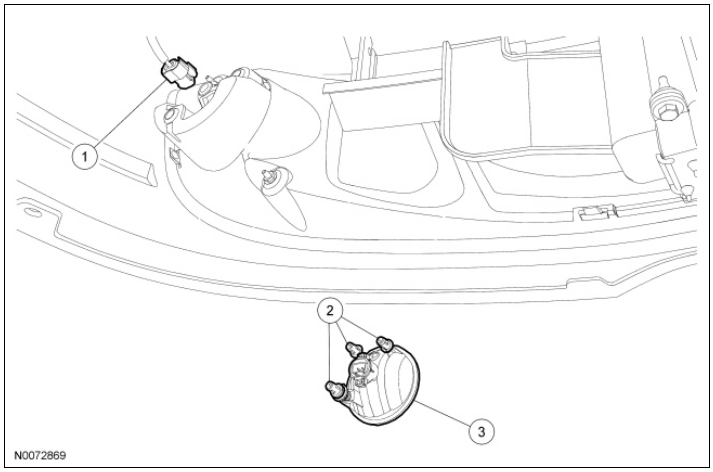
Base Fog Lamp

NOTE: Explorer, Explorer Sport Trac shown, Mountaineer similar.



Item	Part Number	Description
1	-	Fog lamp electrical connector (part of 14398)
2	-	Fog lamp retainers (part of 15201/15200)
3	15201/15200	Fog lamp (LH/RH)

Adrenalin Package Fog Lamp



Item	Part Number	Description
1	-	Fog lamp electrical connector (part of 14398)
2	-	Fog lamp retainers (part of 15200)
3	15200	Fog lamp

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

2. Disconnect the fog lamp electrical connector.

3. **NOTE:** Use a 13 mm (0.5 in) diameter tool to collapse the tabs.

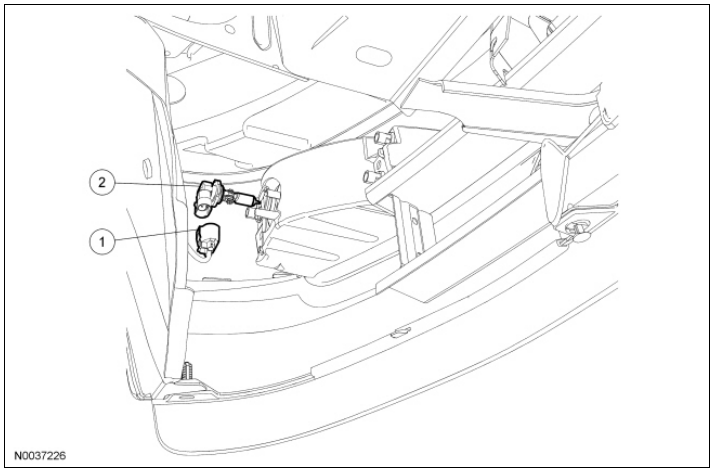
   Collapse the tabs and remove the fog lamp.

4. To install, reverse the removal procedure.

Fog Lamp Bulb

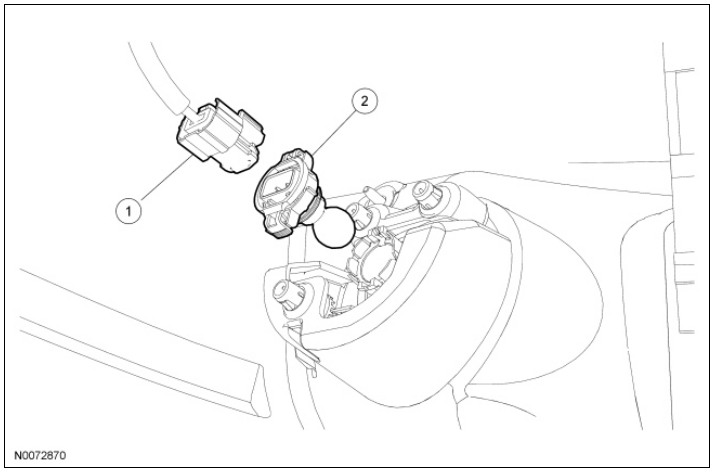
Base Fog Lamp Bulb

NOTE: Explorer, Explorer Sport Trac shown, Mountaineer similar.



Item	Part Number	Description
1	-	Fog lamp electrical connector (part of 14398)
2	13N021	Fog lamp bulb

Adrenalin Package Fog Lamp Bulb



Item	Part Number	Description
1	-	Fog lamp electrical connector (part of 14398)
2	13N021	Fog lamp bulb

Removal and Installation

⚠ WARNING: The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

NOTE: The fog lamp bulb should not be removed from the fog lamp assembly until just before a new bulb is installed. Removing the bulb for an extended period of time may affect fog lamp bulb performance. Contaminants may enter the fog lamp assembly where they can settle on the lens and reflector. Never turn on the fog lamps with the bulb removed from the fog lamp assembly.

NOTE: Make sure the headlamp switch and ignition switch are in the OFF position.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .

Vehicles with base fog lamp

2. **NOTE:** To remove, rotate the bulb approximately one-eighth turn counter clockwise.

   Disconnect the electrical connector and remove the fog lamp bulb.

Vehicles with Adrenalin fog lamp

3. **NOTE:** To remove, squeeze the tabs and pull the fog lamp bulb from the fog lamp assembly.

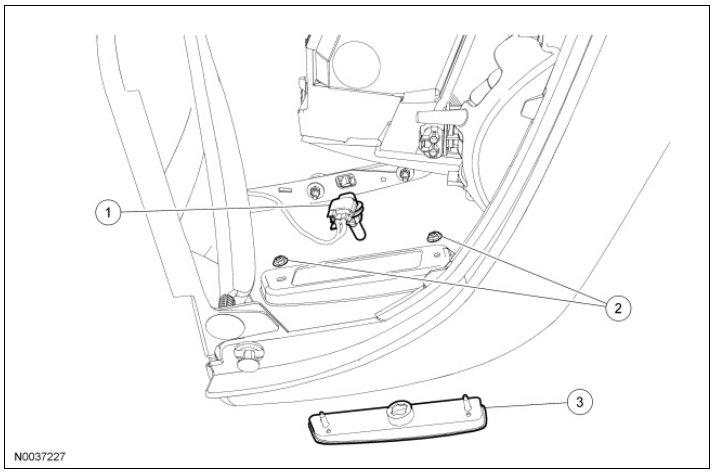
   Disconnect the electrical connector and remove the fog lamp bulb.

All vehicles

4. To install, reverse the removal procedure.

Side Marker Lamp

NOTE: LH front shown, others similar.

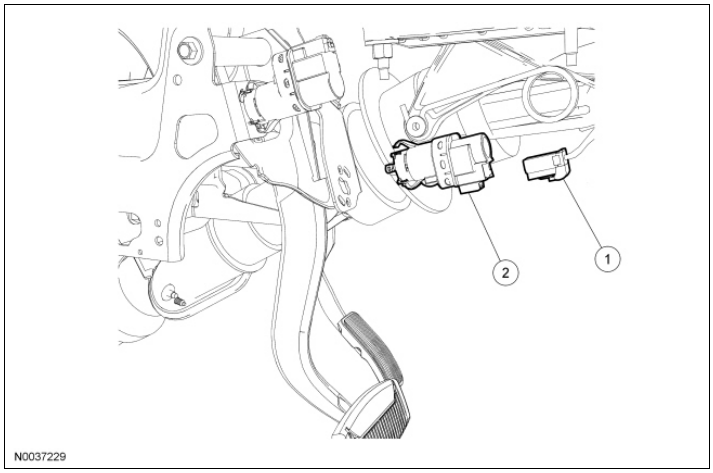


Item	Part Number	Description
1	13411	Side marker lamp bulb socket
2	W707501	Side marker lamp nuts (2 required)
3	13201	Side marker lamp

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02 .
2. Remove the socket from the side marker lamp.
3. Remove the 2 nuts and the side marker lamp.
4. To install, reverse the removal procedure.

Stoplamp Switch



Item	Part Number	Description
1	-	Stoplamp switch electrical connector (part of 14390)
2	13480	Stoplamp switch

Removal and Installation

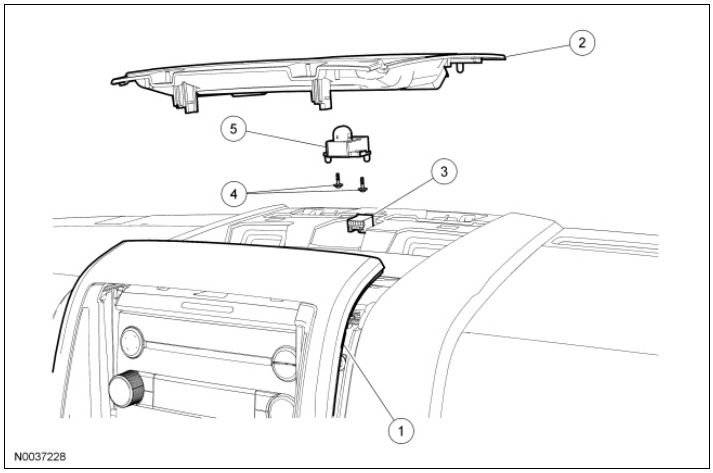
NOTICE: **Do not remove or repair the brake pedal, brake booster or master cylinder without first removing the stoplamp switch. Do not install the stoplamp switch without the brake pedal arm secured to the brake booster push rod. Do not pull or push on the brake pedal when removing or installing the stoplamp switch, as misadjustment or damage to the switch may occur.**

1. Disconnect the stoplamp switch electrical connector.

2. Rotate the stoplamp switch 45 degrees clockwise and remove the stoplamp switch.

3. To install, reverse the removal procedure.

Light Sensor



Item	Part Number	Description
1	7804302	Lower center instrument panel finish panel
2	78042A82	Upper center instrument panel finish panel
3	-	Light sensor electrical connector (part of 14401)
4	W701679	Light sensor screws (2 required)
5	13A018	Light sensor

Removal and Installation

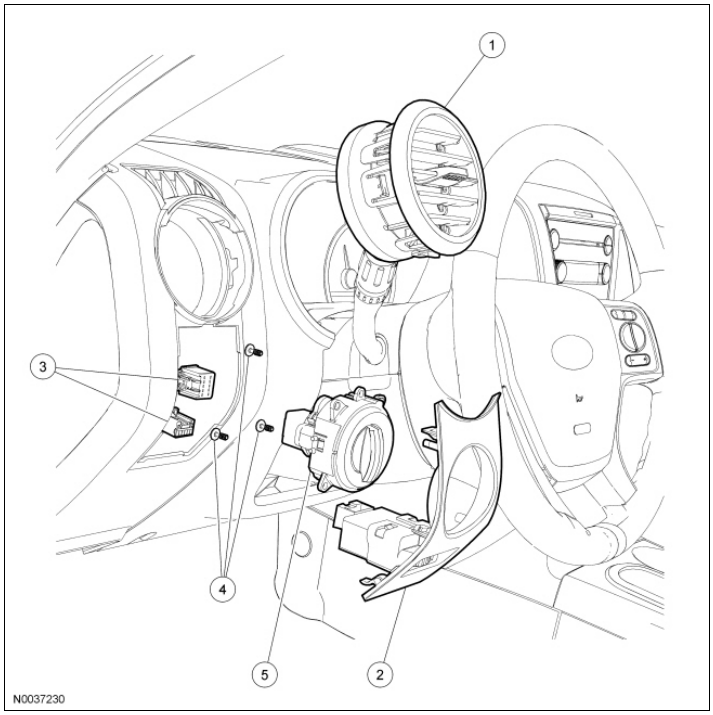
1. Position the top portion of the lower center instrument panel finish panel rearward.

2. Remove the upper center instrument panel finish panel.
   - Disconnect the electrical connector.

3. Remove the 2 screws and the light sensor.

4. To install, reverse the removal procedure.

Headlamp Switch



Item	Part Number	Description
1	19893	Driver side register
2	7804338	Headlamp switch bezel
3	-	Headlamp switch electrical connectors (part of 14401)
4	W701679	Headlamp switch screws (3 required)
5	11654	Headlamp switch

Removal and Installation

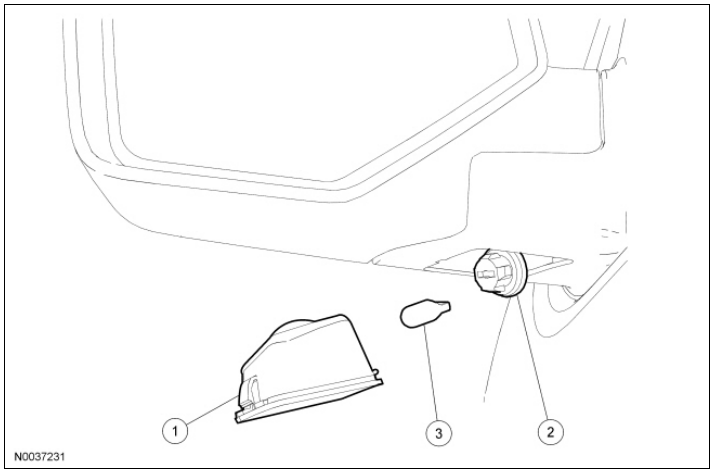
1. Remove the driver side register.

2. Remove the headlamp switch and bezel as an assembly.
   - Disconnect the electrical connectors.

3. Remove the 3 screws and the headlamp switch.

4. To install, reverse the removal procedure.

Puddle Lamp



Item	Part Number	Description
1	-	Puddle lamp lens (part of 17683)
2	-	Puddle lamp socket (part of 17683)
3	13466	Puddle lamp bulb

Removal and Installation

1. **NOTE:** Use a thin-bladed tool to release the tab on the puddle lamp lens.

   Release the tab and remove the puddle lamp lens.

   - Remove the puddle lamp socket from the puddle lamp lens.

2. Remove the puddle lamp bulb from the puddle lamp socket.

3. To install, reverse the removal procedure.

Interior Lighting

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The interior lighting system consists of the following components:

- SJB
- Instrument panel dimmer switch
- Interior/map lamps
- Cargo lamp
- Glove compartment lamp
- Vanity mirror lamps
- Door ajar switches
- Puddle lamps

The interior lighting system consists of 2 subsystems:

- Courtesy lamps
- Demand lamps

Courtesy Lamps

The courtesy lamps are controlled by the SJB . The courtesy lamp subsystem consists of the interior dome lamps, the cargo lamp, the puddle lamps (if equipped) and the overhead console lamps (if equipped). The SJB supplies voltage to the courtesy lamps when the SJB receives the required input.

Demand Lamps

The demand lamps are controlled by the SJB . The demand lamps subsystem consists of the glove compartment lamp, all map/reading lamps, and the vanity mirror lamps.

Interior Lighting Delay

The interior lighting delay feature provides temporary illumination of the courtesy lamps after the doors are opened and then closed. The interior lighting delay feature keeps the courtesy lamps on for a period of 25 seconds. If during the 25-second delay, the SJB detects that the ignition has been turned to RUN, ACC, START position, or if the vehicle is locked using the Remote Keyless Entry (RKE) transmitter, the courtesy lamp illumination is discontinued.

Illuminated Entry

The illuminated entry requests the courtesy lamps to illuminate when the ignition is off and the RKE transmitter UNLOCK button is pressed. The illuminated entry requests the courtesy lamps off after 25 seconds have elapsed, the ignition is switched to ON, or when the RKE transmitter LOCK button is pressed.

Illuminated Exit

The illuminated exit illuminates the courtesy lamps for 25 seconds when all doors are closed and the ignition key is removed from the ignition lock cylinder. The illuminated exit deactivates when any door becomes ajar,

the ignition key is inserted into the ignition lock cylinder, or 25 seconds have elapsed.

Theater Lighting

The theater lighting option ramps-up the courtesy lamps over 0.7 seconds when courtesy lamp activation is requested. The theater lighting feature ramps-down the courtesy lamps over 1.7 seconds when interior lighting deactivation is requested by any feature other than the panic alarm or battery saver.

Interior Lighting

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB supplies voltage to the interior lighting system. The interior lighting system illuminates the courtesy lamps to enhance visibility of the interior while a vehicle door is ajar (or a request from the instrument panel dimmer switch is received), and the vehicle speed is less than 15 km/h (9 mph). The SJB controls all interior lighting functions and timing by monitoring inputs from the door ajar switches, liftgate ajar switch, liftgate glass ajar switch, instrument panel dimmer switch, and vehicle speed.

Interior Lamp Arbitrator

The interior lamp arbitrator (part of the SJB programming) chooses between the interior lighting, the interior mode, the interior lighting delay, the illuminated entry, the illuminated exit, the battery saver, and the alarm flash processing to determine which feature has precedence of activating and deactivating the interior lamps.

Battery Saver

The battery saver is internal to the SJB and provides automatic shut off of the demand lamps (vanity lamps, map lamps and glove compartment lamp) and courtesy lamps after a time-out period in order to save battery voltage. A timer in the SJB is started when the ignition is turned to the OFF position. When the time-out period for the lamps has elapsed, the voltage is automatically shutoff to the lamps by the battery saver. While the battery saver has voltage disabled, if the ignition is turned to any position other than off, any door or liftgate/glass becomes ajar, the UNLOCK button of the Remote Keyless Entry (RKE) transmitter is pressed, the instrument panel dimmer switch is placed in the DOME position, the battery saver restores voltage and starts the timer again.

NOTE: Time out is 1 minute if the vehicle has less than 80 km (50 miles).

The battery saver time-outs are as follows:

- Courtesy lamps if the dome lamp is off and the liftgate/liftgate glass is closed = 10 minutes
- Courtesy lamps if the dome lamp is on or the liftgate/liftgate glass is open = 30 minutes

- Demand lamps = 30 minutes

Field-Effect Transistor (FET) Protection

The SJB utilizes a Field-Effect Transistor (FET) protective circuit strategy for many of its outputs (for example, a headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A continuous DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the FET circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (FET protection) and the circuit remains shorted, the FET protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each FET protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the FET and the ability of the FET to withstand it. A module lifetime level of fault events is established based upon the durability of the FET . If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal operation until a successful self-test proves that the fault has been repaired. After the self-test has successfully completed (no on-demand DTCs present), the continuous DTC automatically clears and the circuit function returns.

When the first or second level is reached, the continuous DTC (associated with the short circuit) sets along with DTC B106E. These DTCs can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then DTCs B106F and B1342 set along with the associated continuous DTC. This DTC cannot be cleared and the module must be replaced.

The SJB FET protected output circuits for the instrument panel illumination system are the courtesy and demand lamp system output circuits.

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Door ajar switches • Liftgate ajar switch (part of the liftgate latch)	• Smart Junction Box (SJB) fuse 23 (15A) • Wiring, terminals or connectors

• Liftgate glass ajar switch (part of the liftgate window latch)	• Courtesy lamp • Map lamp • Puddle lamps • Cargo lamp • Vanity lamps • Glove compartment lamp • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication with the SJB , refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Smart Junction Box (SJB) DTC Chart

NOTE: Make sure the instrument panel dimmer switch is not in the dome lamp or dome lamp defeat position.

DTC	Description	Action
B1316	Battery Saver Relay Coil Circuit Short to Ground	GO to Pinpoint Test E .
B1319	Driver Door Ajar Circuit Failure	GO to Pinpoint Test C .

B1327	Passenger Door Ajar Circuit Failure	GO to Pinpoint Test C .
B1335	Door Ajar RR Circuit Failure	GO to Pinpoint Test C .
B1374	Illuminated Entry Relay Short to Ground	GO to Pinpoint Test A .
B1571	Door Ajar LR Circuit Failure	GO to Pinpoint Test C .
B1687	Lamp Dome Input Circuit Short to Battery	If the courtesy lamps do not turn on with one door open, GO to Pinpoint Test D . If the dome defeat is inoperative, GO to Pinpoint Test M .
B1688	Lamp Dome Input Circuit Short to Ground	GO to Pinpoint Test C .
B2077	Liftgate Ajar Sw Circuit Failure	GO to Pinpoint Test C .
B2089	Puddle/Approach Lamp Fault	VERIFY the Smart Junction Box (SJB) fuse 23 (15A) is OK. If OK, INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
All other DTCs	-	REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Courtesy Lamps Are Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) fuse 23 (15A) supplies voltage to the courtesy/demand and puddle lamps through a solid-state relay in the SJB . When any door, liftgate, liftgate glass is opened, or the instrument panel dimmer switch is placed in the dome position, the SJB interprets this as a request for the courtesy lamps. Based on the input, the SJB energizes the solid-state relay supplying voltage to the courtesy lamps on circuit CLN03 (YE/GY). The interior courtesy lamps share a common ground through circuit GD133 (BK).

- DTC B1374 (Illuminated Entry Relay Short to Gnd) - a continuous and on-demand DTC that sets when the SJB detects a short to ground on the courtesy lamp output circuit.

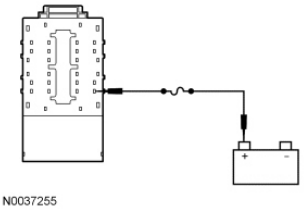
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- SJB

PINPOINT TEST A: THE COURTESY LAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
A1 CHECK THE PUDDLE LAMP OPERATION	
• Ignition OFF. • Open any door and observe the puddle lamps. • **Do the puddle lamps illuminate?**	**Yes** GO to A2 . **No** For Explorer or Mountaineer, GO to Pinpoint Test J . For Explorer Sport Trac, GO to Pinpoint Test K .
A2 CHECK THE DEMAND LAMP FUNCTION	
• Using the demand lamp function, turn any demand lamp on (map lamp or vanity mirror lamp). • **Does the demand lamp illuminate?**	**Yes** GO to A3 . **No** REPAIR circuit GD133 (BK) for an open. TEST the system for normal operation.
A3 BYPASS THE SJB	
NOTE: If the fuse in the jumper wire fails, refer to the Wiring Diagrams Manual to identify the possible causes of the circuit short. • Disconnect: SJB C2280a. • Connect a fused jumper wire between the SJB C2280a-8, circuit CLN03 (YE/GY), harness side and battery positive.  N0037255 • **Do the courtesy lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to A4 . **No** REMOVE the jumper wire. REPAIR circuit CLN03 (YE/GY) for an open. CLEAR the DTCs. REPEAT the self-test.
A4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.

♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: An Individual Courtesy Lamp Is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

Circuit CLN03 (YE/GY) provides voltage to each courtesy lamp when activated. The courtesy lamps are grounded through circuits GD133 (BK) and GD149 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior lamp

PINPOINT TEST B: AN INDIVIDUAL COURTESY LAMP IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>B1 CHECK THE INTERIOR LAMP</td><td></td></tr>
<tr><td>• Ignition OFF.
• Disconnect: Suspect Interior Lamp.
• Open the driver door.
• Measure the voltage between the suspect interior lamp pins, harness side as follows:

<table>
<tr><th>Location</th><th>Connector-Pin/ Circuit</th><th>Connector-Pin/ Circuit</th></tr>
<tr><td>Front interior lamp (without overhead console)</td><td>C981-1

CLN03 (YE/GY)</td><td>C981-2

GD149 (BK/GY)</td></tr>
<tr><td>Front interior/map lamp (with overhead console)</td><td>C929-3

CLN03 (YE/GY)</td><td>C929-2

GD133 (BK)</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td><td>Yes
INSTALL a new interior lamp for the lamp in question. REFER to Interior Lamp - Front or Interior Lamp - Rear in this section. TEST the system for normal operation.

No
GO to B2 .</td></tr>
</table>

Rear interior lamp (Explorer/Mountaineer)	C901-1 CLN03 (YE/GY)	C901-2 GD149 (BK/GY)
Rear interior lamp (Explorer Sport Trac)	C901-1 CLN03 (YE/GY)	C901-2 GD133 (BK)
Cargo lamp (Explorer/Mountaineer)	C926-1 CLN03 (YE/GY)	C926-2 GD149 (BK/GY)

- **Is the voltage greater than 10 volts?**

B2 CHECK CIRCUIT CLN03 (YE/GY) FOR VOLTAGE	
• Measure the voltage between the suspect interior lamp, circuit CLN03 (YE/GY), harness side and ground as follows: **Location / Connector-Pin / Circuit** Front interior lamp (without overhead console) — C981-1 — CLN03 (YE/GY) Front interior/map lamp (with overhead console) — C929-3 — CLN03 (YE/GY) Rear interior lamp — C901-1 — CLN03 (YE/GY) Cargo lamp (Explorer/Mountaineer) — C926-1 — CLN03 (YE/GY) • **Is the voltage greater than 10 volts?**	**Yes** REPAIR circuit GD133 (BK) or GD149 (BK/GY) of the lamp in question for an open. TEST the system for normal operation. **No** REPAIR circuit CLN03 (YE/GY) for an open. TEST the system for normal operation.

Pinpoint Test C: The Courtesy Lamps Stay On Continuously

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When any door, the liftgate or the liftgate glass is opened, the ajar switch opens the circuit to the Smart Junction Box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, the SJB supplies voltage to the courtesy lamps on circuit CLN03 (YE/GY).

When the instrument panel dimmer switch is rotated to the dome detent, ground is supplied on circuit CLN28 (GN/BU) to the SJB . The SJB monitors the dome input circuit. Based on the input, the SJB supplies voltage to the courtesy lamps on circuit CLN03 (YE/GY).

DTC Description	Fault Trigger Conditions
• B1319 - Driver Door Ajar Circuit Failure • B1327 - Passenger Door Ajar Circuit Failure • B1335 - Door Ajar RR Circuit Failure • B1571 - Door Ajar LR Circuit Failure	An on-demand DTC that sets when the SJB detects an open from the door ajar circuits.
• B1688 - Lamp Dome Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the dome request input circuit.
• B2077 - Liftgate Ajar Circuit Failure	An on-demand DTC that sets when the SJB detects an open from the liftgate/liftgate glass ajar circuit.

This pinpoint test is intended to diagnose the following:

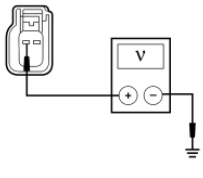
- Wiring, terminals or connectors
- Ajar switch
- Instrument panel dimmer switch
- SJB

PINPOINT TEST C: THE COURTESY LAMPS STAY ON CONTINUOUSLY

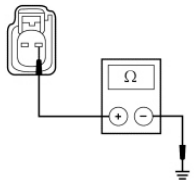
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
C1 CHECK THE SJB DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Use the recorded results from the SJB continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** For DTC B1319, B1327, B1335 or B1571, GO to C2 . For DTC B2077

	(Explorer/Mountaineer), GO to C5 . For DTC B2077 (Explorer Sport Trac), GO to C6 . For DTC B1688, GO to C10 . For all other DTCs, REFER to DTC Charts in this section. **No** GO to C12 .
C2 CHECK FOR VOLTAGE TO THE DOOR AJAR SWITCH	
• Ignition OFF. • Disconnect: Suspect Ajar Switch. • Measure the voltage between the suspect ajar switch connector, harness side and ground as follows: **Location** / **Connector-Pin** / **Circuit** LH front / C526-2 / CPL26 (GN/VT) RH front / C602-2 / CPL31 (GN/BK) LH rear / C715-2 / CPL36 (GN) RH rear / C820-2 / CPL39 (YE)  N0075516 • **Is the voltage greater than 10 volts?**	**Yes** GO to C3 . **No** GO to C4 .
C3 CHECK CIRCUIT GD133 (BK/OG) OR CIRCUIT GD143 (BK/VT) FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the suspect ajar switch, harness side and ground as follows: **Location** / **Connector-Pin** / **Circuit** LH front / C526-1 / GD133 (BK/OG) RH front / C602-1 / GD133 (BK/OG)	**Yes** INSTALL a new ajar switch in question. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the ground circuit in question for an open. CLEAR the DTCs. REPEAT the self-test.

LH rear	C715-1	GD143 (BK/VT)
RH rear	C820-1	GD143 (BK/VT)



N0058796

- **Is the resistance less than 5 ohms?**

C4 CHECK THE DOOR AJAR SWITCH INPUT CIRCUIT FOR AN OPEN

- Disconnect: SJB C2280b.
- Measure the resistance between the SJB , harness side and the suspect door ajar switch, harness side as follows:

Location	SJB Connector-Pin/ Circuit	Ajar Switch Connector-Pin/ Circuit
LH front	C2280b-17 CPL26 (GN/VT)	C526-2 CPL26 (GN/VT)
RH front	C2280b-19 CPL31 (WH)	C602-2 CPL31 (GN/BK)
LH rear	C2280b-20 CPL36 (GN)	C715-2 CPL36 (GN)
RH rear	C2280b-21 CPL39 (YE)	C820-2 CPL39 (YE)

- **Is the resistance less than 5 ohms?**

Yes
GO to C13 .

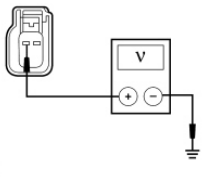
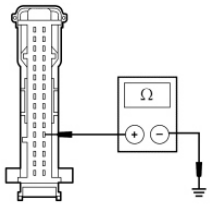
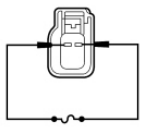
No
REPAIR the circuit in question for an open. CLEAR the DTCs. REPEAT the self-test.

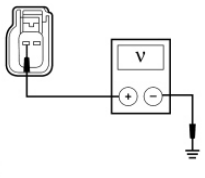
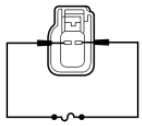
C5 CHECK FOR VOLTAGE TO THE LIFTGATE GLASS AJAR SWITCH

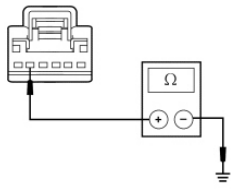
- Disconnect: Liftgate Glass Ajar Switch C478.
- Measure the voltage between the liftgate glass ajar switch C478-2, circuit CPL58 (GY/OG), harness side and ground.

Yes
GO to C7 .

No
GO to C6 .

 N0075516 • **Is the voltage greater than 10 volts?**	
C6 CHECK THE LIFTGATE/LIFTGATE GLASS AJAR SWITCH INPUT CIRCUIT FOR AN OPEN	
NOTE: For Explorer/Mountaineer, make sure the liftgate and liftgate glass are closed. • Ignition OFF. • Connect: Liftgate Glass Ajar Switch C478. • Disconnect: Negative Battery Cable. • Disconnect: SJB C2280b. • Measure the resistance between the SJB C2280b-28, circuit CPL58 (GY/OG) (Explorer/Mountaineer), or circuit GD143 (BK/VT) (Explorer Sport Trac), harness side and ground.  N0072748 • **Is the resistance less than 5 ohms?**	**Yes** GO to C13 . **No** For Explorer/Mountaineer, REPAIR circuit CPL58 (GY/OG) for an open. CLEAR the DTCs, REPEAT the self-test. For Explorer Sport Trac, REPAIR circuit GD143 (BK/VT) for an open. CLEAR the DTCs. REPEAT the self-test.
C7 BYPASS THE LIFTGATE GLASS SWITCH	
• **NOTE:** Make sure the liftgate is closed.  N0075517 • Connect a fused jumper wire between the liftgate glass ajar switch C478-2, circuit CPL58 (GY/OG), harness side and the liftgate glass ajar switch C478-1, circuit CPL44 (YE/OG), harness side. • Wait 30 seconds and observe the interior lamps. • **Do the courtesy lamps continue to illuminate?**	**Yes** REMOVE the jumper wire. GO to C8 . **No** REMOVE the jumper wire. INSTALL a new liftgate glass ajar switch. REFER to Section 501-14 . CLEAR the DTCs. REPEAT the self-test.
C8 CHECK CIRCUIT CPL44 (YE/OG) FOR AN OPEN	

• Connect: Liftgate Glass Ajar Switch C478. • Disconnect: Liftgate Ajar Switch C479. • **NOTE:** Make sure the liftgate glass is closed. • Measure the voltage between the liftgate ajar switch C479-2, circuit CPL44 (YE/OG), harness side and ground.  N0075516 • **Is the voltage greater than 10 volts?**	**Yes** GO to C9 . **No** REPAIR circuit CPL44 (YE/OG) for an open. CLEAR the DTCs. REPEAT the self-test.
C9 BYPASS THE LIFTGATE AJAR SWITCH	
• Connect a fused jumper wire between the liftgate ajar switch C479-2, circuit CPL44 (YE/OG), harness side and the liftgate ajar switch C479-1, circuit GD143 (BK/VT), harness side.  N0075517 • Wait 30 seconds and observe the courtesy lamps. • **Do the courtesy lamps continue to illuminate?**	**Yes** REMOVE the jumper wire. REPAIR circuit GD143 (BK/VT) for an open. CLEAR the DTCs. REPEAT the self-test. **No** REMOVE the jumper wire. INSTALL a new liftgate glass ajar switch. REFER to Section 501-12 . CLEAR the DTCs. REPEAT the self-test.
C10 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Ignition OFF. • Disconnect: Instrument Panel Dimmer Switch C2298. • **NOTE:** Make sure all the doors are closed. • Wait 30 seconds and observe the courtesy lamps. • **Are the courtesy lamps still illuminated?**	**Yes** GO to C11 . **No** INSTALL a new instrument panel dimmer switch. REFER to Section 413-00 . CLEAR the DTCs. REPEAT the self-test.
C11 CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280d. • Measure the resistance between the instrument panel dimmer switch C2298-5, circuit CLN28 (GN/BU), harness side and ground.	**Yes** GO to C13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 • **Is the resistance greater than 10,000 ohms?**	
C12 CHECK CIRCUIT CLN03 (YE/GY) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280a. • Observe the courtesy lamps. • **Are the courtesy lamps still illuminated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to C13 .
C13 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Courtesy Lamps Do Not Turn On With One Door Open

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When any door, the liftgate or the liftgate glass is opened, the ajar switch opens the circuit to the Smart Junction Box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, the SJB supplies voltage to the courtesy lamps on circuit CLN03 (YE/GY). The SJB also monitors the instrument panel dimmer switch for the dome defeat request through circuit VLN36 (GY/OG).

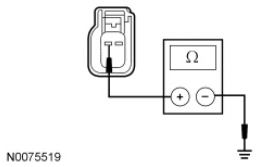
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Instrument panel dimmer switch
- Ajar switch
- SJB

PINPOINT TEST D: THE COURTESY LAMPS DO NOT TURN ON WITH ONE DOOR OPEN

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
D1 CHECK THE SJB DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Verify all the doors, the liftgate and the liftgate glass are closed. • Use the recorded results from the SJB continuous and on-demand self-tests. • **Are any DTCs recorded?**	**Yes** REFER to DTC Charts in this section. **No** GO to D2 .
D2 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Ignition OFF. • Enter the following diagnostic mode on the scan tool: Instrument Panel Dimmer Switch C2298. • Open any door. • **Do the courtesy lamps illuminate?**	**Yes** INSTALL a new instrument panel dimmer switch. TEST the system for normal operation. **No** GO to D3 .
D3 CHECK THE LIFTGATE AJAR SWITCH PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Check the liftgate ajar switch SJB PID (LGATESW) while opening and closing the liftgate and then the liftgate glass. • **Does the liftgate ajar PID values agree with the liftgate and liftgate glass positions?**	**Yes** GO to D4 . **No** If the PID does not agree for both positions, GO to D6 . If the PID does not agree for only the liftgate, GO to D8 . If the PID does not agree for only the liftgate glass, INSTALL a new liftgate ajar switch. REFER to Section 501-14 . TEST the system for normal operation.
D4 CHECK THE AJAR SWITCH OPERATION	
• Disconnect: Suspect Ajar Switch . • **Do the courtesy lamps turn on?**	**Yes** INSTALL a new ajar switch in question. REFER to Section 501-14 . TEST the system for normal operation. **No** GO to D5 .
D5 CHECK THE AJAR SWITCH CIRCUIT FOR A SHORT TO GROUND	
• Disconnect: SJB C2280b. • Measure the resistance between the suspect ajar switch, harness side and ground as follows:	**Yes** GO to D9 . **No** REPAIR the circuit in question. TEST the

	system for normal operation.
Location / **Connector-Pin** / **Circuit** LH front / C526-2 / CPL26 (GN/VT) RH front / C602-2 / CPL31 (GN/BK) LH rear / C715-2 / CPL36 (GN) RH rear / C820-2 / CPL39 (YE) • **Is the resistance greater than 10,000 ohms?**	
D6 CHECK THE REAR WIPER MOTOR	
• Ignition OFF. • Disconnect: Rear Wiper Motor C4323. • Open the liftgate. • **Do the courtesy lamps turn on?**	**Yes** INSTALL a new rear window wiper motor. REFER to Section 501-16 . TEST the system for normal operation. **No** GO to D7 .
D7 CHECK CIRCUIT CPL58 (GY/OG) FOR A SHORT TO GROUND	
• Disconnect: SJB C2280B. • Disconnect: Liftgate Glass Ajar Switch C478. • Measure the resistance between the liftgate glass ajar switch C478-2, circuit CPL58 (GY/OG), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to D9 . **No** REPAIR the circuit. TEST the system for normal operation.
D8 CHECK THE LIFTGATE AJAR SWITCH	
• Disconnect: Liftgate Ajar Switch C479. • **Do the courtesy lamps turn on?**	**Yes** INSTALL a new liftgate ajar switch. REFER to Section 501-14 . TEST the system for normal operation. **No** REPAIR circuit CPL44 (YE/OG) for a short to ground. TEST the system for normal operation.
D9 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.

♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test E: All The Demand Lamps Are Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) supplies voltage to the demand lamps on circuit CLN01 (GN/VT). The demand lamps are grounded through circuit GD133 (BK) or circuit GD149 (BK/GY).

- DTC B1316 (Battery Saver Relay Coil Circuit Short to Ground) - a continuous and on-demand DTC that sets when the SJB detects a short to ground on the demand lamp voltage supply circuits.

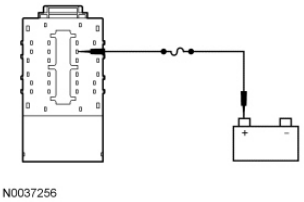
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST E: ALL THE DEMAND LAMPS ARE INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
E1 CHECK THE PUDDLE LAMP OPERATION	
• Ignition OFF. • Open any door and observe the puddle lamps. • **Do the puddle lamps illuminate?**	**Yes** GO to E2 . **No** For Explorer or Mountaineer, GO to Pinpoint Test J . For Explorer Sport Trac, GO to Pinpoint Test K .
E2 CHECK THE SJB DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Use the recorded results from the SJB continuous and on-demand self-tests. • **Is DTC B1316 recorded?**	**Yes** REFER to the Wiring Diagrams Manual to isolate the possible causes of the circuit short on circuits CLN01 (GN/VT) and CLN15 (GY/YE). **No** GO to E3 .

E3 CHECK THE GLOVE BOX LAMP OPERATION	
• Ignition OFF. • Open the glove box and observe the glove box lamp. • **Does the glove box lamp operate correctly?**	**Yes** GO to E4 . **No** GO to E5 .
E4 CHECK CIRCUIT CLN01 (GN/VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280a. • Connect a fused jumper wire between the SJB C2280a-23, circuit CLN01 (GN/VT), harness side and battery positive.  N0037256 • Operate any demand lamp on. • **Does the demand lamp illuminate?**	**Yes** GO to E5 . **No** REPAIR circuit CLN01 (GN/VT) for an open. TEST the system for normal operation.
E5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: An Individual Demand Lamp Is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) supplies voltage to the demand lamps on circuit CLN01 (GN/VT). The demand lamps are grounded through circuit GD133 (BK) or circuit GD149 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior lamp

PINPOINT TEST F: AN INDIVIDUAL DEMAND LAMP IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: To diagnose the glove compartment lamp, GO to Pinpoint Test H .

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>F1 CHECK CIRCUIT CLN01 (GN/VT) FOR VOLTAGE</td><td></td></tr>
<tr><td>

Ignition OFF.
Disconnect: Suspect Demand Lamp.
Ignition ON.
Measure the voltage between the suspect demand lamp connector, harness side and ground as follows:

<table>
<tr><th>Location</th><th>Connector-Pin</th><th>Circuit</th></tr>
<tr><td>RH vanity mirror lamp</td><td>C906-1</td><td>CLN01 (GN/VT)</td></tr>
<tr><td>LH vanity mirror lamp</td><td>C907-1</td><td>CLN01 (GN/VT)</td></tr>
<tr><td>Front interior lamp (without overhead console)</td><td>C981-3</td><td>CLN01 (GN/VT)</td></tr>
<tr><td>Front interior/map lamp (with overhead console)</td><td>C929-1 or C929-4</td><td>CLN01 (GN/VT)</td></tr>
<tr><td>Rear interior lamp</td><td>C901-3</td><td>CLN01 (GN/VT)</td></tr>
<tr><td>Cargo lamp (Explorer/Mountaineer)</td><td>C926-3</td><td>CLN01 (GN/VT)</td></tr>
</table>

Is the voltage greater than 10 volts?

</td><td>Yes
GO to F2 .

No
REPAIR circuit CLN01 (GN/VT) for an open. TEST the system for normal operation.</td></tr>
<tr><td>F2 CHECK THE GROUND CIRCUIT FOR AN OPEN</td><td></td></tr>
</table>

• Disconnect: Negative Battery Cable. • Measure the resistance between the suspect demand lamp, harness side and ground as follows: • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new interior lamp for the lamp in question. REFER to Interior Lamp - Front or Interior Lamp - Rear in this section. TEST the system for normal operation. **No** REPAIR the ground circuit in question for an open. TEST the system for normal operation.

Location	Connector-Pin	Circuit
RH vanity mirror lamp	C906-2	GD133 (BK)
LH vanity mirror lamp	C907-2	GD133 (BK)
Front interior lamp (without overhead console)	C981-2	GD149 (BK/GY)
Front interior/map lamp (with overhead console)	C929-2	GD133 (BK)
Rear interior lamp	C901-2	GD149 (BK/GY)
Cargo lamp (Explorer/Mountaineer)	C926-2	GD149 (BK/GY)

Pinpoint Test G: The Courtesy Lamps Are Inoperative From The Instrument Panel Dimmer Switch

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) monitors the instrument panel dimmer switch status on circuit CLN28 (GN/BU) to determine if the courtesy lamps are requested. Based on the instrument panel dimmer switch status, the SJB supplies voltage to the courtesy lamps through circuit CLN03 (YE/GY).

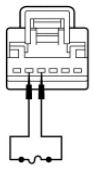
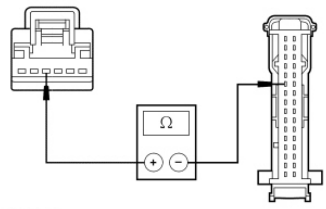
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST G: THE COURTESY LAMPS ARE INOPERATIVE FROM THE INSTRUMENT PANEL DIMMER SWITCH

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
G1 CHECK THE SJB DTCs FROM BOTH CONTINUOUS AND ON-DEMAND SELF-TESTS	

• Use the recorded results from the SJB continuous and on-demand self-test. • **Are any DTCs recorded?**	**Yes** REFER to DTC Charts in this section. **No** GO to G2 .
G2 BYPASS THE INSTRUMENT PANEL DIMMER SWITCH	
• Ignition OFF. • Disconnect: Instrument Panel Dimmer Switch C2298. • Connect a fused jumper wire between the instrument panel dimmer switch C2298-5, circuit CLN28 (GN/BU), harness side and the instrument panel dimmer switch C2298-4, circuit CLN17 (BN), harness side.  N0037303 • **Do the courtesy lamps illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new instrument panel dimmer switch. REFER to Section 413-00 . TEST the system for normal operation. **No** REMOVE the jumper wire. GO to G3 .
G3 CHECK THE INSTRUMENT PANEL DIMMER SWITCH INPUT CIRCUIT FOR AN OPEN	
• Measure the resistance between the instrument panel dimmer switch C2298-4, circuit CLN28 (GN/BU), harness side and the SJB C2280d-6, circuit CLN28 (GN/BU), harness side.  N0090490 • **Is the resistance less than 5 ohms?**	**Yes** GO to G4 . **No** REPAIR circuit CLN28 (GN/BU) for an open. TEST the system for normal operation.
G4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly.	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded

• Operate the system and verify the concern is still present. • **Is the concern still present?**	connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: The Glove Compartment Lamp Is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) provides voltage to the glove compartment lamp on circuit CLN15 (GY/YE). The glove compartment lamp is grounded through circuit GD138 (BK/WH).

This pinpoint test is intended to diagnose the following:

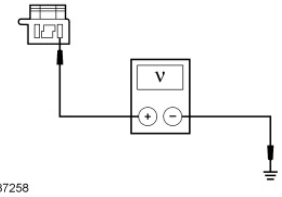
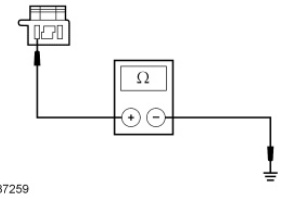
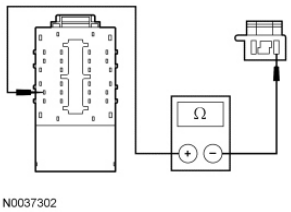
- Wiring, terminals or connectors
- Glove compartment lamp
- SJB

PINPOINT TEST H: THE GLOVE COMPARTMENT LAMP IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Section 414-01 .

Test Step	Result / Action to Take
H1 CHECK THE OPERATION OF THE DEMAND LIGHTING	
• Ignition ON. • Operate the demand lamps. • **Do the demand lamps illuminate?**	**Yes** GO to H2 . **No** GO to Pinpoint Test E .
H2 CHECK CIRCUIT CLN15 (GY/YE) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Glove Compartment Lamp C254. • Ignition ON. • Measure the voltage between the glove compartment lamp C254-1, circuit CLN15 (GY/YE) and ground.	**Yes** GO to H3 . **No** GO to H4 .

 N0037258 • **Is the voltage greater than 10 volts?**	
H3 CHECK CIRCUIT GD138 (BK/WH) FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the glove compartment lamp C254-2, circuit GD138 (BK/WH) and ground.  N0037259 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new glove compartment lamp. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
H4 CHECK CIRCUIT CLN15 (GY/YE) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280c. • Measure the resistance between the SJB C2280c-9, circuit CLN15 (GY/YE), harness side and the glove compartment lamp C254-1, circuit CLN15 (GY/YE), harness side.  N0037302 • **Is the resistance less than 5 ohms?**	**Yes** GO to H5 . **No** REPAIR the circuit. TEST the system for normal operation.
H5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No**

• Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test I: The Battery Saver Does Not Deactivate After Time-Out

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) provides a battery saver function. The battery saver function provides automatic shutoff of the interior lamps (courtesy lamps and demand lamps) after a predetermined time has elapsed in order to save battery power.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST I: THE BATTERY SAVER DOES NOT DEACTIVATE AFTER TIME-OUT

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
I1 CHECK CIRCUIT CLN03 (YE/GY) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280a. • Ignition ON. • Operate any map lamp. • **Does the lamp illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to I2 .
I2 CHECK CIRCUIT CLN15 (GY/YE) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280c. • Ignition ON. • Operate the glove compartment lamp. • **Does the glove compartment lamp illuminate?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to I3 .
I3 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation.

♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Puddle Lamps Are Inoperative - Explorer, Mountaineer

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) provides voltage to the puddle lamps through circuit CLN25 (VT). The puddle lamps have separate ground circuits. The LH exterior mirror is grounded through circuit GD133 (BK), and the RH exterior mirror is grounded through circuit GD151 (BK/GN).

This pinpoint test is intended to diagnose the following:

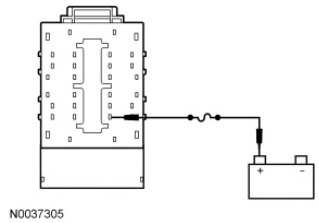
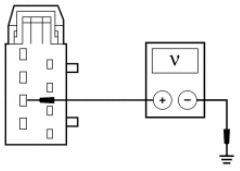
- Fuse
- Wiring, terminals or connectors
- Exterior mirror
- SJB

PINPOINT TEST J: THE PUDDLE LAMPS ARE INOPERATIVE - EXPLORER, MOUNTAINEER

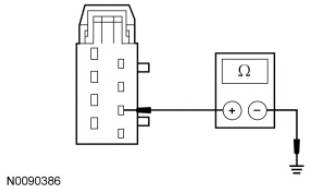
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
J1 CHECK THE RECORDED RESULTS FROM THE SJB CONTINUOUS AND ON-DEMAND SELF-TESTS	
• Review the recorded results from the continuous and on-demand self-tests. • **Are any DTCs present?**	**Yes** REFER to DTC Charts in this section. **No** GO to J2 .
J2 CHECK THE PUDDLE LAMP OPERATION	
• Observe the puddle lamps. • **Are both the puddle lamps inoperative?**	**Yes** VERIFY the SJB fuse 23 (15A) is OK. If OK, GO to J3 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. **No** GO to J4 .

J3 CHECK CIRCUIT CLN25 (VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280a. • Connect a fused jumper wire between the SJB C2280a-7, circuit CLN25 (VT), harness side and battery positive.  N0037305 • **Do the puddle lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to J6 . **No** REMOVE the jumper wire. REPAIR circuit CLN25 (VT) for an open. TEST the system for normal operation.
J4 CHECK CIRCUIT CLN25 (VT) FOR VOLTAGE	
• Ignition OFF. • Disconnect: Suspect Exterior Mirror. • **NOTE:** The courtesy lamps must be active during this test. • Measure the voltage between the suspect exterior mirror connector, harness side and ground as follows: **Location** / **Connector-Pin** / **Circuit** RH exterior mirror / C601-6 / CLN25 (VT) LH exterior mirror / C520-6 / CLN25 (VT)  N0090385 • **Is the voltage greater than 10 volts?**	**Yes** GO to J5 . **No** REPAIR circuit CLN25 (VT) for an open. TEST the system for normal operation.
J5 CHECK THE GROUND CIRCUIT FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the suspect exterior mirror connector, harness side and ground as follows:	**Yes** INSTALL a new exterior mirror in question. REFER to Section 501-09 . TEST the system for normal operation. **No** REPAIR the ground circuit in question for an open. TEST the system for normal

Location	Connector-Pin	Circuit
RH exterior mirror	C601-5	GD151 (BK/GN)
LH exterior mirror	C520-5	GD133 (BK)



- **Is the resistance less than 5 ohms?**

operation.

J6 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Puddle Lamp(s)/Cargo Lamp Is Inoperative - Explorer Sport Trac

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) provides voltage to the puddle lamps and the cargo lamp through circuit CLN25 (VT). The puddle lamps and the cargo lamp have separate ground circuits. The LH exterior mirror is grounded through circuit GD133 (BK), and the RH exterior mirror is grounded through circuit GD151 (BK/GN). The cargo lamp is grounded through circuit GD133 (BK).

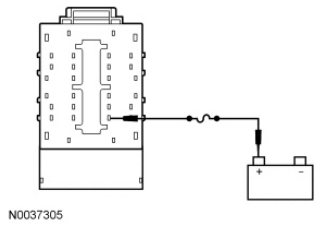
This pinpoint test is intended to diagnose the following:

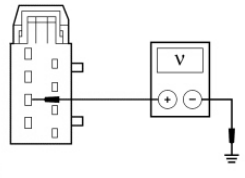
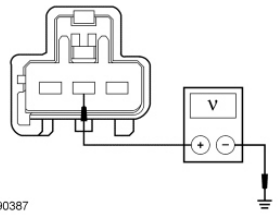
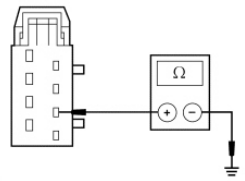
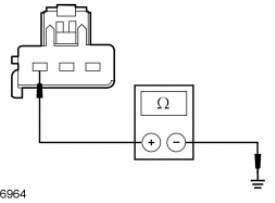
- Fuse
- Wiring, terminals or connectors
- Exterior mirror
- SJB

PINPOINT TEST K: THE PUDDLE LAMP(S)/CARGO LAMP IS INOPERATIVE - EXPLORER SPORT TRAC

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
K1 CHECK THE RECORDED RESULTS FROM THE SJB CONTINUOUS AND ON-DEMAND SELF-TEST	
• Review the recorded results from the continuous and on-demand self-tests. • **Are any DTCs present?**	**Yes** REFER to the DTC Charts in this section. **No** GO to K2 .
K2 CHECK THE PUDDLE LAMP OPERATION	
• Observe the puddle lamps. • **Are both puddle lamps inoperative?**	**Yes** VERIFY the SJB fuse 23 (15A) is OK. If OK, GO to K3 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. **No** GO to K4 .
K3 CHECK CIRCUIT CLN25 (VT) FOR AN OPEN	
• Ignition OFF. • Disconnect: SJB C2280a. • Connect a fused jumper wire between the SJB C2280a-7, circuit CLN25 (VT), harness side and battery positive.  N0037305 • **Do the puddle lamps illuminate?**	**Yes** REMOVE the jumper wire. GO to K6 . **No** REMOVE the jumper wire. REPAIR circuit CLN25 (VT) for an open. TEST the system for normal operation.
K4 CHECK CIRCUIT CLN25 (VT) FOR VOLTAGE	
• Disconnect: Suspect Exterior Mirror or Cargo Lamp. • **NOTE:** The courtesy lamps must be active during this test. • For an inoperative puddle lamp, measure the voltage between the RH exterior mirror C601-6, circuit CLN25 (VT), harness side and ground; and between the LH exterior mirror C520-6, circuit CLN25 (VT), harness side and ground	**Yes** GO to K5 . **No** REPAIR circuit CLN25 (VT) for an open. TEST the system for normal operation.

 N0090385 • For an inoperative cargo lamp, measure the voltage between the suspect cargo lamp connector C927-2, circuit CLN25 (VT), harness side and ground.  N0090387 • **Is the voltage greater than 10 volts?**	
K5 CHECK THE GROUND CIRCUIT FOR AN OPEN	
• Disconnect: Negative Battery Cable. • For an inoperative puddle lamp, measure the resistance between the RH exterior mirror C601-5, circuit GD151 (BK/GN), harness side and ground; and between the LH exterior mirror C520-5, circuit GD133 (BK), harness side and ground  N0090386 • For an inoperative cargo lamp, measure the resistance between the suspect cargo lamp connector C927-1, circuit CLN25 (VT), harness side and ground.  N0046964 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new cargo lamp or exterior mirror in question. REFER to Section 501-09 . TEST the system for normal operation. **No** REPAIR the ground circuit in question for an open. TEST the system for normal operation.
K6 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors.	**Yes** INSTALL a new SJB . REFER

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: The Puddle Lamps/Cargo Lamp Is Always On

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) provides voltage to the puddle lamps and the cargo lamp through circuit CLN25 (VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST L: THE PUDDLE LAMPS/CARGO LAMP IS ALWAYS ON

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
L1 CHECK CIRCUIT CLN25 (VT) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: SJB C2280a. • Ignition ON. • **Do the puddle lamps continue to illuminate?**	**Yes** REPAIR circuit CLN25 (VT) for a short to voltage. TEST the system for normal operation. **No** GO to L2 .
L2 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

concern is still present. • **Is the concern still present?**	

Pinpoint Test M: The Dome Defeat Feature Is Inoperative

Refer to Wiring Diagrams Cell 71 , Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) send a reference signal to the instrument panel dimmer switch through circuit VLN36 (GY/OG) to monitor the dome defeat request. The voltage signal is routed through a series of resistors within the switch and then back to the SJB . When the instrument panel dimmer switch is placed in the DOME DEFEAT position, the signal is routed through a single resistor, signaling the SJB a request for the dome defeat feature. When the SJB detects a dome defeat request, the SJB does not turn the courtesy lamps on when a door/liftgate/liftgate glass is opened, a door is unlocked using a key or when the doors are unlocked using the Remote Keyless Entry (RKE) transmitter.

- DTC B1687 (Lamp Dome Input Circuit Short to Ground) - a continuous and on-demand DTC that may set when the SJB detects an open or short to voltage from the dome defeat request input circuit.

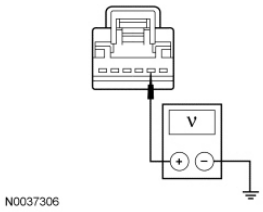
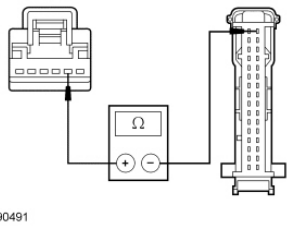
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

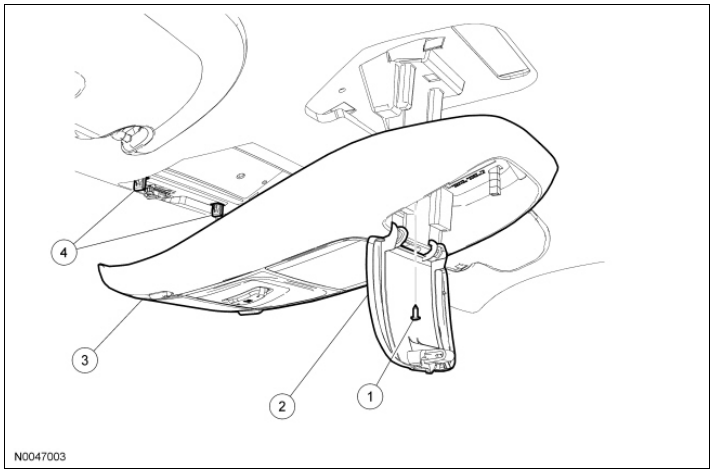
PINPOINT TEST M: THE DOME DEFEAT FEATURE IS INOPERATIVE

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
M1 CHECK THE DIMMABLE LIGHTING SYSTEM FOR CORRECT OPERATION	
• Ignition OFF. • Place the headlamp switch in the PARKING LAMPS ON position. • Rotate the instrument panel dimmer switch to the lowest and highest setting while observing the dimmable components. • **Does the dimmable lighting operate correctly?**	**Yes** GO to M2 . **No** REFER to Section 413-00 .
M2 CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
• Place the headlamp switch in the OFF position. • Disconnect: Instrument Panel Dimmer Switch C2298. • Carry out the instrument panel dimmer switch component test.	**Yes** GO to M3 . **No** INSTALL a new instrument panel dimmer switch. REFER to Section 413-00 .

Refer to Wiring Diagrams Cell 149 for component testing. • **Is the instrument panel dimmer switch OK?**	CLEAR the DTCs. REPEAT the self-test.
M3 CHECK DOME DEFEAT REQUEST INPUT CIRCUIT FOR A SHORT TO VOLTAGE	
• Disconnect: SJB C2280d. • Ignition ON. • Measure the voltage between the instrument panel dimmer switch C2298-2, circuit VLN36 (GY/OG), harness side and ground.  • **Is any voltage present?**	**Yes** REPAIR circuit VLN36 (GY/OG) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. **No** GO to M4 .
M4 CHECK DOME DEFEAT REQUEST INPUT CIRCUIT FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the instrument panel dimmer switch C2298-2, circuit VLN36 (GY/OG), harness side and the SJB C2280d-6, circuit VLN36 (GY/OG), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to M5 . **No** REPAIR circuit VLN36 (GY/OG) for an open. CLEAR the DTCs. REPEAT the self-test.
M5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Interior Lamp - Front



Item	Part Number	Description
1	-	Overhead console screw
2	-	Overhead console storage door (part of 78519A70)
3	78519A70	Overhead console
4	-	Overhead console retainer clips

Removal and Installation

1. **NOTE:** Use a small screwdriver to pry open the garage door opener bin.

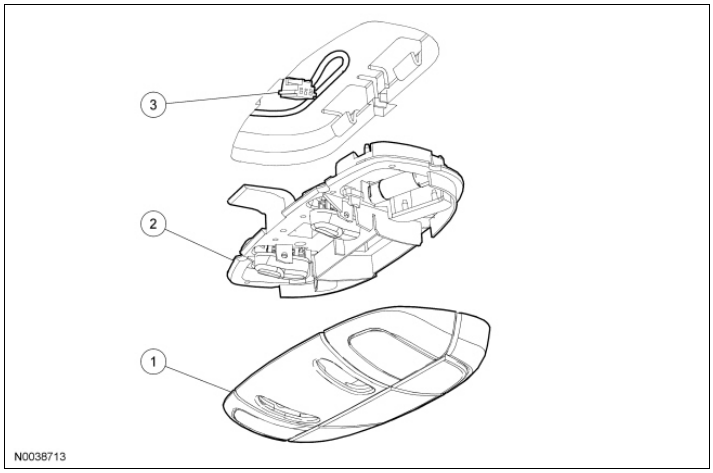
   Open the rear overhead console storage or garage door opener bin to access the retaining screw.

   - Remove the screw.

2. Pull the front of the overhead console down and remove the console from the console retaining clips.
   - Disconnect the electrical connector(s).

3. To install, reverse the removal procedure.

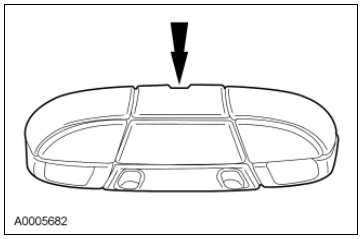
Interior Lamp - Rear



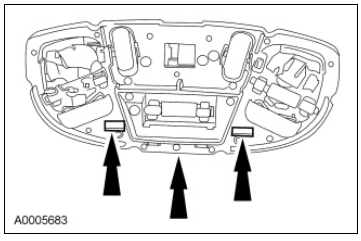
Item	Part Number	Description
1	13783	Rear interior lamp lens
2	13776	Rear interior lamp
3	-	Rear interior lamp electrical connector (part of 14335)

Removal and Installation

1. Remove the rear interior lamp lens.

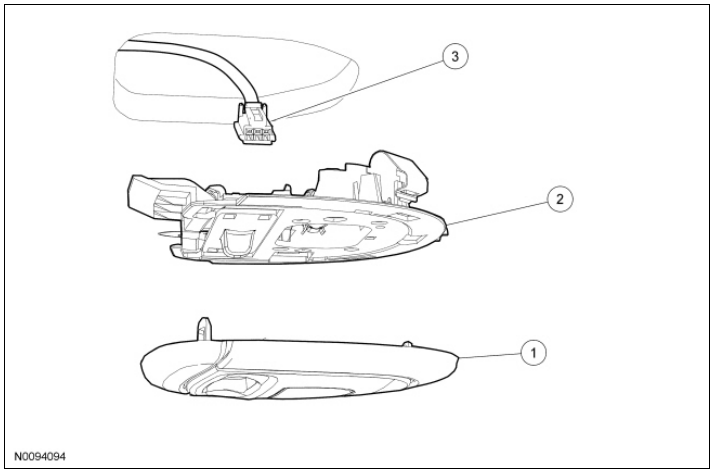


2. Release the 2 retaining clips (through the access holes) and remove the rear interior lamp assembly.
   - Disconnect the electrical connector.



3. To install, reverse the removal procedure.

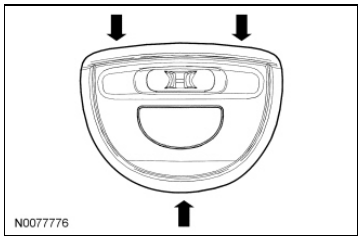
Cargo Lamp



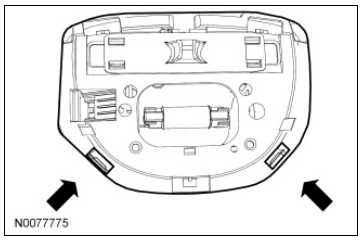
Item	Part Number	Description
1	13783	Cargo lamp lens
2	13776	Cargo lamp
3	-	Interior lamp electrical connector (part of 14335)

Removal and Installation

1. Remove the cargo lamp lens.



2. Release the 2 retaining clips (through the access holes) and remove the cargo lamp.
   - Disconnect the electrical connector.



3. To install, reverse the removal procedure.

Communications Network

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

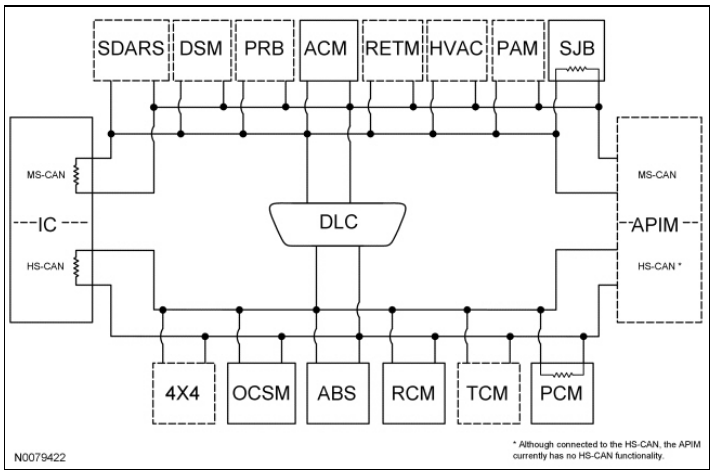
Vehicle communication utilizes both Medium Speed (MS) and High Speed (HS) Controller Area Network (CAN) communications. CAN is used for many modules to communicate with each other on a common network. CAN in-vehicle networking is a method for transferring data among distributed electronic modules via serial data bus. Without serial networking, intermodule communication requires dedicated, point to point wiring resulting in bulky, expensive, complex, and difficult to install wiring harnesses. Applying a serial data network reduces the number of wires, combining the signals on a single network. Information is sent to the individual control modules that control each function.

The vehicle has 2 module communication networks:

- Medium Speed Controller Area Network (MS-CAN)
- High Speed Controller Area Network (HS-CAN)

Both networks are connected to the Data Link Connector (DLC). This makes diagnosis and testing of these systems easier by allowing one scan tool to be able to diagnose and control any module on both networks from one connector. The DLC can be found under the instrument panel between the steering column and the Audio Front Control Module (ACM).

Network Topology



Module Name	Network Type	Termination Module
4X4 control module (if equipped)	HS-CAN	No
ABS module	HS-CAN	No
Accessory Protocol Interface Module (APIM)	HS-CAN MS-CAN	No No
Audio Front Control Module (ACM)	MS-CAN	No
Driver Seat Module (DSM) (if equipped)	MS-CAN	No

HVAC module (if equipped)	MS-CAN	No
Instrument Cluster (IC) (gateway module)	HS-CAN MS-CAN	Yes Yes
Occupant Classification System Module (OCSM)	HS-CAN	No
Parking Aid Module (PAM) (if equipped)	MS-CAN	No
PCM	HS-CAN	Yes
Power Running Board (PRB) module (if equipped)	MS-CAN	No
Rear Entertainment Module (RETM) (if equipped)	MS-CAN	No
Restraints Control Module (RCM)	HS-CAN	No
Satellite Digital Audio Receiver System (SDARS) module (if equipped)	MS-CAN	No
Smart Junction Box (SJB)	MS-CAN	Yes
Transmission Control Module (TCM) (if equipped)	HS-CAN	No

Medium Speed Controller Area Network (MS-CAN) Operation

The MS-CAN communicates using bussed messages. The MS-CAN has an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The MS-CAN is a medium speed communication network used for the following modules:

- Accessory Protocol Interface Module (APIM)
- Audio Front Control Module (ACM)
- Driver Seat Module (DSM) (if equipped)
- HVAC module (if equipped)
- Instrument Cluster (IC)
- Parking Aid Module (PAM) (if equipped)
- Power Running Board (PRB) module (if equipped)
- Rear Entertainment Module (RETM) (if equipped)
- Satellite Digital Audio Receiver System (SDARS) module (if equipped)
- Smart Junction Box (SJB)

High Speed Controller Area Network (HS-CAN) Operation

The HS-CAN communicates using bussed messages. The HS-CAN uses an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The HS-CAN is a high speed communication network used for the following modules:

- 4X4 control module (if equipped)
- ABS module
- APIM
- IC
- Occupant Classification System Module (OCSM)
- PCM
- Restraints Control Module (RCM)
- Transmission Control Module (TCM) (if equipped)

Network Termination

The CAN uses a network termination circuit to improve communication reliability. The network termination of the CAN bus takes place inside the termination modules by termination resistors. Termination modules are located at either end of the bus network. As network messages are broadcast in the form of voltage signals, the network voltage signals are stabilized by the termination resistors. Each termination module has a 120 ohm resistor across the positive and negative bus connection in the termination module. With 2 termination modules on each network, and the 120 ohm resistors located in a parallel circuit configuration, the total network impedance, or total resistance is 60 ohms.

Network termination improves bus message reliability by:

- Stabilizing bus voltage
- Eliminating electrical interference

Gateway Module

The IC is the gateway module, translating HS-CAN to MS-CAN and vice versa. This information allows a message to be distributed throughout both networks. The IC is the only module on this vehicle that has this ability.

Communications Network

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

Vehicle communication utilizes both Medium Speed (MS) and High Speed (HS) Controller Area Network (CAN) communications. CAN is a method for transferring data among distributed electronic modules via a serial data bus.

The vehicle is equipped with 2 module communication networks:

- Medium Speed Controller Area Network (MS-CAN)
- High Speed Controller Area Network (HS-CAN)

Medium Speed Controller Area Network (MS-CAN)

The MS-CAN is a medium speed communication network that uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other. The MS-CAN will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The MS-CAN may remain operational when 1 of the 2 termination resistors are not present.

The MS-CAN operates at a maximum data transfer speed of 125 Kbps for bus messages and designed for general information transfer. The network will remain operational, but at a degraded level, when certain circuit faults are present.

The following modules are on the MS-CAN :

- Accessory Protocol Interface Module (APIM) (if equipped)
- Audio Front Control Module (ACM)

- Driver Seat Module (DSM) (if equipped)
- HVAC module (if equipped)
- Instrument Cluster (IC)
- Parking Aid Module (PAM) (if equipped)
- Power Running Board (PRB) module (if equipped)
- Rear Entertainment Module (RETM) (if equipped)
- Satellite Digital Audio Receiver System (SDARS) module (if equipped)
- Smart Junction Box (SJB)

The following fault chart describes the specific MS-CAN failures and their resulting symptom:

Medium Speed Controller Area Network (MS-CAN) Communication Fault Chart

Failure Description	Symptom
MS-CAN (+) shorted to MS-CAN (-)	No communication
MS-CAN (+) short to voltage	No communication
MS-CAN (-) short to voltage	No communication
MS-CAN (+) short to ground	No communication
MS-CAN (-) short to ground	Unreliable communication possible to all network modules
MS-CAN (+) open	Unreliable communication possible to all network modules
MS-CAN (-) open	Unreliable communication possible to all network modules
Module loss of voltage or ground	No communication
Module internal failure	No communication

High Speed Controller Area Network (HS-CAN)

The HS-CAN is a high speed communication network that uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other. The HS-CAN will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The HS-CAN bus may remain operational when 1 of the 2 termination resistors are not present.

The HS-CAN operates at a maximum data transfer speed of 500 Kbps and is designed for real time information transfer and control. The network will remain operational, but at a degraded level, when certain circuit faults are present.

The following modules are on the HS-CAN :

- 4X4 control module (if equipped)
- ABS module
- Accessory Protocol Interface Module (APIM) (if equipped)
- Instrument Cluster (IC)
- Occupant Classification System Module (OCSM)
- PCM
- Restraints Control Module (RCM)

- Transmission Control Module (TCM) (if equipped)

The following fault chart describes the specific HS-CAN failures and their resulting symptom:

High Speed Controller Area Network (HS-CAN) Communication Fault Chart

Failure Description	Symptom
HS-CAN (+) shorted to HS-CAN (-)	No communication
HS-CAN (+) short to voltage	No communication
HS-CAN (-) short to voltage	No communication
HS-CAN (+) short to ground	No communication
HS-CAN (-) short to ground	Unreliable communication possible to all network modules
HS-CAN (+) open	Unreliable communication possible to all network modules
HS-CAN (-) open	Unreliable communication possible to all network modules
Module loss of voltage or ground	No communication
Module internal failure	No communication

The following chart describes the specific CAN messages broadcast by each module, and the module(s) that receive the message:

CAN Module Communication Message Chart

Broadcast Message	Originating Module	Network Type	Receiving Module(s)
ABS event in progress	ABS module	HS-CAN	• PCM • RCM
ABS/traction control system configuration	ABS module	HS-CAN	• 4X4 control module • IC
ABS malfunction indicator request	ABS module	HS-CAN	• IC
ABS Roll Stability Control (RSC®) malfunction	ABS module	HS-CAN	• IC
A/C clutch inhibit request	TCM	HS-CAN	• PCM
A/C clutch request	HVAC module	MS-CAN	• IC
A/C clutch request (gateway)	IC	HS-CAN	• PCM
Accelerator pedal position	PCM	HS-CAN	

			• ABS module • RCM • TCM • 4X4 control module
Accessory delay status	SJB	MS-CAN	• ACM • RETM
Advance-Trac (stability control) event in progress	ABS	HS-CAN	• PCM • RCM
Advance-Trac (stability control) indicator/message request	ABS	HS-CAN	• IC
Airbag deployment eCall confirmation	APIM	HS-CAN	• RCM
Airbag deployment eCall notification	RCM	HS-CAN	• APIM
Airbag deployment event status	RCM	HS-CAN	• IC • OCSM • PCM
Airbag malfunction indicator request	RCM	HS-CAN	• IC
Ambient temperature, with HVAC module	HVAC module	MS-CAN	• SJB • PRB module
Ambient temperature, with manual A/C	IC	MS-CAN	• SJB • PRB module
Audio volume cutback request	PAM	MS-CAN	• ACM
Autolamp delay status	SJB	MS-CAN	• IC
Autolamp sensor status	SJB	MS-CAN	• IC
Axle ratio	PCM	HS-CAN	• ABS module • TCM
Barometric pressure	PCM	HS-CAN	• IC • TCM
Barometric pressure (gateway)	IC	MS-CAN	• SJB
Battery saver status	SJB	MS-CAN	• IC

Brake fluid level status	ABS module	HS-CAN	• IC
Brake malfunction indicator request	ABS module	HS-CAN	• IC
Brake switch status	PCM	HS-CAN	• IC • TCM • 4X4 control module
Charging system warning indicator request	PCM	HS-CAN	• IC
Charging system status	PCM	HS-CAN	• IC
Door ajar status	SJB	MS-CAN	• IC • PRB module
Door ajar status (gateway)	IC	HS-CAN	• ABS module
Door lock command (autolock)	IC	MS-CAN	• SJB
Door unlock command (auto un-lock)	IC	MS-CAN	• SJB
Door lock status (autolock)	SJB	MS-CAN	• IC
Door unlock status (auto un-lock)	SJB	MS-CAN	• IC
Easy entry/exit command	IC	MS-CAN	• DSM
Easy entry/exit status	DSM	MS-CAN	• IC
Engine coolant temperature	PCM	HS-CAN	• ABS module • IC • TCM
Engine coolant temperature (gateway)	IC	MS-CAN	• HVAC module
Engine fail-safe cooling mode status	PCM	HS-CAN	• IC
Engine fail-safe Electronic Throttle Control (ETC) mode status	PCM	HS-CAN	• IC • TCM
Engine fuel consumption data	PCM	HS-CAN	• IC
Engine load %	PCM	HS-CAN	• TCM
Engine oil temperature protection active	PCM	HS-CAN	

			• TCM
Engine Malfunction Indicator Lamp (MIL) request	PCM	HS-CAN	• IC
Engine MIL request	TCM	HS-CAN	• PCM • IC
Engine off timer	PCM	HS-CAN	• IC
Engine off timer (gateway)	IC	MS-CAN	• HVAC module
Engine RPM	PCM	HS-CAN	• ABS module • IC • TCM
Engine RPM (gateway)	IC	MS-CAN	• SJB
Engine RPM request	TCM	HS-CAN	• PCM
Engine torque data	PCM	HS-CAN	• TCM
Engine torque reduction request	ABS module	HS-CAN	• PCM • 4X4 control module
Engine torque reduction request	TCM	HS-CAN	• PCM
Fuel cap off indicator request	PCM	HS-CAN	• IC
Fuel level input status (instant)	IC	HS-CAN	• PCM
Fuel level state	IC	MS-CAN	• ACM
Headlamp high beam indicator request	SJB	MS-CAN	• IC
Headlamp switch position	SJB	MS-CAN	• IC
Ignition switch position	IC	HS-CAN	• 4X4 control module
Ignition switch position	IC	MS-CAN	• ACM • DSM • RETM • PAM • PRB module

Illumination dimmer level	SJB	MS-CAN	• ACM • RETM • IC
Key fob button status	SJB	MS-CAN	• DSM • IC
Key-in-ignition status	IC	MS-CAN	• SJB • DSM
Lamp out warning status	SJB	MS-CAN	• IC
Navigation rolling wheel count	ABS module	HS-CAN	• IC
Navigation rolling wheel count (gateway)	IC	MS-CAN	• ACM
Occupant Classification System (OCS) data	OCSM	HS-CAN	• RCM
OCS serial number and calibration	OCSM	HS-CAN	• RCM
OCS object entrapped request	OCSM	HS-CAN	• IC
Odometer count	PCM	HS-CAN	• IC
Parking aid disable switch status	IC	MS-CAN	• PAM
Parking aid system status	PAM	MS-CAN	• IC
Parking aid volume cutback request	PAM	MS-CAN	• ACM
Parking brake status	SJB	MS-CAN	• IC
Parking brake status (gateway)	IC	HS-CAN	• PCM
Passive Anti-Theft System (PATS) OK to start	IC	HS-CAN	• PCM
PATS security data	IC	HS-CAN	• PCM
PATS security data	PCM	HS-CAN	• IC
PATS theft condition	PCM	HS-CAN	• IC
Power running board enable/disable	IC	MS-CAN	• PRB module
Power running board status	PRB module	HS-CAN	• IC
RCM serial number	RCM	HS-CAN	• OCSM
Safety belt indicator request	RCM	HS-CAN	

			• IC
Safety belt indicator status	IC	HS-CAN	• RCM
Safety belt latch status - Passenger	RCM	HS-CAN	• OCSM
Safety Belt-Minder® chime/flash request	RCM	HS-CAN	• IC
Safety Belt-Minder® chime/flash status	IC	HS-CAN	• RCM
Speed control indicator request	PCM	HS-CAN	• IC
Speed control status	PCM	HS-CAN	• IC • TCM
Steering wheel angle	ABS	HS-CAN	• 4X4 control module
Throttle position	PCM	HS-CAN	• TCM
Tire Pressure Monitoring System (TPMS) status	SJB	MS-CAN	• IC
Tire revs per mile	PCM	HS-CAN	• TCM
TPMS sensor status (LF, RF, RR, LR, spare)	SJB	MS-CAN	• IC
Tire size information	ABS module	HS-CAN	• PCM
Torque converter lockup status	TCM	HS-CAN	• PCM
Trailer sway event in progress	ABS module	HS-CAN	• IC
Transmission malfunction indicator request - 4.0L engine	PCM	HS-CAN	• IC
Transmission malfunction indicator request - 4.6L engine	TCM	HS-CAN	• IC
Transmission output shaft speed	TCM	HS-CAN	• PCM
Transmission overdrive indicator request	PCM	HS-CAN	• IC
Transmission selector (PRNDL) range - 4.0L engine	PCM	HS-CAN	• ABS module • IC • PCM • 4X4 control module
Transmission selector (PRNDL) range - 4.6L engine	TCM	HS-CAN	

			• ABS module • IC • PCM • 4X4 control module
Transmission selector (PRNDL) range (gateway)	IC	MS-CAN	• ACM • DSM • SJB • PAM
Transmission shift in progress - 4.0L engine	PCM	HS-CAN	• ABS module
Transmission shift in progress - 4.6L engine	TCM	HS-CAN	• ABS module • PCM
Transmission temperature	TCM	HS-CAN	• PCM
Transmission torque converter lockup status	TCM	HS-CAN	• PCM
Transmission turbine shaft speed	TCM	HS-CAN	• PCM
Turn signal request	SJB	MS-CAN	• IC
Vehicle speed	PCM	HS-CAN	• IC • RCM
Vehicle speed (gateway)	IC	MS-CAN	• ACM • HVAC module • PAM • PRB module • SJB
Vehicle Identification Number (VIN) information	PCM	HS-CAN	• ABS module • OCSM • RCM • 4X4 control module
Windshield defrost status - Front	SJB	MS-CAN	• IC
Windshield defrost command - Rear	HVAC module	MS-CAN	• SJB
Windshield defrost status - Rear	SJB	MS-CAN	

			• HVAC module
Wheel speed output (RF, LF, RR, LR)	ABS module	HS-CAN	• PCM • TCM
4X4 coupling mode and status	4X4 control module	HS-CAN	• ABS module • PCM • TCM
4X4 high indicator/message request	4X4 control module	HS-CAN	• IC
4X4 low indicator/message request	4X4 control module	HS-CAN	• IC

Inspection and Verification

1. Verify the customer concern.

2. Visually inspect for obvious signs of electrical damage.
   - If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Visual Inspection Chart

Electrical
• Battery Junction Box (BJB) fuse(s): ♦ 3 (50A) (no communication with Smart Junction Box (SJB)) ♦ 6 (40A) (no communication with ABS module) ♦ 19 (30A) (no communication with Power Running Board (PRB) module) ♦ 23 (20A) (no communication with 4X4 control module) ♦ 24 (10A) (no communication with PCM) ♦ 26 (20A) (no communication with 4X4 control module) ♦ 27 (20A) (no communication with Transmission Control Module (TCM)) ♦ 33 (30A) (no communication with ABS module) ♦ 39 (15A) (no communication with PCM) ♦ 41 (15A) (no communication with Accessory Protocol Interface Module (APIM), Satellite Digital Audio Receiver System (SDARS) module, Rear Entertainment Module (RETM)) • SJB fuse(s): ♦ 1 (20A) (no communication with Driver Seat Module (DSM)) ♦ 2 (5A) (no communication with SJB) ♦ 3 (20A) (no communication with Audio Front Control Module (ACM)) ♦ 4 (10A) (no power to scan tool) ♦ 8 (15A) (no communication with Instrument Cluster (IC)) ♦ 9 (2A) (no communication with TCM , PCM) ♦ 12 (5A) (no communication with ACM) ♦ 17 (10A) (no communication with Restraints Control Module (RCM), Occupant Classification System Module (OCSM))

- ♦ 18 (10A) (no communication with ABS module, 4X4 control module, Parking Aid Module (PAM))
- ♦ 20 (10A) (no communication with HVAC module)
- ♦ 24 (10A) (no communication with IC)
- ♦ 28 (10A) (no communication with HVAC module)

- Data Link Connector (DLC)
- Wiring harness
- Wiring, terminals or connectors

3. Connect the scan tool to the DLC .
   - **NOTE:** Make sure to use the latest scan tool software release.

     NOTE: The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

     If the Integrated Diagnostic System (IDS) does not communicate with the VCM :

     - ♦ Check the VCM connection to the vehicle.
     - ♦ Check the scan tool connection to the VCM .
     - ♦ GO to Pinpoint Test U , to diagnose No Power To The Scan Tool.

4. Establish a scan tool session.
   - **NOTE:** The scan tool will first attempt to communicate with the PCM, after establishing communication with the PCM, the scan tool will then attempt to communicate with all other modules on the vehicle.

     If an IDS session cannot be established with the vehicle, (IDS may state "No communication can be established with the PCM"):

     - ♦ Choose "NO" when the scan tool prompts whether or not to retry communication.
     - ♦ Enter either a PCM part number, tear tag or calibration number to identify the vehicle and start a session (the PCM part number and 4-character tear tag are printed on the PCM label).
     - ♦ GO to Pinpoint Test A , to diagnose "The PCM Does Not Respond To The Scan Tool".

5. Carry out the network test.
   - If the network test passes, retrieve and record the continuous memory DTCs and proceed to Step 6.
   - If the network test fails, GO to Symptom Chart to diagnose the failed communication network.
   - If a module fails to communicate during the network test, GO to Symptom Chart .

6. Retrieve and review the DTCs.
   - If the DTCs retrieved are related to the concern, go to DTC Charts. Follow the non-network DTC diagnostics (B-codes, C-codes, P-codes) prior to the network DTC diagnostics (U-codes). For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .
   - If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

NOTE: Network DTCs (U-codes) are often a result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle service procedures such as module reprogramming will often set network DTCs. Replacing a module to resolve a network DTC is unlikely to resolve the concern. To prevent repeat network DTC concerns, inspect all network wiring, especially connectors. Test the vehicle battery, refer to Section 414-01 .

NOTE: Some modules on this vehicle utilize a 5-character DTC followed by a 2-character failure-type code. The failure-type code provides information about specific fault conditions such as opens, or shorts to ground. Continuous memory DTCs have an additional 2-character DTC status code suffix to assist in determining DTC history.

Network DTC Chart

NOTE: DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module.

DTC	Description	Source	Action
U0073	Control Module Communication Bus A Off	Transmission Control Module (TCM)	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0100	Lost Communication With ECM /PCM	TCM	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0100:00	Lost Communication With ECM /PCM "A": No Sub Type Information	Accessory Protocol Interface Module (APIM)	REFER to Section 415-00 .
U0101	Lost Communication With TCM	4X4 control module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0102	Lost Communication With Transfer Case Control Module (4x4CM)	TCM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	4X4 control module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	TCM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0140	Lost Communication With Body Control Module (GEM)	Audio Front Control Module (ACM)	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (	Instrument Cluster (IC)	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate

	GEM)		pinpoint test for the module that fails the network test.
U0140	Lost Communication With Body Control Module (GEM)	Parking Aid Module (PAM)	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0140	Lost Communication With Body Control Module (GEM)	Rear Entertainment Module (RETM)	REFER to Section 415-00 .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	ACM	REFER to Section 415-00 .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	ACM	REFER to Section 415-00 .
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	PAM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Smart Junction Box (SJB)	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	ACM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0159	Lost Communication With Parking Assist Control Module (PAM)	IC	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	ACM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0164	Lost Communication With HVAC Control Module (EATC)	SJB	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that fails the network test.
U0184	Lost Communication With Radio (ACM)	APIM	REFER to Section 415-00 .

U0184	Lost Communication With Radio (ACM)	RETM	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	Satellite Digital Audio Receiver System (SDARS) module	REFER to Section 415-00 .
U0184:00	Lost Communication With Radio: No Sub Type Information	APIM	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	ACM	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	RETM	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	ACM	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	APIM	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	SDARS module	REFER to Section 415-00 .
U0196:00	Lost Communication With Entertainment Control Module - Rear "A": No Sub Type Information	ACM	REFER to Section 415-00 .
U0196:00	Lost Communication With Entertainment Control Module - Rear "A": No Sub Type Information	APIM	REFER to Section 415-00 .
U0197	Lost Communication With Telephone Control Module	ACM	REFER to Section 415-00 .
U0197	Lost Communication With Telephone Control Module	SDARS module	REFER to Section 415-00 .
U0197:00	Lost Communication With Telephone Control Module: No Sub Type Information	ACM	REFER to Section 415-00 .
U0244	Lost Communication With Running Board Control Module (PRB)	IC	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module that failed the network test.
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	RCM	CLEAR the DTC. REPEAT the network test with the scan tool. If the DTC returns, GO to Pinpoint Test P .
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	APIM	RETRIEVE and FOLLOW non-network DTCs from the SJB .

U0423:00	Invalid Data Received From Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	APIM	RETRIEVE and FOLLOW non-network DTCs from the IPC .
U0485:00	Invalid Data Received From Radio: No Sub Type Information	APIM	RETRIEVE and FOLLOW non-network DTCs from the ACM .
U1900	CAN Communication Bus Fault-Receive Error	4X4 control module	GO to Symptom Chart for module that failed the network test.
U1900	CAN Communication Bus Fault-Receive Error	ABS module	GO to Symptom Chart for module that failed the network test.
U1900	CAN Communication Bus Fault-Receive Error	Driver Seat Module (DSM)	GO to Symptom Chart for module that failed the network test.
U1900	CAN Communication Bus Fault-Receive Error	IC	GO to Symptom Chart for module that failed the network test.
U1900	CAN Communication Bus Fault-Receive Error	Occupant Classification System Module (OCSM)	GO to Symptom Chart for module that failed the network test.
U1900	CAN Communication Bus Fault-Receive Error	Power Running Board (PRB) module	GO to Symptom Chart for module that failed the network test.
U1900	CAN Communication Bus Fault-Receive Error	RCM	GO to Symptom Chart for module that failed the network test.
U1901	CAN Network #2 Communication Bus Fault - Receive Error	ABS module	REFER to Section 206-09 .
U2013	Compass Module Is Not Responding	IC	REFER to Section 413-01 .
U2023	Fault Received From External Node	4X4 control module	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.
U2023	Fault Received From External Node	ABS module	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.
U2023	Fault Received From External Node	IC	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to Section 419-10 for a list of all DTCs.
U2023	Fault Received From External Node	PAM	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the

			network. REFER to Section 419-10 for a list of all DTCs.
U2471	Unexpected PRNDL State	PAM	RETRIEVE and FOLLOW non-network DTCs from the other modules. REFER to Section 419-10 for a list of all DTCs.
U2472	Unexpected Ignition State	PAM	RETRIEVE and FOLLOW non-network DTCs from the other modules. REFER to Section 419-10 for a list of all DTCs.
U2473	Unexpected Vehicle Speed (VSS)	PAM	RETRIEVE and FOLLOW non-network DTCs from the other modules. REFER to Section 419-10 for a list of all DTCs.
U2510	CAN - Invalid Data For Vehicle Security	IC	RETRIEVE and FOLLOW non-network DTCs from the other modules. REFER to Section 419-01 .
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	IC	RETRIEVE and FOLLOW non-network DTCs from the other modules. REFER to Section 419-01 .
U3000:88	Control Module: Bus Off	APIM	The module could not communicate on the network at a point in time. The fault is currently not present since the module is currently communicating with the scan tool reporting this DTC. CLEAR the DTC. REPEAT the network test with the scan tool.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The PCM Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 23 , Electronic Engine Controls - 4.0L for schematic and connector information.

Refer to Wiring Diagrams Cell 24 , Electronic Engine Controls - 4.6L for schematic and connector information.

Normal Operation

The PCM communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the PCM.

This pinpoint test is intended to diagnose the following:

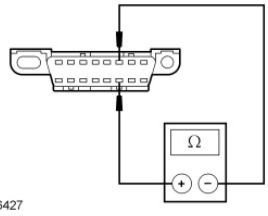
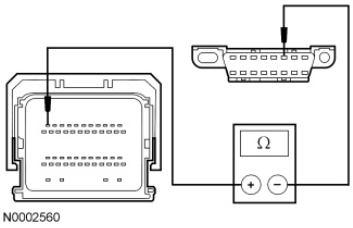
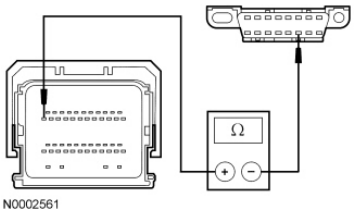
- Wiring, terminals or connectors
- PCM

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
A1 VERIFY WHETHER OTHER HS-CAN MODULES PASS THE NETWORK TEST	
• Enter the following diagnostic mode on the scan tool: Network Test. • In the left hand pane of the Integrated Diagnostic System (IDS) network test display screen, verify whether any HS-CAN modules passed the network test. • **Is the text "pass" or a DTC listed next to any of the following modules (if equipped): 4x4 control module, ABS module, Accessory Protocol Interface Module (APIM), Instrument Cluster (IC), Occupant Classification System Module (OCSM), PCM or Restraints Control Module (RCM)?**	**Yes** If "pass" or a DTC was listed next to the PCM, a network fault is not currently present. GO to Pinpoint Test T to diagnose an intermittent HS-CAN fault condition. If "pass" or a DTC was listed next to one or more modules other than the PCM, GO to A2 . **No** No modules are currently communicating on the HS-CAN . GO to Pinpoint Test S to diagnose no HS-CAN communication.
A2 PC/ED MANUAL PINPOINT TEST QA VERIFICATION CHECK	
• Verify that pinpoint test QA has been performed. • **Has pinpoint test QA been performed?**	**Yes** GO to A3 . **No** REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual, Section 5, pinpoint test QA to diagnose no communication with the PCM.
A3 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the Data Link Connector (DLC) C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** CONNECT the negative battery cable. GO to A5 . **No** GO to A4 .

 N0026427 • **Is the resistance between 54 and 66 ohms?**	
A4 CHECK THE CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN	
• Disconnect: PCM C175b. • Measure the resistance between the PCM C175b-11, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0002560 • Measure the resistance between the PCM C175b-23, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0002561 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to A5 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
A5 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test B: The Transmission Control Module (TCM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 30 , Transmission Controls - 6R60 for schematic and connector information.

Normal Operation

The 6R60 transmission utilizes a Transmission Control Module (TCM) to control transmission functions. The TCM communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the TCM . Voltage for the TCM is provided by circuits SBB27 (BU/RD) and CE517 (BU/GN). Circuit GD113 (BK/YE) provides ground.

This pinpoint test is intended to diagnose the following:

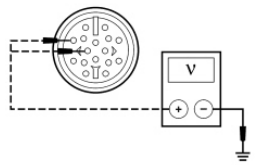
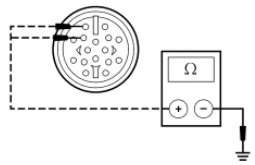
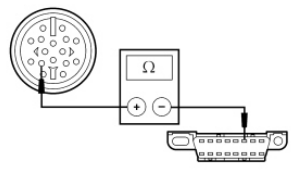
- Fuse
- Wiring, terminals or connectors
- TCM

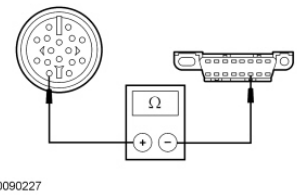
PINPOINT TEST B: THE TCM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
B1 CHECK THE TCM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: TCM C1575 (6R60 Transmission). • Ignition ON. • Measure the voltage between the TCM C1575-9, circuit CE517 (BU/GN), harness side and ground; and between the TCM C1575-14, circuit SBB27 (BU/RD), harness side and ground	**Yes** GO to B2 . **No** VERIFY that the Battery Junction Box (BJB) fuse 27 (20A) or Smart Junction Box (SJB) fuse 9 (2A) is OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0090217 • **Are the voltages greater than 10 volts?**	
B2 CHECK THE TCM GROUND CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the TCM C1575-13, circuit GD113 (BK/YE), harness side and ground; and between the TCM C1575-16, circuit GD113 (BK/YE), harness side and ground.  N0090218 • **Are the resistances less than 5 ohms?**	**Yes** GO to B3 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
B3 CHECK THE HS-CAN CIRCUITS BETWEEN THE TCM AND THE DLC FOR AN OPEN	
• Measure the resistance between the TCM C1575-6, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0090226 • Measure the resistance between the TCM C1575-2, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** CONNECT the negative battery cable. GO to B4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

 • **Are the resistances less than 5 ohms?**	
B4 CHECK FOR CORRECT TCM OPERATION	
• Disconnect the TCM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the TCM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new TCM . REFER to Mechatronic Assembly in Section 307-01B . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test C: The ABS Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 42 , Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the ABS module. Voltage for the ABS module is provided by circuits CBP18 (GY/OG), SBB06 (BN/RD) and SBB33 (RD). Ground is provided by circuit GD120 (BK/GN).

This pinpoint test is intended to diagnose the following:

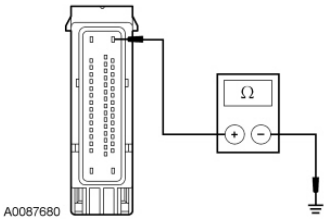
- Fuse
- Wiring, terminals or connectors
- ABS module

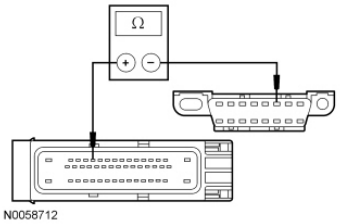
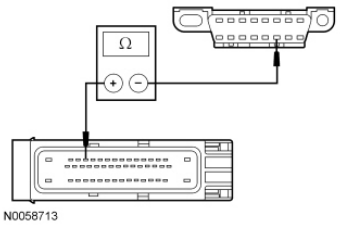
PINPOINT TEST C: THE ABS MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take

C1 CHECK THE ABS VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: ABS Module C155. • Ignition ON. • Measure the voltage between the ABS module, harness side and ground as follows: **Connector-Pin / Circuit** C155-1 / SBB06 (BN/RD) C155-8 / CBP18 (GY/OG) C155-32 / SBB33 (RD) • **Are the voltages greater than 10 volts?**	**Yes** GO to C2 . **No** VERIFY the Battery Junction Box (BJB) fuse 6 (40A) or fuse 33 (30A) and the Smart Junction Box (SJB) fuse 18 (10A) is OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
C2 CHECK THE ABS GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the ABS module C155-16, circuit GD120 (BK/GN) harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to C3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
C3 CHECK THE HS-CAN CIRCUITS BETWEEN THE ABS MODULE AND THE DLC FOR AN OPEN	
• Measure the resistance between the ABS module C135-12, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.	**Yes** CONNECT the negative battery cable. GO to C4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0058712 • Measure the resistance between the ABS module C135-13, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0058713 • **Are the resistances less than 5 ohms?**	
C4 CHECK FOR CORRECT ABS MODULE OPERATION	
• Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test D: The Restraints Control Module (RCM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Restraints Control Module (RCM) communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the RCM . Voltage for the RCM is provided by circuit CBP17 (BN/GN), and the RCM is case grounded.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors

- Case ground open
- RCM

PINPOINT TEST D: THE RCM DOES NOT RESPOND TO THE SCAN TOOL

⚠ WARNING: Never probe the electrical connectors on air bag, Safety Canopy® or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

⚠ WARNING: Never disassemble or tamper with seat belt deployable components, including pretensioners, load limiters and inflators. Never back probe deployable device electrical connectors. Tampering or back probing may cause an accidental deployment and result in personal injury or death.

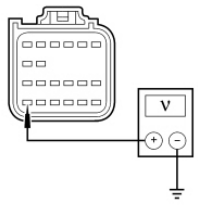
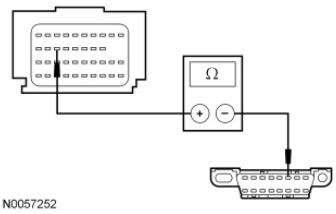
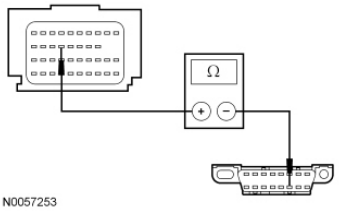
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
D1 CHECK THE RCM CONNECTION	
• Ignition OFF. • Depower the SRS . Refer to Section 501-20B . • Disconnect: RCM C310a. • Disconnect: RCM C310b. • **Are RCM C310a pin 24 and RCM C310b pins 17 and 18 OK?**	**Yes** GO to D2 . **No** REPAIR the RCM connector pins as necessary. REPOWER the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
D2 CHECK THE RCM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Deactivate the SRS . Refer to Section 501-20B . • Repower the SRS . Refer to Section 501-20B . • Ignition ON. • Measure the voltage between the RCM C310a-24, circuit CBP17 (BN/GN), harness side and ground.	**Yes** GO to D3 . **No** VERIFY the Smart Junction Box (SJB) fuse 17 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0037003 • **Is the voltage greater than 10 volts?**	
D3 CHECK THE RCM CASE GROUND	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the RCM case and a good chassis ground. • **Is the resistance less than 5 ohms?**	**Yes** GO to D4 . **No** REPAIR the RCM case ground as necessary. CONNECT the negative battery cable. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
D4 CHECK THE HS-CAN CIRCUITS BETWEEN THE RCM AND THE DLC FOR AN OPEN	
• Measure the resistance between the RCM C310b-18, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0057252 • Measure the resistance between the RCM C310b-17, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0057253 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to D5 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
D5 CHECK FOR CORRECT RCM OPERATION	

• Disconnect all the RCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the RCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RCM . REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test E: The 4X4 Control Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 34 , Four Wheel Drive Systems for schematic and connector information.

Normal Operation

The 4X4 control module communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the 4X4 control module. Voltage is supplied by circuits CBP18 (GY/OG), SBB23 (RD/WH) and SBB26 (RD/BK). Ground is supplied by circuits GD138 (BK/WH) and GD145 (BK/BU).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- 4X4 control module

PINPOINT TEST E: THE 4X4 CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
E1 CHECK THE 4X4 CONTROL MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: 4X4 Control Module C281a. • Disconnect: 4X4 Control Module C281b. • Ignition ON. • Measure the voltage between the 4X4 control module, harness side and ground as follows:	**Yes** GO to E2 . **No** VERIFY the Battery Junction Box (BJB) fuse 23 (20A) or fuse 26 (20A) is OK and the Smart Junction Box (SJB) fuse 18 (10A) is OK. If OK, REPAIR the circuit in question. If not OK,

	REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.

Connector-Pin	Circuit
C281a-8	CBP18 (GY/OG)
C281b-6	SBB23 (WH/RD)
C281b-7	SBB26 (YE/RD)

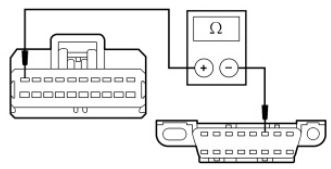
- **Are the voltages greater than 10 volts?**

E2 CHECK THE 4X4 CONTROL MODULE GROUND CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the 4X4 control module, harness side and ground as follows:	**Yes** GO to E3 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

Connector-Pin	Circuit
C281b-3	GD145 (BK/BU)
C281b-10	GD138 (BK/WH)

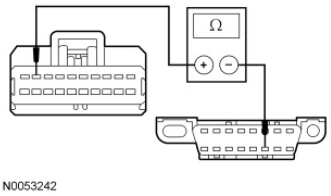
- **Are the resistances less than 5 ohms?**

E3 CHECK THE HS-CAN CIRCUITS BETWEEN THE 4X4 CONTROL MODULE AND THE DLC FOR AN OPEN	
• Measure the resistance between the 4X4 control module C281a-10, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.	**Yes** CONNECT the negative battery cable. GO to E4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.



N0053241

- Measure the resistance between the 4X4 control module C281a-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.

 N0053242 • **Are the resistances less than 5 ohms?**	
E4 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
• Disconnect all the 4X4 control module connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the 4X4 control module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. REFER to Section 308-07A . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test F: The Occupant Classification System Module (OCSM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 46 , Supplemental Restraint System for schematic and connector information.

Normal Operation

The Occupant Classification System Module (OCSM) communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the OCSM . Voltage to the OCSM is supplied by circuit CBP17 (BN/GN). Ground is supplied by circuit GD145 (BK/BU).

This pinpoint test is intended to diagnose the following:

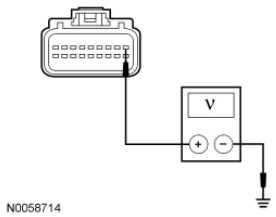
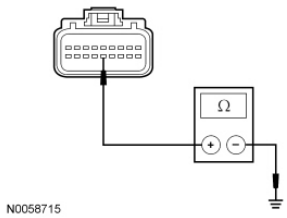
- Fuse
- Wiring, terminals or connectors
- OCSM

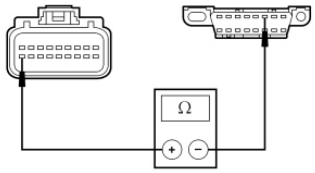
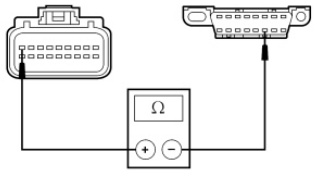
PINPOINT TEST F: THE OCSM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

Test Step	Result / Action to Take
F1 CHECK THE OCSM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
⚠ WARNING: Never disassemble or tamper with seat belt deployable components, including pretensioners, load limiters and inflators. Never back probe deployable device electrical connectors. Tampering or back probing may cause an accidental deployment and result in personal injury or death. **NOTE:** The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer. • Ignition OFF. • Depower the SRS . Refer to Section 501-20B . • Disconnect: OCSM C3159. • Deactivate the SRS . Refer to Section 501-20B . • Repower the SRS . Refer to Section 501-20B . • Ignition ON. • Measure the voltage between the OCSM C3159-1, circuit CBP17 (BN/GN), harness side and ground.  N0058714 • **Is the voltage greater than 10 volts?**	**Yes** GO to F2 . **No** VERIFY the Smart Junction Box (SJB) fuse 17 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.
F2 CHECK THE OCSM GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the OCSM C3159-14, circuit GD145 (BK/BU), harness side and ground.  N0058715	**Yes** GO to F3 . **No** REPAIR the circuit. CONNECT the negative battery cable. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.

• **Is the resistance less than 5 ohms?**	
F3 CHECK THE HS-CAN CIRCUITS BETWEEN THE OCSM AND THE DLC FOR AN OPEN	
• Measure the resistance between the OCSM C3159-18, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0026670 • Measure the resistance between the OCSM C3159-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026671 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to F4 . **No** REPAIR the circuit. REACTIVATE the SRS . REFER to Section 501-20B . CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
F4 CHECK FOR CORRECT OCSM OPERATION	
• Disconnect the OCSM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the OCSM connector and make sure it seats correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new OCSM . REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the SRS . REFER to Section 501-20B . CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test G: The Instrument Cluster (IC) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Normal Operation

The Instrument Cluster (IC) communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the HS-CAN connection to the IC and circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the MS-CAN connection to the IC . Voltage for the IC is provided by circuits CDC34 (WH/OG) and SBP24 (VT/RD). Circuit GD145 (BK/BU) provides ground.

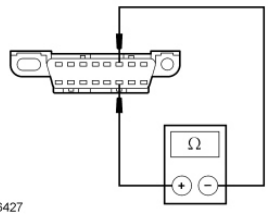
This pinpoint test is intended to diagnose the following:

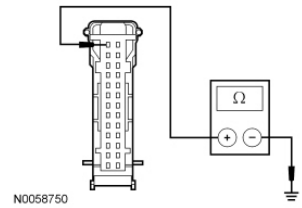
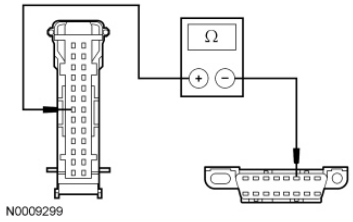
- Fuse
- Wiring, terminals or connectors
- IC

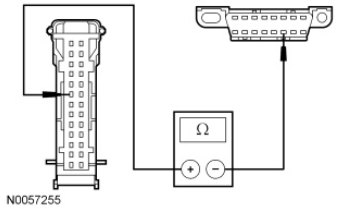
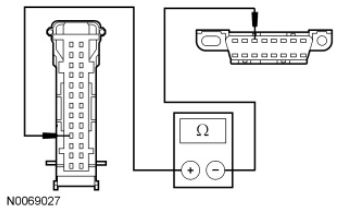
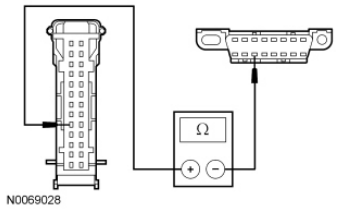
PINPOINT TEST G: THE IC DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
G1 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Disconnect the scan tool cable from the Data Link Connector (DLC). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to G2 . **No** GO to G4 .
G2 CHECK THE IC GROUND CIRCUIT FOR AN OPEN	

• Measure the resistance between the IC C220-13, circuit GD145 (BK/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to G3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
G3 CHECK THE IC VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Disconnect: IC C220. • Ignition ON. • Measure the voltage between the IC , harness side and ground as follows: **IC Connector-Pin** / **Circuit** C220-1 / SBP24 (VT/RD) C220-2 / CDC34 (WH/OG) • **Are the voltages greater than 10 volts?**	**Yes** GO to G5 . **No** VERIFY the Smart Junction Box (SJB) fuse 8 (15A) or fuse 24 (10A) is OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
G4 CHECK THE HS-CAN CIRCUITS BETWEEN THE IC AND THE DLC FOR AN OPEN	
• Measure the resistance between the IC C220-7, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  • Measure the resistance between the IC C220-8, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to G5 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

 • **Are the resistances less than 5 ohms?**	
G5 CHECK THE MS-CAN CIRCUITS BETWEEN THE IC AND THE DLC FOR AN OPEN	
• Measure the resistance between the IC C220-4, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  • Measure the resistance between the IC C220-5, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to G6 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
G6 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test H: The Smart Junction Box (SJB) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 10 , Grounds for schematic and connector information.

Refer to Wiring Diagrams Cell 13 , Power Distribution/SJB for schematic and connector information.

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

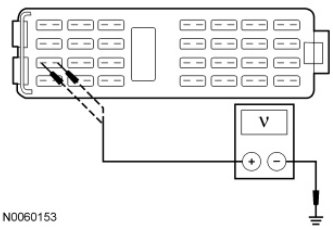
The Smart Junction Box (SJB) communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the SJB . Voltage for the SJB is provided by circuit SBB03 (BU/RD). Circuit GD108 (BK/VT) provides ground.

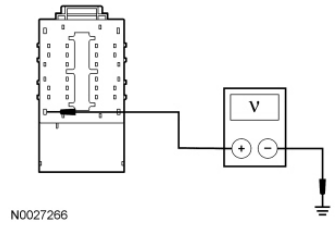
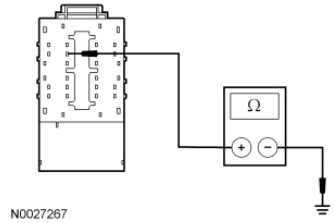
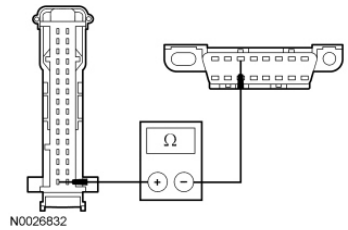
This pinpoint test is intended to diagnose the following:

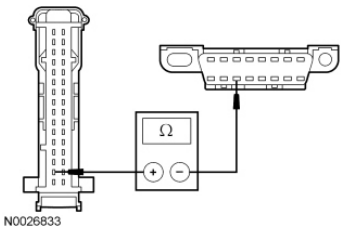
- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST H: THE SJB DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
H1 CHECK THE SJB FUSE FOR VOLTAGE	
• Ignition OFF. • **NOTE:** Measurements are taken with the fuses installed. • Measure the voltage between the SJB fuse 2 (5A) and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to H3 . **No** VERIFY the Smart Junction Box (SJB) fuse 2 (5A) is OK. If OK, GO to H2 . If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
H2 CHECK THE SJB VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	

• Disconnect: SJB C2280e. • Measure the voltage between the SJB C2280e-1, circuit SBB03 (BU/RD), harness side and ground.  N0027266 • **Is the voltage greater than 10 volts?**	**Yes** GO to H5 . **No** VERIFY the Battery Junction Box (BJB) fuse 3 (50A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
H3 CHECK THE SJB GROUND CIRCUIT FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Disconnect: SJB C2280e. • Measure the resistance between the SJB C2280e-22, circuit GD108 (BK/VT), harness side and ground.  N0027267 • **Is the resistance less than 5 ohms?**	**Yes** GO to H4 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
H4 CHECK THE MEDIUM SPEED CAN CIRCUITS BETWEEN THE SJB AND THE DLC FOR AN OPEN	
• Disconnect: SJB C2280d. • Measure the resistance between the SJB C2280d-16, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0026832 • Measure the resistance between the SJB C2280d-15, circuit VDB07 (VT/OG),	**Yes** CONNECT the negative battery cable. GO to H5 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  • **Are the resistances less than 5 ohms?**	
H5 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test I: The HVAC Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 55 , Automatic Climate Control System for schematic and connector information.

Normal Operation

The HVAC module communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the HVAC module. Voltage for the HVAC module is provided by circuits CBP20 (YE/VT) and SBP28 (GN/RD). Circuit GD145 (BK/BU) provides ground.

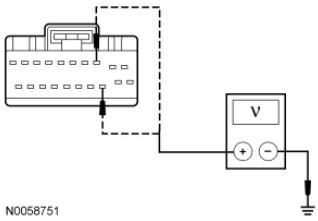
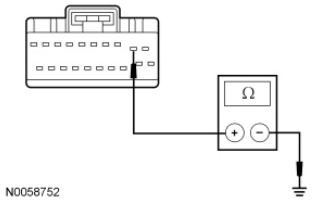
This pinpoint test is intended to diagnose the following:

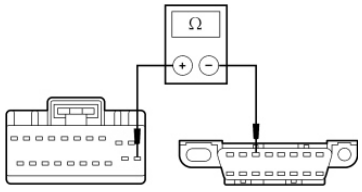
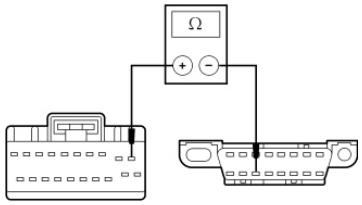
- Fuse
- Wiring, terminals or connectors
- HVAC module

PINPOINT TEST I: THE HVAC MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
I1 CHECK THE HVAC MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: HVAC Module C228a. • Ignition ON. • Measure the voltage between the HVAC module C228a-13, circuit SBP28 (GN/RD), and between the HVAC module C228a-3, circuit CBP20 (YE/VT) and ground.  • **Are the voltages greater than 10 volts?**	**Yes** GO to I2 . **No** VERIFY the Smart Junction Box (SJB) fuse 20 (10A) or fuse 28 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. REPEAT the network test with the scan tool.
I2 CHECK THE HVAC GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the HVAC module C228a-2, circuit GD145 (BK/BU) and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to I3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
I3 CHECK THE MS-CAN CIRCUITS BETWEEN THE HVAC MODULE AND THE DLC FOR AN OPEN	
• Measure the resistance between the HVAC module C228a-11, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.	**Yes** CONNECT the negative battery cable. GO to I4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs.

 N0026826 • Measure the resistance between the HVAC module C228a-1, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0026827 • **Are the resistances less than 5 ohms?**	REPEAT the network test with the scan tool.
I4 CHECK FOR CORRECT HVAC MODULE OPERATION	
• Disconnect all the HVAC module connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the HVAC module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test J: The Audio Front Control Module (ACM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the Audio Front Control Module (ACM). Voltage for the ACM is provided by circuits CBP12 (GN/WH) and SBP03 (BU/RD). Circuit GD114 (BK/BU) provides ground.

This pinpoint test is intended to diagnose the following:

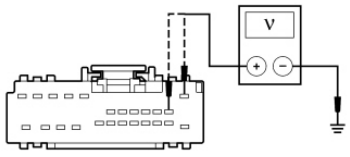
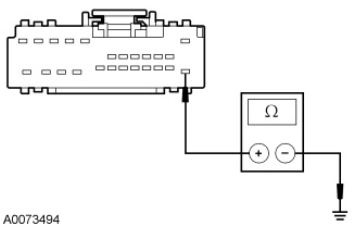
- Fuse

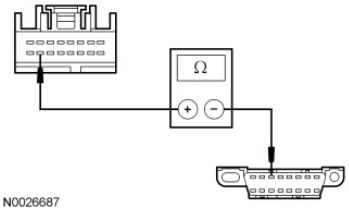
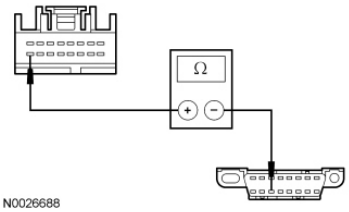
- Wiring, terminals or connectors
- ACM

PINPOINT TEST J: THE ACM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
J1 CHECK THE ACM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: ACM C290a. • Ignition ON. • Measure the voltage between the ACM C290a-1, circuit SBP03 (BU/RD), harness side and ground; and between the ACM C290a-2, circuit CBP12 (GN/WH), harness side and ground.  A0073493 • **Are the voltages greater than 10 volts?**	**Yes** GO to J2 . **No** VERIFY the Smart Junction Box (SJB) fuse 3 (20A) or fuse 12 (5A) is OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
J2 CHECK THE ACM GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the ACM C290a-13, circuit GD114 (BK/BU), harness side and ground.  A0073494 • **Is the resistance less than 5 ohms?**	**Yes** GO to J3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

J3 CHECK THE MS-CAN CIRCUITS BETWEEN THE ACM AND THE DLC FOR AN OPEN	
• Measure the resistance between the ACM C290b-15, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0026687 • Measure the resistance between the base ACM C290b-16, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0026688 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to J4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
J4 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ACM . REFER to Section 415-00 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test K: The Satellite Digital Audio Receiver System (SDARS) Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The Satellite Digital Audio Receiver System (SDARS) module communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the SDARS module. Voltage for the SDARS module is provided by circuit SBB41 (RD). Circuit GD114 (BK/BU) provides ground.

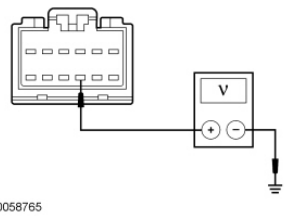
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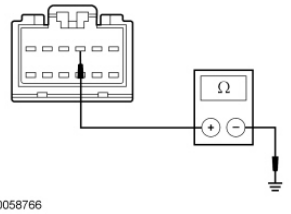
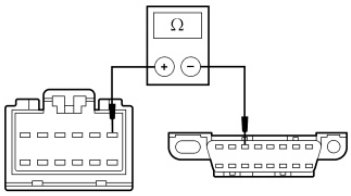
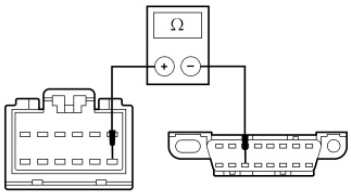
- Fuse
- Wiring, terminals or connectors
- SDARS module

PINPOINT TEST K: THE SDARS MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
K1 CHECK THE SDARS MODULE VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: SDARS Module C3290. • Ignition ON. • Measure the voltage between the SDARS module C3290-9, circuit SBB41 (RD), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to K2 . **No** VERIFY the Battery Junction Box (BJB) fuse 41 (15A) is OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
K2 CHECK THE SDARS MODULE GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the SDARS module C3290-3, circuit GD114 (BK/BU), harness side and ground.	**Yes** GO to K3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0058766 • **Is the resistance less than 5 ohms?**	
K3 CHECK THE MS-CAN CIRCUITS BETWEEN THE SDARS MODULE AND THE DLC FOR AN OPEN	
• Measure the resistance between the SDARS module C3290-1, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0026834 • Measure the resistance between the SDARS module C3290-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0026835 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to K4 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
K4 CHECK FOR CORRECT SDARS MODULE OPERATION	
• Disconnect the SDARS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SDARS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present.	**Yes** INSTALL a new SDARS module. REFER to Section 415-00 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

• **Is the concern still present?**	

Pinpoint Test L: The Rear Entertainment Module (RETM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 130 , Audio System/Navigation for schematic and connector information.

Normal Operation

The Rear Entertainment Module (RETM) communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the RETM . The RETM is only on vehicles equipped with rear seat entertainment. Voltage for the RETM is provided by circuit SBB41 (RD). Circuit GD114 (BK/BU) provides ground.

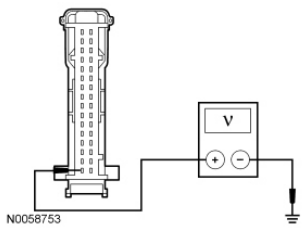
This pinpoint test is intended to diagnose the following:

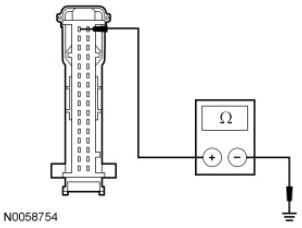
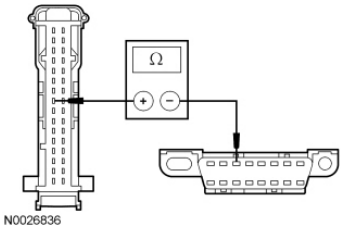
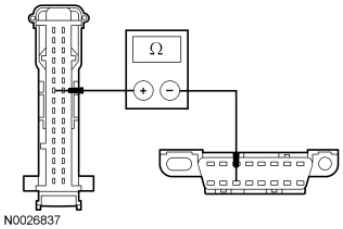
- Fuse
- Wiring, terminals or connectors
- RETM

PINPOINT TEST L: THE RETM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
L1 CHECK THE RETM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: RETM C9029. • Ignition ON. • Measure the voltage between the RETM C9029-16, circuit SBB41 (RD), harness side and ground.  	**Yes** GO to L2 . **No** VERIFY the Battery Junction Box (BJB) fuse 41 (15A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.

• **Is the voltage greater than 10 volts?**	
L2 CHECK THE RETM GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the RETM C9029-1, circuit GD114 (BK/BU), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to L3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
L3 CHECK THE MS-CAN CIRCUITS BETWEEN THE RETM AND THE DLC FOR AN OPEN	
• Measure the resistance between the RETM C9029-8, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  • Measure the resistance between the RETM C9029-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to L4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
L4 CHECK FOR CORRECT RETM OPERATION	
• Disconnect the RETM connector.	**Yes** INSTALL a new RETM . REFER to Section

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	415-00 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test M: The Driver Seat Module (DSM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 123 , Memory Seats for schematic and connector information.

Normal Operation

The Driver Seat Module (DSM) communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DSM . Voltage for the DSM is provided by circuit SBP01 (RD). Circuit GD143 (BK/OG) provides ground.

This pinpoint test is intended to diagnose the following:

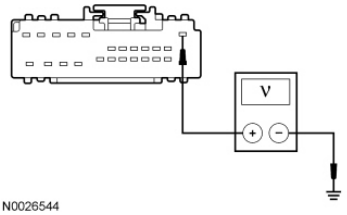
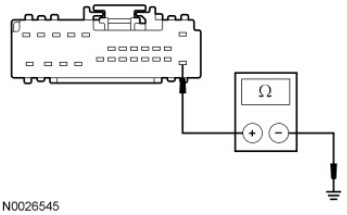
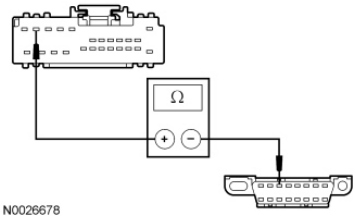
- Fuse
- Wiring, terminals or connectors
- DSM

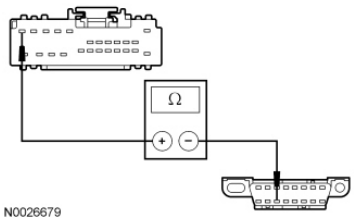
PINPOINT TEST M: THE DSM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
M1 CHECK THE DSM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: DSM C341c. • Ignition ON. • Measure the voltage between the DSM C341c-1, circuit SBP01 (RD), harness side and ground.	**Yes** GO to M2 . **No** VERIFY the Smart Junction Box (SJB) fuse 1 (20A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0026544 • **Is the voltage greater than 10 volts?**	
M2 CHECK THE DSM GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the DSM C341c-13, circuit GD143 (BK/OG), harness side and ground.  N0026545 • **Is the resistance less than 5 ohms?**	**Yes** GO to M3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
M3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE DSM FOR AN OPEN	
• Measure the resistance between the DSM C341c-11, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0026678 • Measure the resistance between the DSM C341c-12, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** CONNECT the negative battery cable. GO to M4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

 • **Are the resistances less than 5 ohms?**	
M4 CHECK FOR CORRECT DSM OPERATION	
• Disconnect all the DSM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the DSM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DSM . REFER to Section 419-10 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test N: The Power Running Board Module Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The Power Running Board (PRB) module communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the PRB module. Voltage for the PRB module is provided by circuit SBB19 (BU/RD). Circuit GD151 (BK/GN) provides ground.

This pinpoint test is intended to diagnose the following:

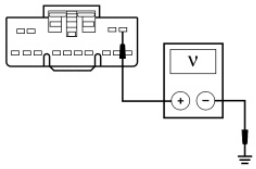
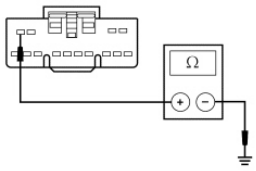
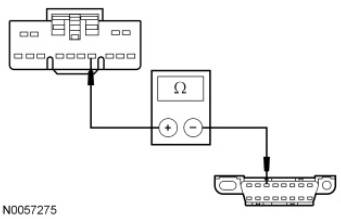
- Fuse
- Wiring, terminals or connectors
- PRB module

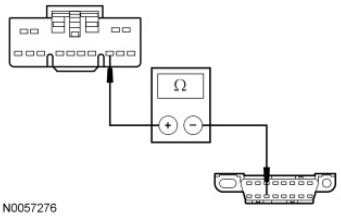
PINPOINT TEST N: THE PRB MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
N1 CHECK THE PRB MODULE VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	

• Ignition OFF. • Disconnect: PRB Module C4322b. • Ignition ON. • Measure the voltage between the PRB module C4322b-1, circuit SBB19 (BU/RD), harness side and ground.  N0057277 • **Is the voltage greater than 10 volts?**	**Yes** GO to N2 . **No** VERIFY the Battery Junction Box (BJB) fuse 19 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
N2 CHECK THE PRB MODULE GROUND CIRCUIT FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the PRB module C4322b-4, circuit GD151 (BK/GN), harness side and ground.  N0057278 • **Is the resistance less than 5 ohms?**	**Yes** GO to N3 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
N3 CHECK THE MS-CAN CIRCUITS BETWEEN THE PRB MODULE AND THE DLC FOR AN OPEN	
• Measure the resistance between the PRB module C4322b-8, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0057275	**Yes** CONNECT the negative battery cable. GO to N4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

• Measure the resistance between the PRB module C4322b-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  • **Are the resistances less than 5 ohms?**	
N4 CHECK FOR CORRECT PRB MODULE OPERATION	
• Disconnect all the PRB module connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Section 501-08 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test O: The Parking Aid Module (PAM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Refer to Wiring Diagrams Cell 131 , Parking Aid for schematic and connector information.

Normal Operation

The Parking Aid Module (PAM) communicates with the scan tool through the Medium Speed Controller Area Network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the PAM . Voltage for the PAM is provided by circuit CBP18 (GY/OG). Circuit GD145 (BK/BU) provides ground.

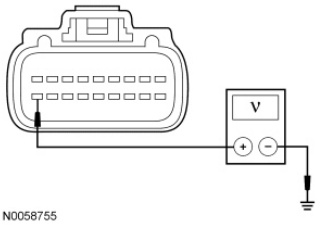
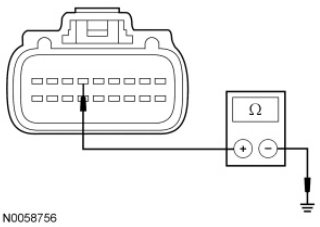
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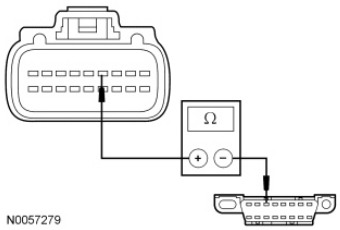
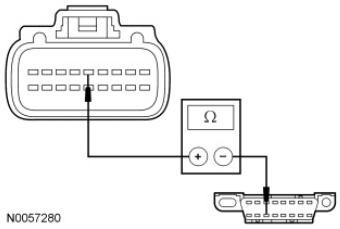
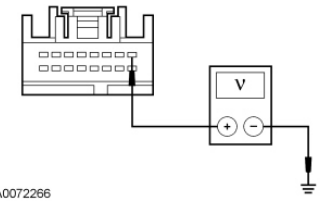
- Fuse
- Wiring, terminals or connectors
- PAM

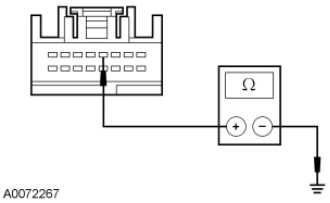
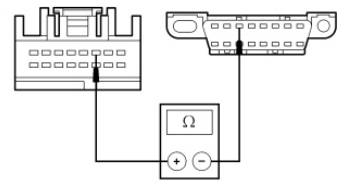
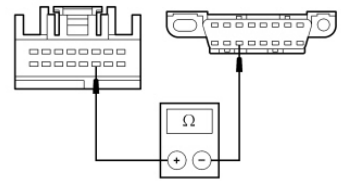
PINPOINT TEST O: THE PAM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
O1 VERIFY PARKING AID SYSTEM TYPE	
• **NOTE:** The Explorer uses a radar parking aid system while the Mountaineer and Explorer Sport Trac use an ultrasonic system. • Verify the parking aid system. • **Is the vehicle equipped with a RADAR parking aid system?**	**Yes** GO to O2 . **No** GO to O5 .
O2 CHECK THE PAM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN (RADAR)	
• Ignition OFF. • Disconnect: PAM C4226. • Ignition ON. • Measure the voltage between the PAM C4226-18, circuit CBP18 (GY/OG), harness side and ground.  N0058755 • **Is the voltage greater than 10 volts?**	**Yes** GO to O3 . **No** VERIFY the Smart Junction Box (SJB) fuse 18 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
O3 CHECK THE PAM GROUND CIRCUIT FOR AN OPEN (RADAR)	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the PAM C4226-6, circuit GD145 (BK/BU), harness side and ground.  N0058756 • **Is the resistance less than 5 ohms?**	**Yes** GO to O4 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

O4 CHECK THE MS-CAN CIRCUITS BETWEEN THE PAM AND THE DLC FOR AN OPEN (RADAR)	
• Measure the resistance between the PAM C4226-4, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  • Measure the resistance between the PAM C4226-5, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to O8 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
O5 CHECK THE PAM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN (ULTRASONIC)	
• Ignition OFF. • Disconnect: PAM C4014 (Mountaineer) or C3267 (Explorer Sport Trac). • Ignition ON. • Measure the voltage between the PAM C4014-1 (Mountaineer) or C3267-1 (Explorer Sport Trac), circuit CBP18 (GY/OG), harness side and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to O6 . **No** VERIFY the Smart Junction Box (SJB) fuse 18 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.
O6 CHECK THE PAM GROUND CIRCUIT FOR AN OPEN (ULTRASONIC)	

• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the PAM C4014-4 (Mountaineer) or C3267-4 (Explorer Sport Trac), circuit GD145 (BK/BU), harness side and ground.  A0072267 • **Is the resistance less than 5 ohms?**	**Yes** GO to O7 . **No** REPAIR the circuit. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
O7 CHECK THE MS-CAN CIRCUITS BETWEEN THE PAM AND THE DLC FOR AN OPEN (ULTRASONIC)	
• Measure the resistance between the PAM C4014-3 (Mountaineer) or C3267-3 (Explorer Sport Trac), circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0058843 • Measure the resistance between the PAM C4014-11 (Mountaineer) or C3267-11 (Explorer Sport Trac), circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0058844 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to O8 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
O8 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins	**Yes** INSTALL a new PAM . REFER to Section 413-13 . CLEAR the DTCs. REPEAT the network test with the scan tool.

♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test P: The Accessory Protocol Interface Module (APIM) Does Not Respond To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The Accessory Protocol Interface Module (APIM) communicates with the scan tool through the High Speed Controller Area Network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the HS-CAN connection to the APIM . Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the MS-CAN connection to the APIM . Voltage for the APIM is provided by circuit SBB41 (RD). Circuit GD114 (BK/BU) provides ground.

This pinpoint test is intended to diagnose the following:

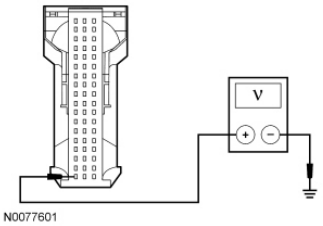
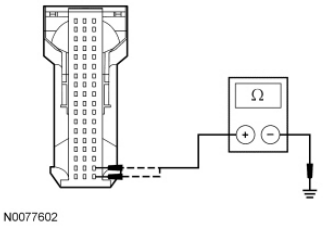
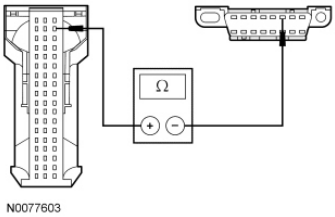
- Fuse
- Wiring, terminals or connectors
- APIM

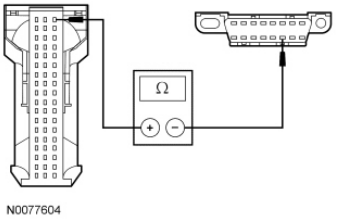
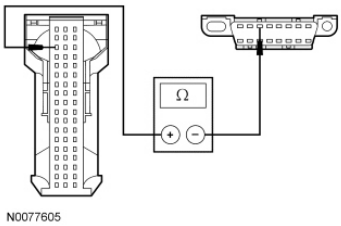
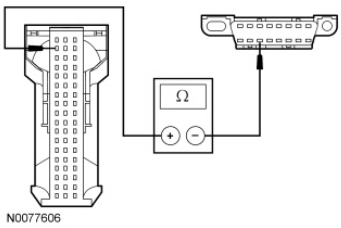
PINPOINT TEST P: THE APIM DOES NOT RESPOND TO THE SCAN TOOL

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
P1 CHECK THE APIM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
• Disconnect: APIM C3342. • Ignition ON. • Measure the voltage between the APIM C3342-1, circuit SBB41 (RD), harness side and ground.	**Yes** GO to P2 . **No** VERIFY the BJB fuse 41 (15A) is OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0077601 • **Is the voltage greater than 10 volts?**	
P2 CHECK THE APIM GROUND CIRCUITS FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the APIM C3342-37, circuit GD114 (BK/BU), harness side and ground; and between the APIM C3342-38, circuit GD114 (BK/BU), harness side and ground.  N0077602 • **Are the resistances less than 5 ohms?**	**Yes** GO to P3 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
P3 CHECK THE HS-CAN CIRCUITS BETWEEN THE APIM AND THE DLC FOR AN OPEN	
• Measure the resistance between the APIM C3342-53, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0077603 • Measure the resistance between the APIM C3342-54, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to P4 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

 N0077604 • **Are the resistances less than 5 ohms?**	
P4 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE APIM FOR AN OPEN	
• Measure the resistance between the APIM C3342-16, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0077605 • Measure the resistance between the APIM C3342-17, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0077606 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to P5 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
P5 CHECK FOR CORRECT APIM OPERATION	
• Disconnect all the APIM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the APIM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Section 415-00 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test Q: No Medium Speed Controller Area Network (MS-CAN) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The Medium Speed Controller Area Network (MS-CAN) uses an unshielded twisted pair cable, circuits VDB06 (GY/OG) and VDB07 (VT/OG) provide the network connection to all modules on the network.

This pinpoint test is intended to diagnose the following:

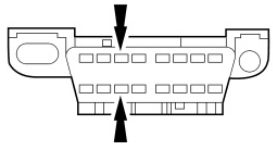
- Wiring, terminals or connectors
- Accessory Protocol Interface Module (APIM) (if equipped)
- Audio Front Control Module (ACM)
- Driver Seat Module (DSM) (if equipped)
- HVAC module (if equipped)
- Instrument Cluster (IC)
- Parking Aid Module (PAM) (if equipped)
- Power Running Board (PRB) module (if equipped)
- Rear Entertainment Module (RETM) (if equipped)
- Satellite Digital Audio Receiver System (SDARS) module (if equipped)
- Smart Junction Box (SJB)

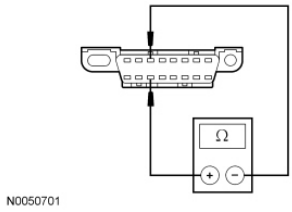
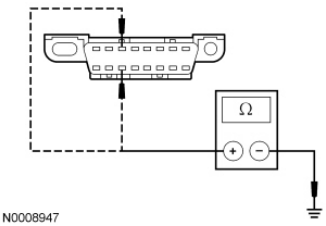
PINPOINT TEST Q: NO MS-CAN COMMUNICATION, ALL MODULES ARE NOT RESPONDING

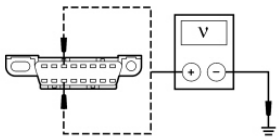
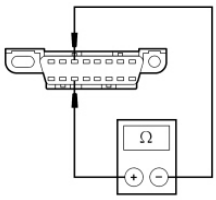
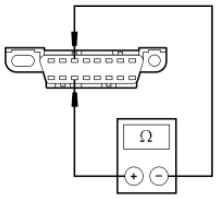
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

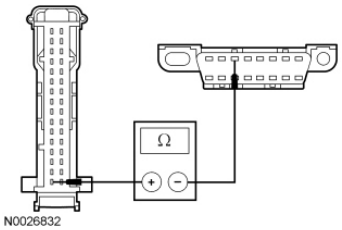
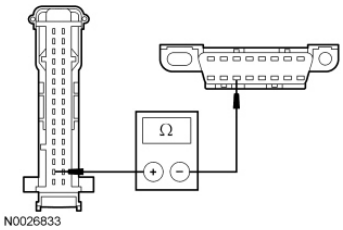
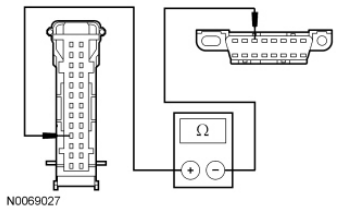
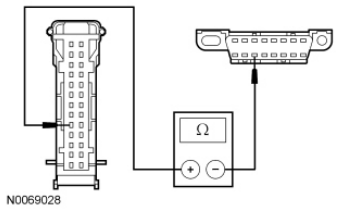
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

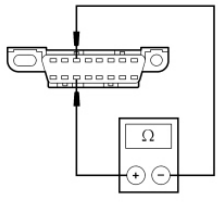
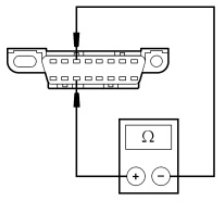
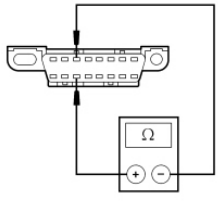
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

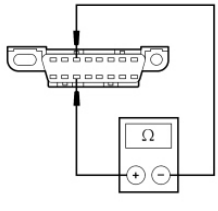
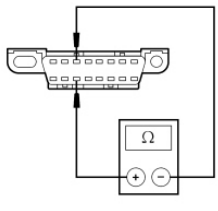
Test Step	Result / Action to Take
Q1 CHECK THE DLC PINS FOR DAMAGE	
• Ignition OFF. • Disconnect the scan tool cable from the Data Link Connector (DLC). • Inspect DLC pins 3 and 11 for damage.  N0053178	**Yes** GO to Q2 . **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

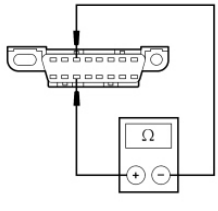
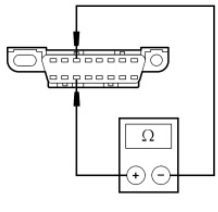
• **Are DLC pins 3 and 11 OK?**	
Q2 CHECK THE MS-CAN TERMINATION RESISTANCE	
• Disconnect: Negative Battery Cable. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to Q3 . **No** GO to Q5 .
Q3 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  • **Are the resistances greater than 1,000 ohms?**	**Yes** GO to Q4 . **No** GO to Q28 .
Q4 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	
• Connect: Negative Battery Cable. • Ignition ON. • Measure the voltage between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The CAN has tested within specifications. GO to Pinpoint Test R to diagnose the intermittent MS-CAN fault.

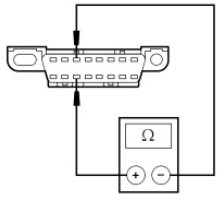
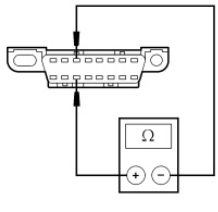
 N0050702 • **Is the voltage greater than 6 volts?**	
Q5 CHECK THE MS-CAN TERMINATION RESISTOR	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to Q6 . **No** GO to Q9 .
Q6 CHECK THE MS-CAN TERMINATION RESISTOR WITH THE SJB DISCONNECTED	
• Disconnect: SJB C2280b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to Q7 . **No** GO to Q8 .
Q7 CHECK THE MS-CAN CIRCUITS BETWEEN THE SJB AND THE DLC FOR AN OPEN	
• Measure the resistance between the SJB C2280d-16, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.	**Yes** CONNECT the negative battery cable. GO to Q54 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

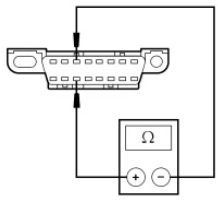
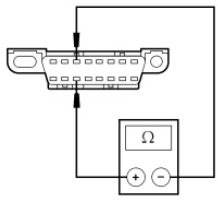
 N0026832 • Measure the resistance between the SJB C2280d-15, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0026833 • **Are the resistances less than 5 ohms?**	
Q8 CHECK THE MS-CAN CIRCUITS BETWEEN THE IC AND THE DLC FOR AN OPEN	
• Disconnect: IC C220. • Measure the resistance between the IC C220-4, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.  N0069027 • Measure the resistance between the IC C220-5, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0069028 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q45 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q9 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER	

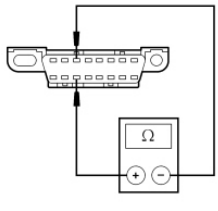
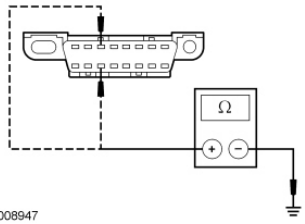
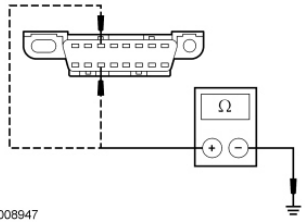
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q11 . **No** GO to Q10 .
Q10 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR AN OPEN	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the DLC or REPAIR the circuit in question. CONNECT the negative battery cable. VERIFY the scan tool operation on a substitute vehicle. CLEAR the DTCs. REPEAT the network test on the suspect vehicle. **No** A capacitor internal to a module may still be draining causing irregular resistance readings. WAIT 5 minutes. REPEAT the pinpoint test.
Q11 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE IC DISCONNECTED	
• Disconnect: IC C220. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q12 . **No** CONNECT the negative battery cable. GO to Q45 .
Q12 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE ACM DISCONNECTED	

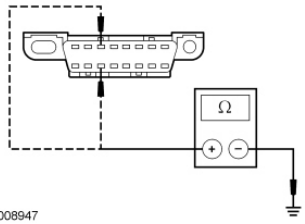
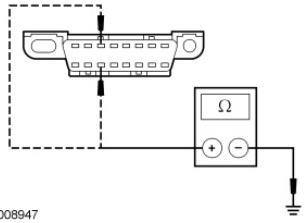
• Disconnect: ACM C290b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q13 . **No** CONNECT the negative battery cable. GO to Q46 .
Q13 VERIFY VEHICLE EQUIPMENT - HVAC MODULE	
• Inspect the vehicle for an HVAC module. • **Is the vehicle equipped with an HVAC module?**	**Yes** GO to Q14 . **No** GO to Q15 .
Q14 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE HVAC MODULE DISCONNECTED	
• Disconnect: HVAC Module C228a. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q15 . **No** CONNECT the negative battery cable. GO to Q47 .
Q15 VERIFY VEHICLE EQUIPMENT - RETM	
• Inspect the vehicle for an RETM . • **Is the vehicle equipped with an RETM ?**	**Yes** GO to Q16 . **No** GO to Q17 .
Q16 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE RETM DISCONNECTED	

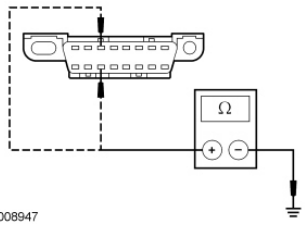
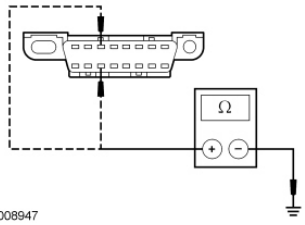
• Disconnect: RETM C9029. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q17 . **No** CONNECT the negative battery cable. GO to Q48 .
Q17 VERIFY VEHICLE EQUIPMENT - DSM	
• Inspect the vehicle for a DSM . • **Is the vehicle equipped with a DSM ?**	**Yes** GO to Q18 . **No** GO to Q19 .
Q18 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DSM DISCONNECTED	
• Disconnect: DSM C341c. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q19 . **No** CONNECT the negative battery cable. GO to Q49 .
Q19 VERIFY VEHICLE EQUIPMENT - SDARS MODULE	
• Inspect the vehicle for a SDARS module. • **Is the vehicle equipped with a SDARS module?**	**Yes** GO to Q20 . **No** GO to Q21 .
Q20 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SDARS MODULE DISCONNECTED	

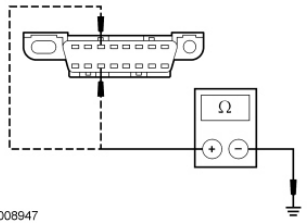
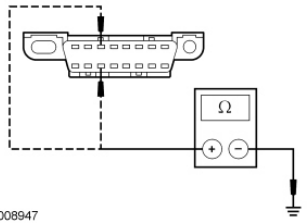
• Disconnect: SDARS C3290. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q21 . **No** CONNECT the negative battery cable. GO to Q50 .
Q21 VERIFY VEHICLE EQUIPMENT - PRB MODULE	
• Inspect the vehicle for a PRB module. • **Is the vehicle equipped with a PRB module?**	**Yes** GO to Q22 . **No** GO to Q23 .
Q22 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PRB MODULE DISCONNECTED	
• Disconnect: PRB Module C4322b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q23 . **No** CONNECT the negative battery cable. GO to Q51 .
Q23 VERIFY VEHICLE EQUIPMENT - PAM	
• Inspect the vehicle for a PAM . • **Is the vehicle equipped with a PAM ?**	**Yes** GO to Q24 . **No** GO to Q25 .
Q24 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PAM DISCONNECTED	

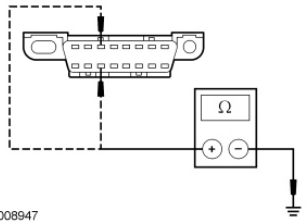
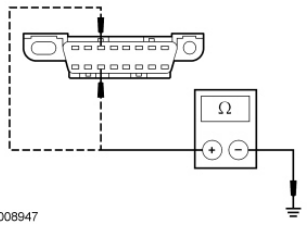
• Disconnect: PAM C4014 (Mountaineer), C3267 (Explorer Sport Trac) or C4226 (Explorer). • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q25 . **No** CONNECT the negative battery cable. GO to Q52 .
Q25 VERIFY VEHICLE EQUIPMENT - APIM	
• Inspect the vehicle for an APIM . • **Is the vehicle equipped with an APIM ?**	**Yes** GO to Q26 . **No** GO to Q27 .
Q26 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE APIM DISCONNECTED	
• Disconnect: APIM C3342. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance less than 5 ohms?**	**Yes** GO to Q27 . **No** CONNECT the negative battery cable.GO to Q53 .
Q27 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SJB DISCONNECTED	
• Disconnect: SJB C2280d. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.	**Yes** REPAIR the circuit. CONNECT all modules. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** CONNECT the negative battery cable. GO to Q54 .

 N0050701 • **Is the resistance less than 5 ohms?**	
Q28 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE IC DISCONNECTED	
• Disconnect: IC C220. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q45 . **No** GO to Q29 .
Q29 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE ACM DISCONNECTED	
• Disconnect: ACM C290b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q46 . **No** GO to Q30 .
Q30 VERIFY VEHICLE EQUIPMENT - HVAC MODULE	
• Inspect the vehicle for an HVAC module. • **Is the vehicle equipped with an HVAC module?**	**Yes** GO to Q31 . **No** GO to Q32 .

Q31 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE HVAC MODULE DISCONNECTED	
• Disconnect: HVAC Module C228a. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q47 . **No** GO to Q32 .
Q32 VERIFY VEHICLE EQUIPMENT - RETM	
• Inspect the vehicle for a RETM . • **Is the vehicle equipped with a RETM ?**	**Yes** GO to Q33 . **No** GO to Q34 .
Q33 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE RETM DISCONNECTED	
• Disconnect: RETM C9029. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q48 . **No** GO to Q34 .
Q34 VERIFY VEHICLE EQUIPMENT - DSM	
• Inspect the vehicle for a DSM . • **Is the vehicle equipped with a DSM ?**	**Yes** GO to Q35 . **No** GO to Q36 .
Q35 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE	

DSM DISCONNECTED	
• Disconnect: DSM C341c. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q49 . **No** GO to Q36 .
Q36 VERIFY VEHICLE EQUIPMENT - SDARS MODULE	
• Inspect the vehicle for a SDARS module. • **Is the vehicle equipped with a SDARS module?**	**Yes** GO to Q37 . **No** GO to Q38 .
Q37 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SDARS MODULE DISCONNECTED	
• Disconnect: SDARS Module C3290. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q50 . **No** GO to Q38 .
Q38 VERIFY VEHICLE EQUIPMENT - PRB MODULE	
• Inspect the vehicle for a PRB module. • **Is the vehicle equipped with a PRB module?**	**Yes** GO to Q39 . **No** GO to Q40 .
Q39 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PRB MODULE DISCONNECTED	

• Disconnect: PRB Module C4322b. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q51 . **No** GO to Q40 .
Q40 VERIFY VEHICLE EQUIPMENT - PAM	
• Inspect the vehicle for a PAM . • **Is the vehicle equipped with a PAM ?**	**Yes** GO to Q41 . **No** GO to Q42 .
Q41 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PAM DISCONNECTED	
• Disconnect: PAM C4014 (Mountaineer), C3267 (Explorer Sport Trac) or C4226 (Explorer). • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0008947 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q52 . **No** GO to Q42 .
Q42 VERIFY VEHICLE EQUIPMENT - APIM	
• Inspect the vehicle for an APIM . • **Is the vehicle equipped with an APIM ?**	**Yes** GO to Q43 . **No** GO to Q44 .
Q43 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE APIM DISCONNECTED	

• Disconnect: APIM C3342. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q53 . **No** GO to Q44 .
Q44 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SJB DISCONNECTED	
• Disconnect: SJB C2280d. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to Q54 . **No** REPAIR the circuit in question. CONNECT all modules. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q45 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q46 CHECK FOR CORRECT ACM OPERATION	
• Disconnect all the ACM connectors. • Check for:	**Yes** INSTALL a new ACM . REFER to Section 415-00 . CONNECT all

♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the ACM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q47 CHECK FOR CORRECT HVAC MODULE OPERATION	
• Disconnect all the HVAC module connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the HVAC module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new HVAC module. REFER to Section 412-01 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q48 CHECK FOR CORRECT RETM OPERATION	
• Disconnect the RETM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the RETM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RETM . REFER to Section 415-00 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q49 CHECK FOR CORRECT DSM OPERATION	
• Disconnect all the DSM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the DSM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DSM . REFER to Section 419-10 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with

	the scan tool.
Q50 CHECK FOR CORRECT SDARS MODULE OPERATION	
• Disconnect the SDARS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SDARS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SDARS module. REFER to Section 415-00 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q51 CHECK FOR CORRECT PRB MODULE OPERATION	
• Disconnect all the PRB module connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PRB module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PRB module. REFER to Section 501-08 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q52 CHECK FOR CORRECT PAM OPERATION	
• Disconnect the PAM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the PAM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PAM . REFER to Section 413-13 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q53 CHECK FOR CORRECT APIM OPERATION	
• Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins	**Yes** INSTALL a new APIM . REFER to Section 415-00 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
Q54 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Section 419-10 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test R: Intermittent No Medium Speed Controller Area Network (MS-CAN) Communication, One Or More Modules Are Not Responding During Network Test

Normal Operation

An open circuit VDB06 (GY/OG) (MS-CAN +) or VDB07 (VT/OG) (MS-CAN -) may cause intermittent or unreliable communication to all modules on the Medium Speed Controller Area Network (MS-CAN). The MS-CAN is used for communication between the following modules:

- Accessory Protocol Interface Module (APIM)
- Audio Front Control Module (ACM)
- Driver Seat Module (DSM)
- HVAC module
- Instrument Cluster (IC)
- Parking Aid Module (PAM)
- Power Running Board (PRB) module
- Rear Entertainment Module (RETM)
- Satellite Digital Audio Receiver System (SDARS) module
- Smart Junction Box (SJB)

In the event that 1 of the 2 network circuits (MS-CAN + or MS-CAN -) becomes open to a module on the network, unreliable network communication to all modules on the network may result.

This pinpoint test is intended to diagnose the following:

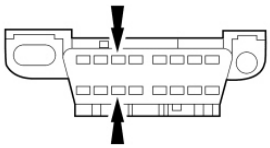
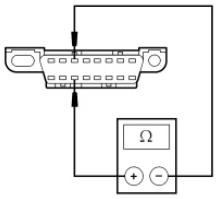
- Wiring, terminals or connectors

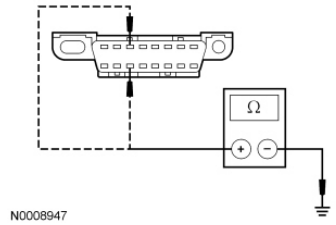
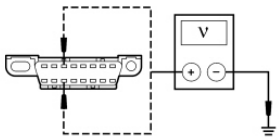
PINPOINT TEST R: INTERMITTENT NO MS-CAN COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Various network DTCs will set while disabling modules in this test procedure which will need to be cleared after the diagnostic procedure is completed.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
R1 CHECK THE DLC PINS FOR DAMAGE	
• Ignition OFF. • Disconnect the scan tool cable from the DLC . • Inspect DLC pins 3 and 11 for damage.  N0053178 • **Are DLC pins 3 and 11 OK?**	**Yes** GO to R2 . **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
R2 CHECK THE MS-CAN TERMINATION RESISTANCE	
• Disconnect: Negative Battery Cable. • Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.  N0050701 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to R3 . **No** CONNECT the negative battery cable. GO to Pinpoint Test Q .
R3 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.	**Yes** CONNECT the negative battery cable. GO to R4 . **No** CONNECT the negative battery

 N0008947 • **Are the resistances greater than 1,000 ohms?**	cable. GO to Pinpoint Test P .
R4 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.  N0050702 • **Are the voltages greater than 6 volts?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to R5 .
R5 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE HVAC MODULE DISABLED	
• Disconnect: SJB Fuses 20 (10A) and 28 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test I . **No** INSTALL the removed fuses. GO to R6 .
R6 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE ACM DISABLED	
• Disconnect: SJB Fuse 3 (20A) and 12 (5A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test J . **No** INSTALL the removed fuses. GO to R7 .
R7 VERIFY VEHICLE EQUIPMENT - DSM	
• Inspect the vehicle for a DSM . • **Is the vehicle equipped with a DSM ?**	**Yes** GO to R8 . **No**

	GO to R9 .
R8 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE DSM DISABLED	
• Disconnect: SJB Fuse 1 (20A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to Pinpoint Test M . **No** INSTALL the removed fuse. GO to R9 .
R9 VERIFY VEHICLE EQUIPMENT - PRB MODULE	
• Inspect the vehicle for power running boards. • **Is the vehicle equipped with power running boards?**	**Yes** GO to R10 . **No** GO to R11 .
R10 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE PRB MODULE DISABLED	
• Disconnect: BJB Fuse 19 (30A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to Pinpoint Test N . **No** INSTALL the removed fuse. GO to R11 .
R11 VERIFY VEHICLE EQUIPMENT - RETM APIM AND/OR SDARS MODULE	
• Inspect the vehicle for an RETM , an APIM , and/or a SDARS module. • **Is the vehicle equipped with an RETM , an APIM and/or a SDARS module?**	**Yes** GO to R12 . **No** GO to R14 .
R12 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RETM , APIM , AND/OR SDARS MODULE DISABLED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: BJB Fuse 41 (15A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. For vehicles equipped with two or more of the following modules: RETM , APIM , SDARS module, GO to R13 . For vehicles equipped with a RETM only, GO to Pinpoint Test L . For vehicles equipped with a APIM only, GO to Pinpoint Test P . For vehicles equipped with a SDARS module only, GO to

	Pinpoint Test K . **No** INSTALL the removed fuse. GO to R16 .
R13 VERIFY VEHICLE EQUIPMENT - RETM	
• Inspect the vehicle for an RETM . • **Is the vehicle equipped with an RETM ?**	**Yes** GO to R14 . **No** GO to R15 .
R14 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RETM DISCONNECTED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: RETM C9029. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** CONNECT the RETM . GO to Pinpoint Test L . **No** GO to R15
R15 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE APIM DISCONNECTED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: APIM C3342. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** CONNECT the APIM . GO to Pinpoint Test P . **No** CONNECT the APIM . GO to Pinpoint Test K .
R16 VERIFY VEHICLE EQUIPMENT - PAM	
• Inspect the vehicle for a PAM . • **Is the vehicle equipped with a PAM ?**	**Yes** GO to R17 . **No** GO to R18 .
R17 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE PAM DISABLED	
• Disconnect: SJB Fuse 18 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to Pinpoint Test O . **No** INSTALL the removed fuse. GO to R18 .
R18 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE IC DISABLED	

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB Fuse 8 (15A) and 24 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test G . **No** INSTALL the removed fuses. An intermittent fault is not present. GO to Pinpoint Test Q .

Pinpoint Test S: No High Speed Controller Area Network (HS-CAN) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The High Speed Controller Area Network (HS-CAN) uses an unshielded twisted pair cable, circuits VDB04 (WH/BU) and VDB05 (WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- 4X4 control module (if equipped)
- ABS module
- Accessory Protocol Interface Module (APIM) (if equipped)
- Instrument Cluster (IC)
- Occupant Classification System Module (OCSM)
- PCM
- Restraints Control Module (RCM)
- Transmission Control Module (TCM) (if equipped)

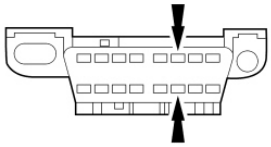
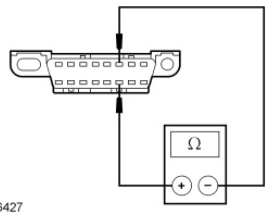
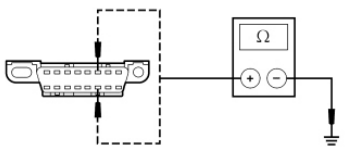
PINPOINT TEST S: NO HS-CAN COMMUNICATION, ALL MODULES ARE NOT RESPONDING

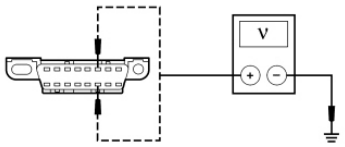
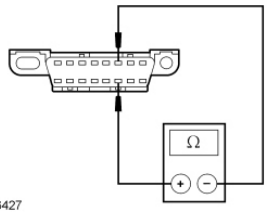
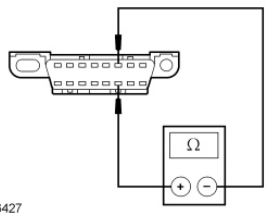
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

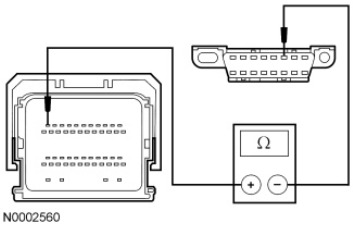
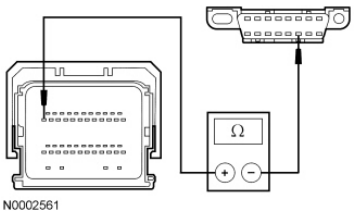
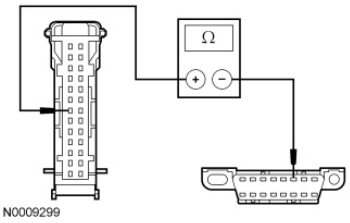
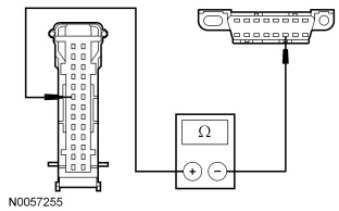
NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

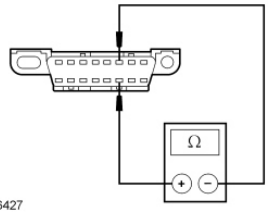
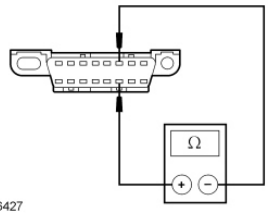
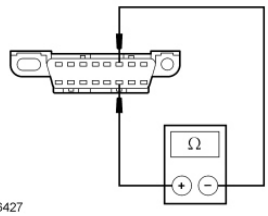
NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

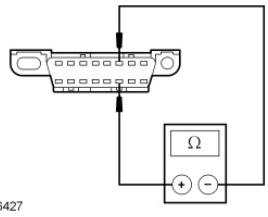
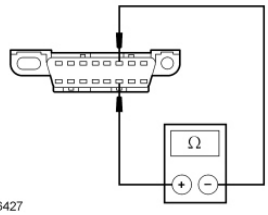
Test Step	Result / Action to Take
S1 CHECK THE DLC PINS FOR DAMAGE	

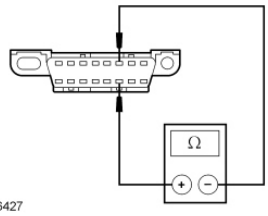
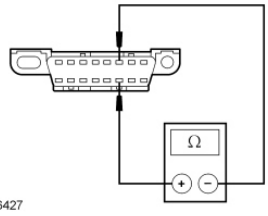
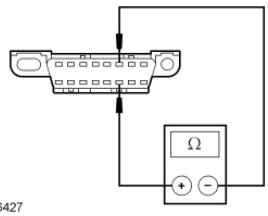
• Ignition OFF. • Disconnect the scan tool cable from the Data Link Connector (DLC). • Inspect DLC pins 6 and 14 for damage.  A0093867 • **Are DLC pins 6 and 14 OK?**	**Yes** GO to S2 . **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
S2 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to S3 . **No** GO to S5 .
S3 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** GO to S4 . **No** GO to S19 .
S4 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	

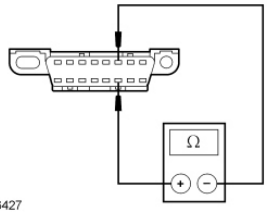
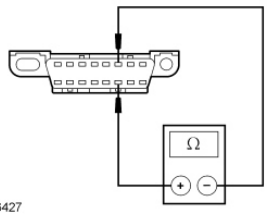
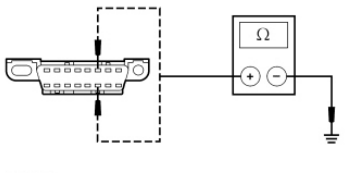
• Connect: Negative Battery Cable. • Ignition ON. • Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002964 • **Are the voltages greater than 6 volts?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The CAN has tested within specifications. GO to Pinpoint Test T to diagnose an intermittent HS-CAN fault.
S5 CHECK THE HS-CAN TERMINATION RESISTOR	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to S6 . **No** GO to S9 .
S6 CHECK THE HS-CAN TERMINATION RESISTOR WITH THE PCM DISCONNECTED	
• Disconnect: PCM C175b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to S7 . **No** GO to S8 .
S7 CHECK THE HS-CAN CIRCUITS BETWEEN THE PCM AND THE DLC FOR AN OPEN	

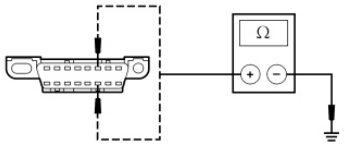
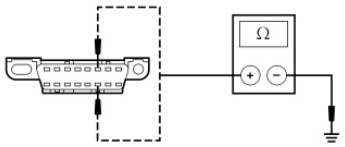
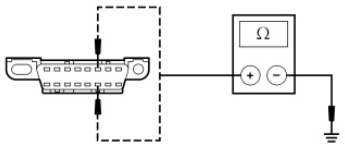
• Measure the resistance between the PCM C175b-11, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0002560 • Measure the resistance between the PCM C175b-23, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0002561 • **Are the resistances less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to S27 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
S8 CHECK THE HS-CAN CIRCUITS BETWEEN THE IC AND THE DLC FOR AN OPEN	
• Measure the resistance between the IC C220-7, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0009299 • Measure the resistance between the IC C220-8, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0057255	**Yes** CONNECT the negative battery cable. GO to S34 . **No** REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

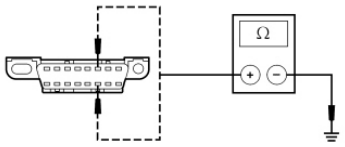
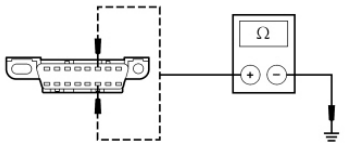
• **Are the resistances less than 5 ohms?**	
S9 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to S11 . **No** GO to S10 .
S10 CHECK THE HS-CAN CIRCUITS FOR AN OPEN AT THE DLC	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the DLC or REPAIR the circuit in question. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** A capacitor internal to a module may still be draining causing irregular resistance readings. WAIT 5 minutes. REPEAT the pinpoint test.
S11 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PCM DISCONNECTED	
• Disconnect: PCM C175b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to S12 . **No** CONNECT the negative battery cable. GO to S27 .

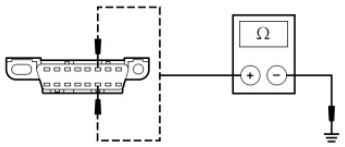
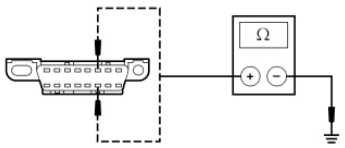
S12 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE ABS MODULE DISCONNECTED	
• Disconnect: ABS Module C155. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** If the vehicle is equipped with a 4X4 control module, GO to S13 . If the vehicle is not equipped with a 4X4 control module, GO to S14 . **No** CONNECT the negative battery cable. GO to S28 .
S13 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE 4X4 CONTROL MODULE DISCONNECTED	
• Disconnect: 4X4 Control Module C281a. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to S14 . **No** CONNECT the negative battery cable. GO to S29 .
S14 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE OCSM DISCONNECTED	
• Disconnect: OCSM C3159. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** If the vehicle is equipped with an APIM , GO to S15 . If the vehicle is not equipped with an APIM , GO to S16 . **No** CONNECT the negative battery cable. GO to S30 .

 • **Is the resistance less than 5 ohms?**	
S15 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE APIM DISCONNECTED	
• Disconnect: APIM C3342. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** GO to S16 . **No** CONNECT the negative battery cable. GO to S31 .
S16 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE RCM DISCONNECTED	
• Disconnect: RCM C310b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  • **Is the resistance less than 5 ohms?**	**Yes** If the vehicle is equipped with a Transmission Control Module (TCM), GO to S17 . If the vehicle is not equipped with a TCM , GO to S18 . **No** CONNECT the negative battery cable. GO to S32 .
S17 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE TCM DISCONNECTED	
• Disconnect: TCM C1575. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	**Yes** GO to S18 . **No** CONNECT the negative battery cable. GO to S33 .

 N0026427 • **Is the resistance less than 5 ohms?**	
S18 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE IC DISCONNECTED	
• Disconnect: IC C220. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuits. CONNECT all modules. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** CONNECT the negative battery cable. GO to S34 .
S19 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PCM DISCONNECTED	
• Disconnect: PCM C175b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to S27 . **No** GO to S20 .
S20 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE ABS MODULE DISCONNECTED	

• Disconnect: ABS C155. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to S28 . **No** If the vehicle is equipped with a 4X4 control module, GO to S21 . If the vehicle is not equipped with a 4X4 control module, GO to S22 .
S21 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE 4X4 CONTROL MODULE DISCONNECTED	
• Disconnect: 4X4 Control Module C281a. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to S29 . **No** GO to S22 .
S22 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE OCSM DISCONNECTED	
• Disconnect: OCSM C3159. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963	**Yes** CONNECT the negative battery cable. GO to S30 . **No** If the vehicle is equipped with an APIM , GO to S23 . If the vehicle is not equipped with an APIM , GO to S24 .

• **Are the resistances greater than 1,000 ohms?**	
S23 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE APIM DISCONNECTED	
• Disconnect: APIM C3342. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to S31 . **No** GO to S24 .
S24 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE RCM DISCONNECTED	
• Disconnect: RCM C310b. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to S32 . **No** If the vehicle is equipped with a Transmission Control Module (TCM), GO to S25 . If the vehicle is not equipped with a TCM , GO to S26 .
S25 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE TCM DISCONNECTED	
• Disconnect: TCM C1575. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.	**Yes** CONNECT the negative battery cable. GO to S33 . **No** GO to S26 .

 N0002963 • **Are the resistances greater than 1,000 ohms?**	
S26 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE IC DISCONNECTED	
• Disconnect: IC C220. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to S34 . **No** REPAIR the circuit in question. CONNECT all modules. CONNECT the negative battery cable. CLEAR the DTCs. REPEAT the network test with the scan tool.
S27 CHECK FOR CORRECT PCM OPERATION	
• Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.
S28 CHECK FOR CORRECT ABS MODULE OPERATION	
• Disconnect the ABS module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. REFER to Section 206-09 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules.

	CLEAR the DTCs. REPEAT the network test with the scan tool.
S29 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
• Disconnect the 4X4 control module connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the 4X4 control module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. REFER to Section 308-07A . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
S30 CHECK FOR CORRECT OCSM OPERATION	
• Disconnect the OCSM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the OCSM connector and make sure it seats correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new OCSM . REFER to Section 501-20B . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
S31 CHECK FOR CORRECT APIM OPERATION	
• Disconnect the APIM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the APIM connector and make sure it seats correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new APIM . REFER to Section 415-00 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
S32 CHECK FOR CORRECT RCM OPERATION	
• Disconnect all the RCM connectors. • Check for: ♦ corrosion ♦ damaged pins	**Yes** INSTALL a new RCM . REFER to Section 501-20B . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

♦ pushed-out pins • Connect all the RCM connectors and make sure they seat correctly. • Verify the concern is still present. • **Is the concern still present?**	**No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. REPEAT the network test with the scan tool.
S33 CHECK FOR CORRECT TCM OPERATION	
• Disconnect the TCM connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the TCM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new TCM . REFER to Section 307-01B . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.
S34 CHECK FOR CORRECT IC OPERATION	
• Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test T: Intermittent No High Speed Controller Area Network (HS-CAN) Communication, One Or More Modules Are Not Responding During Network Test

Normal Operation

An open circuit VDB04 (WH/BU) (HS-CAN +) or VDB05 (WH) (HS-CAN -) may cause intermittent or unreliable communication to all modules on the HS-CAN . The HS-CAN is used for communication between the following modules:

- 4X4 control module (if equipped)
- ABS module
- Accessory Protocol Interface Module (APIM) (if equipped)
- Instrument Cluster (IC)
- Occupant Classification System Module (OCSM)
- PCM

- Restraints Control Module (RCM)
- Transmission Control Module (TCM) (6R60 transmission only)

In the event that one of the 2 network circuits (HS-CAN + or HS-CAN -) becomes open to a module on the network, unreliable network communication to all modules on the network may result.

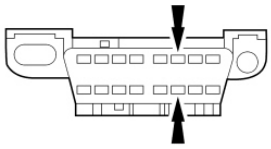
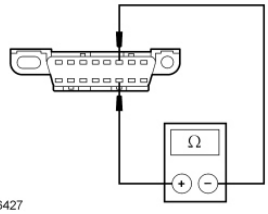
This pinpoint test is intended to diagnose the following:

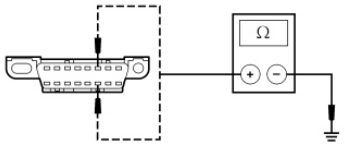
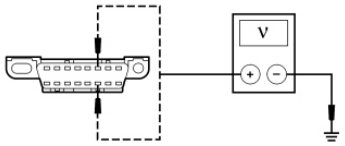
- Wiring, terminals or connectors

PINPOINT TEST T: INTERMITTENT NO HS-CAN COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST

NOTE: Various modules will set network DTCs during this test procedure. Clear DTCs from all modules after the diagnostic procedure is completed.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
T1 CHECK THE DLC PINS FOR DAMAGE	
• Ignition OFF. • Disconnect the scan tool cable from the DLC . • Inspect DLC pins 6 and 14 for damage.  A0093867 • **Are DLC pins 6 and 14 OK?**	**Yes** GO to T2 . **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
T2 CHECK THE HS-CAN TERMINATION RESISTANCE	
• Disconnect: Negative Battery Cable. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to T3 . **No** CONNECT the negative battery cable. GO to Pinpoint Test S .

T3 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 1,000 ohms?**	**Yes** CONNECT the negative battery cable. GO to T4 . **No** CONNECT the negative battery cable. GO to Pinpoint Test R .
T4 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	
• Ignition ON. • Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002964 • **Are the voltages greater than 6 volts?**	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to T5 .
T5 CHECK FOR RESTORED COMMUNICATION WITH THE PCM DISABLED	
NOTE: A scan tool session must be established prior to disabling the PCM in this test step. If the PCM has failed communication during multiple attempts to identify the vehicle, first identify the vehicle manually by entering a PCM part number, calibration number or tear tag when prompted by the IDS . **NOTE:** When a vehicle is manually identified by a PCM part number, calibration number or tear tag, the IDS will not automatically run a network test. The network test must be manually selected and run. • Disconnect: BJB Fuse 24 (10A) and 39 (15A). • Enter the following diagnostic mode on the scan tool:	**Yes** INSTALL the removed fuses. GO to Pinpoint Test A . **No** INSTALL the removed fuses. GO to T6 .

Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	
T6 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE ABS MODULE AND 4X4 CONTROL MODULE (IF EQUIPPED) DISABLED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB fuse 18 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. If the vehicle is equipped with a 4X4 control module, GO to T7 . If the vehicle is not equipped with a 4X4 control module, GO to Pinpoint Test C . **No** INSTALL the removed fuse. GO to T8 .
T7 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE ABS MODULE DISCONNECTED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: ABS Module C155. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** CONNECT the ABS module. GO to Pinpoint Test C . **No** CONNECT the ABS module. GO to Pinpoint Test E .
T8 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RCM AND OCSM DISABLED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB Fuse 17 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to T9 . **No** INSTALL the removed fuse. GO to T10 .
T9 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RCM DISCONNECTED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: RCM C310b.	**Yes** CONNECT the RCM . GO to Pinpoint Test D . **No** CONNECT the RCM . GO to Pinpoint Test F .

• Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	
T10 VERIFY VEHICLE EQUIPMENT - TCM	
• A TCM is present in 6R60 transmission equipped vehicles only. Inspect the vehicle for a 6R60 transmission. • **Is the vehicle equipped with a 6R60 transmission?**	**Yes** GO to T11 . **No** GO to T12 .
T11 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE TCM DISABLED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: BJB Fuse 27 (20A) and SJB Fuse 9 (2A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test B . **No** INSTALL the removed fuses. GO to T12 .
T12 VERIFY VEHICLE EQUIPMENT - APIM	
• Inspect the vehicle for an APIM . • **Is the vehicle equipped with an APIM ?**	**Yes** GO to T13 . **No** GO to T14 .
T13 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE APIM DISABLED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: BJB Fuse 41 (15A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to Pinpoint Test P . **No** INSTALL the removed fuse. GO to T14 .
T14 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE IC DISABLED	
NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB Fuses 8 (15A) and 24 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test G . **No** INSTALL the removed fuses. An intermittent fault is not present. GO to Pinpoint Test S .

Pinpoint Test U: No Power To The Scan Tool

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The scan tool is connected to the Data Link Connector (DLC) to communicate with the High Speed Controller Area Network (HS-CAN) and the Medium Speed Controller Area Network (MS-CAN). Voltage for the scan tool is provided by circuit SBP04 (GN/RD). Ground is provided by circuits GD108 (BK/VT) and GD138 (BK/WH).

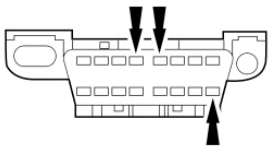
This pinpoint test is intended to diagnose the following:

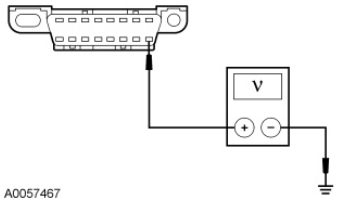
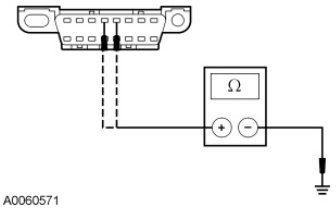
- Fuse
- Wiring, terminals or connectors
- DLC
- Scan tool

PINPOINT TEST U: NO POWER TO THE SCAN TOOL

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
U1 CHECK THE DLC PINS FOR DAMAGE	
• Disconnect the scan tool cable from the DLC . • Inspect DLC pins 4, 5 and 16 for damage.  N0050767 • **Are DLC pins 4, 5 and 16 OK?**	**Yes** GO to U2 . **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
U2 CHECK THE DLC VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	

• Measure the voltage between the DLC C251-16, circuit SBP04 (GN/RD), harness side and ground.  A0057467 • **Is the voltage greater than 10 volts?**	**Yes** GO to U3 . **No** VERIFY the Smart Junction Box (SJB) fuse 4 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short. REPEAT the network test with the scan tool.
U3 CHECK THE DLC GROUND CIRCUITS FOR AN OPEN	
• Disconnect: Negative Battery Cable. • Measure the resistance between the DLC C251-5, circuit GD138 (BK/WH), harness side and ground; and between the DLC C251-4, circuit GD138 (BK/WH), harness side and ground.  A0060571 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the scan tool. CONNECT the negative battery cable. REPEAT the network test with the scan tool. **No** REPAIR the circuit in question. CONNECT the negative battery cable. REPEAT the network test with the scan tool.

Module Configuration

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

Configurable modules accommodate a variety of vehicle options, eliminating the need for many unique modules for one vehicle line. These modules must be configured when replaced as part of a repair procedure. Configurable modules should not be exchanged between vehicles since the settings are unique to each vehicle. Failure to configure a new module may result in incorrect operation and/or DTCs setting.

The following are the 3 different methods of configuration:

- Programmable Module Installation (PMI)
- Module reprogramming ("flashing")
- Programmable parameters

Some modules do not support all 3 methods.

Definition of Terms

The following are definitions of configuration terms:

Programmable Module Installation (PMI)

PMI is a scan tool process which configures settings in a new module. Data used for the PMI process is automatically downloaded from the original module and stored when a scan tool session is started. If this data cannot be retrieved from the module being replaced, the scan tool may prompt for As-Built data entry or display a list of parameter values that need to be manually selected. Some modules are reprogrammed during PMI when a strategy/calibration update is available. To carry out PMI , refer to Programmable Module Installation (PMI) in this section.

NOTE: It is important that the scan tool identifies the vehicle and obtains configuration data prior to removing any modules. The new module must be able to communicate with the scan tool in order to carry out PMI .

Module Reprogramming

Module reprogramming (also referred to as "flashing") is a scan tool process which updates the strategy/calibration in a module. Reprogramming a module with the same level of software will not improve module operation or repair a hardware failure. Module reprogramming is automatically carried out during

PMI when a later strategy/calibration is available.

NOTE: Module reprogramming should be limited to circumstances where a published TSB procedure recommends doing so.

NOTE: A module cannot communicate with other modules on the communication network while being reprogrammed. Clear any network communication DTCs which may have been set in other modules during the reprogramming process.

Accessory Protocol Interface Module (APIM) Programming

APIM programming is a process that updates the APIM Consumer Interface Processor (CIP) and Vehicle Interface Processor (VIP) software. The VIP programming updates the calibration files in the portion of the APIM that interfaces with the Controller Area Network (CAN). The CIP programming updates calibration files in the portion of the APIM that interfaces with mobile phones and other customer devices.

APIM programming uses the VCM to read and program the VIP software through the Data Link Connector (DLC). A web-based OASIS application is used to read and program the CIP software via a Universal Serial Bus (USB) cable between the scan tool and vehicle USB port. Both the VCM and OASIS application must be running on the scan tool during APIM programming. To carry out APIM programming, refer to Accessory Protocol Interface Module (APIM) Programming in this section.

Programmable Parameters

Programmable parameters are customer preference items that may be modified by the dealer via scan tool or in some cases modified by the customer following a procedure listed in the vehicle Owner's Literature. While many configuration options may exist for a module, only a few of these options are programmable parameters.

Adaptive Learning and Calibration

Some modules require a separate learning procedure be carried out if replaced as part of a repair procedure. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

Vehicle Identification Block

Some PCMs contain a memory area called a vehicle identification block. The PCM vehicle identification block commonly stores powertrain configuration items such as Vehicle Identification Number (VIN), tire size, axle ratio, and whether or not the vehicle is equipped with speed control.

Module Address

A unique module address is assigned to each module on the network for identification.

As-Built Data

As-Built data is a VIN -specific module configuration record. During vehicle build, the configuration from all modules is downloaded and stored in the As-Built database. As-Built data does not reflect customer preference items that have been changed from the default state. These items need to be changed using programmable parameters after the module is configured.

NOTE: It is not necessary to obtain As-Built data unless directed to do so by the scan tool. This data may be accessed from the technician service publication website.

The following chart lists As-Built data addresses and describes specific module configuration information:

Module Configuration and Parameter Chart

Module	Module Address	Requires PMI	Reprogram/ Flash Capable	Requires Adaptive Learning or Calibration	Available Programmable Parameters
4X4 control module	761	No	Yes	No	None
ABS module	760	Yes	Yes	• IVD (stability control) initialization	None
Accessory Protocol Interface Module (APIM)	7D0	Yes	Yes	No	• Steering wheel controls • Stereo in pass-through
Audio Front Control Module (ACM)	727	Yes	Yes	No	• Destination (navigation only) • Satellite Digital Audio Receiver System (SDARS) module (except navigation) • Phone module (except navigation)
Driver Seat Module (DSM)	744	Yes	Yes	No	• Easy entry/exit • Memory pedals • Memory recline
HVAC module	733	Yes	Yes	No	None
Instrument Cluster (IC)	720	Yes	Yes	No	• Autolocks • Auto-unlock • Belt-Minder® • Language • Oil life threshold
Occupant Classification System Module (OCSM)	765	No	Yes	• Seat weight sensor re-zero	None
Parking Aid Module (PAM) - Explorer	736	No	No	No	None
PAM - Mountaineer, Explorer Sport Trac	736	Yes	No	No	None
PCM	7E0	Yes	Yes	• Adaptive airflow	• Speed control enable/disable

				• Idle speed • Refueling event • Fuel trim	• Axle ratio • Tire size • 4X4 low range input
Power Running Board (PRB) module	766	No	Yes	No	None
Rear Entertainment Module (RETM)	771	Yes	Yes	No	• Language • SDARS module
Restraints Control Module (RCM)	737	Yes	Yes	• Seat weight sensor re-zero	• Emergency call present (late build only) • Belt-Minder® (driver) enable • Belt-Minder® (passenger) enable
Satellite Digital Audio Receiver System (SDARS) module	782	Yes	Yes	No	None
Smart Junction Box (SJB)	726	Yes	Yes	• Tire Pressure Monitoring System (TPMS) sensor training	• Autolocks • Auto-unlock • Daytime Running Lamps (DRL) (Sport Trac only) • Trim switch inhibit • Tri-color stop lamps (Sport Trac only)
Transmission Control Module (TCM)	7E1	No	Yes	Yes	None

Inspection and Verification

This section provides step-by-step module configuration procedures. Carry out the Programmable Module Installation (PMI) procedure in this section when another workshop manual section directs to carry out configuration or when DTCs from the below list are present:

NOTE: Some of these modules utilize a 5-character DTC followed by a 2-character failure-type code. The failure-type code provides information about specific fault conditions such as opens, or shorts to ground. Continuous memory DTCs have an additional 2-character DTC status code suffix to assist in determining DTC history.

Diagnostic Trouble Code (DTC) Chart

DTC	Description	Source	Action
B2477	Module Configuration Failure	• ABS module • Audio Front Control Module (ACM) • Driver Seat Module (DSM) • HVAC module • Instrument Cluster (IC) • Parking Aid Module (PAM) • Rear Entertainment Module (RETM) • Restraints Control Module (RCM) • Satellite Digital Audio Receiver System (SDARS) module • Smart Junction Box (SJB)	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
B2477	Module Configuration Failure	• Accessory Protocol Interface Module (APIM)	REFER to Accessory Protocol Interface Module (APIM) Programming in this section.
B2477	Module Configuration Failure	• Occupant Classification System Module (OCSM)	INSTALL a new OCSM . REFER to Section 501-20B .
B2900	VIN mismatch	• ABS module • RCM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
P0602	Powertrain Control Module Programming Error	• PCM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
P0605	Internal Control Module Read Only Memory (ROM) Error	• PCM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
P0605	Internal Control Module Read Only Memory (ROM) Error	• Transmission Control Module (TCM)	INSTALL a new TCM . REFER to Section 307-01B .
P1639	Vehicle ID Block Corrupted, Not Programmed	• PCM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.

U0300	Internal Module Software Incompatibility	• RCM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
U201A:51	Control Module Main Calibration Data: Missing Calibration	• ACM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
U2050	No Application Present	• 4X4 control module • ABS module • ACM • DSM • HVAC module • IC • PAM • Power Running Board (PRB) module • RCM • RETM • SDARS module • SJB	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
U2050	No Application Present	• APIM	REFER to Accessory Protocol Interface Module (APIM) Programming in this section.
U2050	No Application Present	• OCSM	INSTALL a new OCSM . REFER to Section 501-20B .
U2051	One or More Calibration Files Missing / Corrupt	• ACM • IC • RCM	CARRY OUT PMI. REFER to Programmable Module Installation (PMI) in this section.
U2051	One or More Calibration Files Missing / Corrupt	• OCSM	INSTALL a new OCSM . REFER to Section 501-20B .
U2051	One or More Calibration Files Missing / Corrupt	• Parking Aid Module (PAM)	INSTALL a new PAM . REFER to Section 413-13 .
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• ACM	CARRY OUT PMI . REFER to Programmable Module Installation (PMI) in this section.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• APIM	CARRY OUT APIM programming. REFER to Accessory Protocol Interface Module (APIM) Programming in this section.
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• APIM	CARRY OUT APIM programming. REFER to Accessory Protocol Interface Module (APIM) Programming in this section.

Programmable Module Installation (PMI)

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Connect the IDS and identify the vehicle as normal.
2. From the Toolbox icon, select Module Programming and press the check mark.
3. Select Programmable Module Installation.
4. Select the module that is being replaced.
5. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
6. Install the new module and press the check mark.
7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
8. The IDS downloads the data into the new module and displays Module Configuration Complete.
9. Test module for correct operation.

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is NOT Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Install the new module.
2. Connect the IDS and identify the vehicle as normal.
3. From the Toolbox icon, select Module Programming and press the check mark.

4. Select Programmable Module Installation.
5. Select the module that was replaced.
6. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
8. If the data is not available, the IDS displays a screen stating to contact the As-Built Data Center. Retrieve the data from the technician service publication website at this time and press the check mark.
9. Enter the module data and press the check mark.
10. The IDS downloads the data into the new module and displays Module Configuration Complete.
11. Test module for correct operation.

Accessory Protocol Interface Module (APIM) Programming

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST3051-A	Universal Serial Bus (USB) Male-A to Male-A Cable CCMUSB2-AM-AM-10 or equivalent

Accessory Protocol Interface Module (APIM) Programming Using the Integrated Diagnostic System (IDS)

NOTE:

- If a new Accessory Protocol Interface Module (APIM) is being installed, install a new APIM before carrying out the following procedure. For additional information, refer to Section 415-00 .
- When carrying out the programming procedures, follow the scan tool on-screen directions.
- Make sure the battery is fully charged before carrying out the programming steps.
- A hardwired internet connection is strongly recommended when programming.
- If unable to complete programming because operation stops or errors are received, internet browser settings may need to be configured. From the on-line OASIS tab, select the "Service Tips" tab, then select "SYNC Software Programming" under "Job Aids".

NOTE:

- For APIM flash programming:
  - The scan tool and a USB male A to male A cable (CCMUSB2-AM-AM-10 or equivalent) are required.
  - The flash procedure deletes any paired phones that were in the SYNC® system.
  - The file for the flash needs to be downloaded from the online database. Allow for extra time for the file to download. The files are approximately 80 megabyte.

1. **NOTE:** The IDS program must be closed before attempting to program the APIM .

   Open a session for the vehicle from the technician service publication web site, and run On-Line Automotive Service Information System (OASIS) using "Read VIN and DTC's".

2. From the OASIS tab, select the "SYNC" button.

3. There are 3 available options for APIM programming:
   - Standard (latest version of current software and applications): Use this option to update the APIM to the latest software level.
   - Custom (show what's available, and let me choose): Use this option to show all the available options that can be programmed, or if a Technical Service Bulletin (TSB) directs for specific software version to be programmed.

- Module Replacement (restore software for newly installed hardware): Use this option when the APIM has been replaced.

4. After selecting 1 of the 3 options (Standard, Custom or Module Replacement), click the "Read SYNC" button to verify the current APIM , Vehicle Interface Processor (VIP) and Consumer Interface Processor (CIP) software levels.
    - The versions are compared to a online database. After the comparison, the available software is displayed.

5. **NOTE:** Do not disconnect the Vehicle Communication Module (VCM) or the USB cable during APIM programming.

   When carrying out the programming procedures, follow the scan tool on-screen directions.

   NOTE: If unable to complete programming because operation stops or errors are received, interned browser settings may need to be configured. From the on-line OASIS tab, select the "Service Tips" tab, then select "SYNC Software Programming" under "Job Aids".

   Select the "Program SYNC" button to begin the APIM programming process.

6. Follow the scan tool on-screen directions for APIM programming.
    - After programming is complete the scan tool displays "Programming has been completed successfully."

Anti-Theft

NOTE: If the Instrument Cluster (IC) or the PCM (or both) is installed, the parameters must be reset in both modules or the vehicle will experience a Passive Anti-Theft System (PATS) no-start. Refer to Passive Anti-Theft System (PATS) Parameter Reset in this section.

The Passive Anti-Theft System (PATS) consists of the following components:

- Anti-theft indicator (located in the autolamp/sunload sensor)
- Encoded (the key contains a transponder) ignition key
- PATS transceiver
- IC
- PCM

The PATS uses radio frequency identification technology to deter a drive-away theft. Passive means that it does not require any activity by the user.

The vehicle is equipped with 2 PATS keys. A maximum of 8 PATS keys can be programmed to start the vehicle. If additional PATS keys are desired, refer to Spare Key Programming - Unlimited Key Mode in this section.

Passive Anti-Theft System (PATS) Function

The PATS function is controlled by the IC . The PATS uses the IC to carry out all of the PATS functions, such as receiving the identification code from the PATS key, issuing a signal to the PCM to control the starter and fuel injectors enable, and initiating the key interrogation sequence when the ignition key is turned to the ON or START position. Because of the interaction between the IC and the PCM, there are parameters that must be set if the IC or the PCM (or both) are replaced. Refer to Passive Anti-Theft System (PATS) Parameter Reset in this section. If the IC must be replaced for any reason (PATS concerns or IC concerns), the PATS keys also must be programmed into the new IC . Refer to Key Programming Using Diagnostic Equipment in this section. All elements of PATS must be functional before the vehicle will start. If any of the components are not working correctly, the vehicle does not start.

PATS is active only for a few seconds when the vehicle is starting. It is not a PATS concern if the vehicle stalls after it has been running for a minimum of 3 seconds. PATS does not disable a running vehicle.

PATS may cause a vehicle no start due to either the fuel injectors or the starter not operating (starter relay does not close) or both. Always check for PATS DTCs from the IC and DTCs from the PCM when a no-crank or no-start condition exists. After a valid key read has been completed, low battery voltage may cause the PATS to allow starter operation, but prevent the fuel injectors from operating.

If the anti-theft indicator does not prove out (it may be either flashing or glowing steadily) and one (or both) of the previous conditions (fuel injectors and/or starter inoperative) are present, it may be due to a PATS issue. If the anti-theft indicator proves out, it may not be a PATS issue. If the anti-theft indicator does not illuminate at all, it may be a circuitry/ IC issue. GO to Symptom Chart in this section.

PATS is not compatible with aftermarket remote start systems, which allow the vehicle to be started from the exterior of the vehicle. These systems may reduce the security of the vehicle, and also may be the cause of no-start concerns. Remote start systems must be removed from the vehicle before any PATS -related no-start concerns are investigated.

Unlimited Key Mode

PATS contains a feature called unlimited key mode. This feature allows a customer to program more than 8 vehicle keys, if requested. Each vehicle in unlimited key mode is set up with a special unlimited transponder security key code. This allows all the customer vehicles to share the same mechanically cut keys. For an individual customer, any randomly selected security key that has been previously mechanically cut and electronically programmed to the vehicle is acceptable. Refer to Spare Key Programming - Unlimited Key Mode in this section.

Anti-Theft

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

NOTE: Replacement of the Passive Anti-Theft System (PATS) transceiver does not require the PATS keys to be programmed into the Instrument Cluster (IC) again.

NOTE: Make sure any aftermarket remote start systems have been removed from the vehicle before any PATS -related no-start concerns are investigated.

NOTE: A minimum of 2 PATS keys must be programmed into the IC before the vehicle will start.

NOTE: If the IC or the PCM is being replaced (or both), the parameters must be reset in both modules or the vehicle will experience a PATS no-start. Refer to Passive Anti-Theft System (PATS) Parameter Reset in this section.

Anti-Theft Indicator

PATS uses a visual anti-theft indicator located in the autolamp/sunload sensor. The indicator proves out for 3 seconds when the ignition key is in the ON or START position. If there is a PATS concern, this indicator either flashes rapidly or glows steadily when the ignition key is turned to the ON or START position. PATS also flashes the anti-theft indicator every 2 seconds when the ignition key is in the OFF position to act as a visual theft deterrent.

Passive Anti-Theft System (PATS) Keys

The PATS uses a special ignition key that is larger than a conventional ignition key because it contains a permanently installed electronic device called a transponder. Each transponder contains a unique, encrypted identification code which is one of a very large number of combinations. The addition of this transponder to the key makes it an "encoded" key. The PATS key does not require batteries and should last the lifetime of the vehicle. Each PATS key must be programmed into the IC before it can be used to start the vehicle. Up to 8 PATS keys can be programmed into the IC . If additional PATS keys are desired, a standard PATS key must

be used. There are special general procedures described in this section that must be carried out if a new PATS key is necessary. Refer to Key Programming Using Diagnostic Equipment in this section.

Passive Anti-Theft System (PATS) Transceiver

The PATS transceiver is located under the steering column shroud and communicates with the encoded ignition key. During each vehicle start sequence, the PATS transceiver reads the encoded ignition key identification code and sends data to the IC . The IC validates the code, and if it is the correct code, sends a message to the PCM to ground the starter relay solenoid coil and allow the fuel injectors to operate.

Passive Anti-Theft System (PATS) Operation

The PATS function is controlled by the IC . With this type of PATS , there are parameters that need to be reset if either the IC or the PCM (or both) are replaced. Refer to Passive Anti-Theft System (PATS) Parameter Reset in this section. When the PATS key is turned to the ON or START position, the IC initiates the key interrogation sequence by sending a voltage signal to the PATS transceiver. The transceiver then uses its antenna to bounce a signal off the transponder in the PATS key. This process "reads" the PATS key identification code and sends the key identification code back to the IC , which interprets it and determines if it matches one of the stored key codes. If it does match one of the stored key codes, the IC sends a message to the PCM to ground the starter relay solenoid coil and allow the fuel injectors to operate. If it does not match one of the stored key codes, or it is only a partial key read or no key read, the IC sends a message to the PCM to not ground the starter relay solenoid coil and not allow fuel injector operation. The anti-theft indicator flashes (or may glow steadily) and the IC stores one or more DTCs.

All elements of PATS must be functional before the vehicle will start. If any of the components are not working correctly, the vehicle does not start. If the IC must be replaced for any reason (PATS concerns or IC concerns), the PATS keys must also be programmed into the new IC . Refer to Key Programming Using Diagnostic Equipment in this section.

PATS disables the vehicle from starting if there is:

- a damaged PATS key.
- a non-programmed PATS key.
- a non- PATS key (key has no electronics).
- damaged wiring.
- a damaged transceiver.
- a damaged IC .
- a damaged PCM.

Passive Anti-Theft System (PATS) Parameter Identification (PIDs)

Monitoring the PATS PIDs can be very useful in determining which diagnostic steps to follow. Viewing the MASTERKEY (verifies if the key is programmed) PID with both keys determines if the key is a programmed key and also proves out the transceiver, circuitry and the IC . A master key is any key that is programmed into the IC .

Viewing the MIN_KEY (minimum number of keys) PID (this PID does not change) determines the minimum number of keys that must be programmed into the IC . There must be at least 2 keys programmed into the IC in this type of PATS before the vehicle starts.

Viewing the N_KEYCODE (number of keys programmed) PID determines if the minimum number of keys have been programmed into the IC . If the N_KEYCODE PID reads 0 or 1, additional key(s) need to be programmed into the IC in order to meet the minimum of 2 keys. If the N_KEYCODE PID reads 0 or 1, and the MASTERKEY PID reads NOTPREST, that particular key must be programmed into the IC .

If the N_KEYCODE PID reads 1, and the MASTERKEY PID reads PRESNT, that particular key is already programmed into the IC . If the IC was replaced, the parameters in the IC , and the parameters in the PCM need to be reset. When the parameters in the IC are reset, that clears (erases) the PCM ID from the IC . A PCM parameter reset sends a PCM ID to the IC that is necessary for the system to operate. Make sure to make 3-5 attempts to start the vehicle for 3-5 seconds each before attempting more procedures. The extra key cycles are necessary for the PCM ID to be sent (by the PCM) and then stored by the IC . If only a PCM parameter reset occurs, the IC may encounter 2 PCM IDs (the original one and the new one) and may cause a PATS -related no-start. If a PCM parameter reset occurs before the IC parameter reset occurs, there is no PCM ID stored in the IC , and a PATS -related no-start may occur. If the PCM_ID (PCM ID status) PID reads STORED, the IC has a PCM ID stored. If it reads NOTSTRD, a parameter reset of the PCM may resolve this issue. If the PATSENABLE (vehicle enable status) PID reads NO, and the N_KEYCODE PID reads 2 or more and the MASTERKEY reads PRESNT, the IC , and the PCM will need to have their parameters reset.

If the PATSENABLE PID reads NO, and the N_KEYCODE PID reads 1 and the MASTERKEY reads PRESNT, or if the N_KEYCODE PID reads 0 and the MASTERKEY PID reads NOTPRESNT, a minimum of 2 keys will need to be programmed into the IC . Refer to Key Programming Using Diagnostic Equipment in this section.

If the MASTERKEY PID continues to read NOTPRESNT after programming, this may indicate an inoperative key. The SPAREKEY (spare key) PID is defaulted to ENABLE. With the SPAREKEY PID displaying ENABLE, the IC accepts more than 2 keys (up to a maximum of 8) being programmed into the IC using the Key Programming Using Two Programmed Keys procedure in this section. It can be toggled to DISABL if the customer does not want any more than 2 keys programmed into the IC . Refer to Key Programming Switch State Control in this section. This switch state control does not affect the Key Programming Using Diagnostic Equipment, the Spare Key Programming - Using Diagnostic Equipment or the Spare Key Programming - Unlimited Key Mode procedures.

In summary for the PATS PIDs and their correct state in order for the vehicle to start:

PID	Normal State
N_KEYCODE	must read 2 or more
MASTERKEY	must read PRESNT
PATSENABLE	must read ENABLED
PCM_ID	must read STORED

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical

• Large metallic objects, a second Passive Anti-Theft System (PATS) key on the same key ring as the PATS key, or electronic devices on the key ring that can be used to purchase gasoline or similar items • Ignition lock cylinder • PATS key • Use of a non- PATS key or incorrect PATS key • More than one PATS key on the key ring • Remote start system installed	• Smart Junction Box (SJB) fuse(s): ♦ 8 (15A) ♦ 24 (10A) • Wiring, terminals or connectors • PATS transceiver • Ignition switch • Instrument Cluster (IC) • PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the IC .

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Instrument Cluster (IC) DTC Chart

DTC	Description	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	**NOTE:** If DTC B1600, B1601, B1602, B1681 or B2103 are present, they must be addressed first. If DTC B1213 is the only DTC present, PROGRAM additional keys. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
B1600	PATS Ignition Key Transponder Signal is Not Received	GO to Pinpoint Test B .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	GO to Pinpoint Test C .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	GO to Pinpoint Test D .
B1681	PATS Transceiver Module Signal is Not Received	GO to Pinpoint Test E .
B2103	Antenna Not Connected	GO to Pinpoint Test A .
B2141	NVM Configuration Failure	There is no PCM ID stored in the IC . CARRY OUT a parameter reset of the IC and the PCM and CYCLE the ignition 3-5 times, making an attempt to start the vehicle each key cycle. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section.
B2431	Transponder Programming Failed	The ignition key was not programmed. PROGRAM the key. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
U1900	CAN Communication Bus Fault - Receive Error	**NOTE:** If DTCs U1900 and U2510 are both present, address DTC U2510 first. GO to Pinpoint Test G .
U2510	CAN - Invalid Data for Vehicle Security	CARRY OUT a parameter reset of the IC and the PCM and CYCLE the ignition 3-5 times, making an attempt to start the vehicle each key cycle. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	**NOTE:** If DTCs U2510 and U2511 are both present, address DTC U2510 first. GO to Pinpoint Test G .
All other DTCs	-	REFER to the Diagnostic Trouble Code (DTC) Chart in Section 419-10 .

PCM DTC Chart

DTC	Description	Action
P1260	Theft Detected, Vehicle Immobilized	If there are any Passive Anti-Theft System (PATS) DTCs present in the Instrument Cluster (IC), ADDRESS them first. This DTC can also indicate a Controller Area Network (CAN) concern or a parameter reset concern. Make sure to verify if there are any communication concerns/DTCs with any modules. REFER to Section 418-00 . If DTC P1260 is the only DTC present, there may be a parameter reset concern or a power or ground concern with the PCM. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. If necessary, CHECK the powers and ground to the PCM. REFER to the Wiring Diagrams Manual to determine the PCM power and ground circuits.
All other DTCs	-	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: DTC B2103

Normal Operation

The Passive Anti-Theft System (PATS) transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the Instrument Cluster (IC). The IC carries out all of the PATS functions such as receiving the identification code from the PATS key and sending a message to the PCM, which controls the engine enable. The IC initiates the key interrogation sequence when the key is turned to the ON or START position.

- DTC B2103 (Antenna Not Connected) - sets when there has been a PATS transceiver antenna failure.

This pinpoint test is intended to diagnose the following:

- PATS transceiver

PINPOINT TEST A: DTC B2103

Test Step	Result / Action to Take

A1 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION OR PHYSICAL DAMAGE	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again. • Ignition OFF. • Verify the PATS transceiver is correctly installed. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B2103 retrieved?**	**Yes** INSTALL a new PATS transceiver. REFER to Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. **No** The system is OK.

Pinpoint Test B: DTC B1600

Normal Operation

The Passive Anti-Theft System (PATS) transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the Instrument Cluster (IC). The IC carries out all of the PATS functions such as receiving the identification code from the PATS key and sending a message to the PCM, which controls the engine enable. The IC initiates the key interrogation sequence when the key is turned to the ON or START position.

- DTC B1600 (PATS Ignition Key Transponder Signal is Not Received) - sets when no PATS key has been read by the IC . No PATS key has been read by the IC .

This pinpoint test is intended to diagnose the following:

- PATS encoded ignition key
- PATS transceiver
- IC

PINPOINT TEST B: DTC B1600

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS ignition key may cause a vehicle starting concern and record DTCs under certain conditions. If a fault cannot be identified, examine the customer's key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS ignition key while starting the engine. These objects and devices cannot damage the PATS ignition key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition OFF and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the encoded ignition key used by the customer is a Ford approved PATS key (PATS keys from Ford, Rotunda, Strattec, and Huf are approved Ford PATS keys).

Test Step	Result / Action to Take
B1 CHECK THE DTCs	
• Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B1600 retrieved?**	**Yes** GO to B2 . **No** If DTCs other than PATS DTCs are retrieved, REFER to Section 413-01 . If no PATS DTCs are retrieved, the system is OK.
B2 INSTALL A NEW PATS IGNITION KEY	
NOTE: Check to make sure the customer and the new encoded PATS ignition keys (contains a transponder) are Ford approved PATS ignition keys. Unapproved PATS keys do not always operate correctly over different temperature ranges (Ford, Rotunda, Strattec, and Huf are the only approved PATS ignition keys). • Cut a new ignition key. • Program the new ignition key. Refer to Spare Key Programming - Using Diagnostic Equipment in this section. • Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B1600 present?**	**Yes** GO to B3 . **No** If no PATS DTCs are retrieved, one (or both) of the original PATS keys are damaged. REPEAT the self-test with the original keys to determine if one (or both) keys are damaged.
B3 INSTALL A NEW PATS TRANSCEIVER	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again. **NOTE:** Do not use the PATS key that was programmed in Step B2. • Ignition OFF. • Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Ignition ON. • Clear the continuous IC DTCs. • Ignition OFF. • Turn the key to the ON position using an existing customer PATS key. • Retrieve the IC DTCs. • **Is DTC B1600 retrieved?**	**Yes** REMOVE the new transceiver and INSTALL the original transceiver. GO to B4 . **No** The system is OK.
B4 CHECK FOR CORRECT IC OPERATION	
NOTE: When a new IC is installed, the PATS keys must be programmed into the IC .	**Yes** INSTALL a new IC . REFER to Section 413-01 . PROGRAM the PATS keys into the new IC .

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM. • Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test C: DTC B1601

Normal Operation

The Passive Anti-Theft System (PATS) transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the Instrument Cluster (IC). The IC then sends a message to the PCM. The PCM carries out the function of controlling the engine enable. The IC initiates the key interrogation sequence when the key is turned to the ON or START position.

- DTC B1601 (PATS Received Incorrect Key-Code From Ignition Key Transponder) - sets when there is an unprogrammed PATS key. The concern is not with the PATS key itself, but the key must be programmed into the PATS memory (unless the maximum number of keys are already programmed). There is an unprogrammed PATS key.

This pinpoint test is intended to diagnose the following:

- PATS key
- IC

PINPOINT TEST C: DTC B1601

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause a vehicle starting concern and record DTCs under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition switch off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, and Huf are approved Ford PATS keys).

NOTE: Only 8 PATS keys can be programmed into the IC during normal programming procedures (unless the unlimited key mode is enabled). If the N_KEYCODE (number of keys programmed) PID reads more than 2 and less than 8, the concern may be the PATS key being used is an unprogrammed key. Verify this by also viewing the MASTERKEY (master key) PID. It must read PRESNT for the key to be valid.

Test Step	Result / Action to Take

C1 RETRIEVE THE DTCs	
• Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B1601 retrieved?**	**Yes** GO to C2 . **No** The system is OK. CHECK all customer encoded PATS ignition keys by attempting to start the vehicle with each key to VERIFY all other encoded PATS ignition keys are programmed.
C2 CHECK FOR PROGRAMMED ENCODED IGNITION KEYS - MONITOR THE IC N_KEYCODE PID	
• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Monitor the IC N_KEYCODE PID. • **Does the IC N_KEYCODE PID display 8?**	**Yes** PROGRAM the keys. REFER to Key Programming Using Diagnostic Equipment in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to C3 .
C3 CHECK THE NUMBER OF PROGRAMMED IGNITION KEYS AVAILABLE	
• Verify there are at least 2 currently programmed PATS ignition keys available with the vehicle. • **Are at least 2 currently programmed PATS ignition keys available with the vehicle?**	**Yes** GO to C4 . **No** CUT a new PATS ignition key so that at least 2 PATS ignition keys are available. PROGRAM the PATS ignition keys. REFER to Key Programming Using Diagnostic Equipment in this section. GO to C5 .
C4 VERIFY THE IC SPAREKEY PID INDICATES YES	
• Enter the following diagnostic mode on the scan tool: IC DataLogger. • Monitor the IC SPAREKEY PID. • **Does the IC SPAREKEY PID indicate ENABLED?**	**Yes** Spare key programming is enabled. PROGRAM the keys. REFER to Key Programming Using Two Programmed Keys in this section. CLEAR the DTCs. REPEAT the self-test. **No** ENABLE the IC PID SPAREKEY. REFER to Key Programming Switch State Control in this section. CLEAR the DTCs. REPEAT the self-test.
C5 CHECK THE PATS IGNITION KEYS FOR CORRECT OPERATION	
• Ignition OFF. • Turn the key to ON for 3 seconds using the first PATS ignition key. • Ignition OFF. • Turn the key to ON for 3 seconds using the second PATS ignition key.	**Yes** The system is OK. If there are additional keys that need to be programmed, REFER to Key Programming Using Two Programmed Keys in this section. **No**

• Start the vehicle using the second PATS ignition key. • **Does the vehicle start?**	GO to C6 .
C6 RETRIEVE THE DTCs - CHECK FOR DTC B1601	
• Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B1601 retrieved?**	**Yes** GO to C7 . **No** The system is OK.
C7 CHECK FOR CORRECT IC OPERATION	
NOTE: When a new IC is installed, the PATS keys must be programmed into the IC . **NOTE:** When a new IC is installed, the parameters must be reset in the IC and the PCM. • Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . PROGRAM the PATS keys into the new IC . REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test D: DTC B1602

Normal Operation

The Passive Anti-Theft System (PATS) transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the Instrument Cluster (IC). The IC then sends a message to the PCM to control the engine enable. The IC initiates the key interrogation sequence when the key is turned to the ON or START position.

- DTC B1602 (PATS Received Invalid Format Of Key-Code From Ignition Key Transponder) - sets when only a partial PATS key was read. Remote starter equipment can also cause this DTC.

This pinpoint test is intended to diagnose the following:

- PATS key
- PATS transceiver
- IC

PINPOINT TEST D: DTC B1602

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause a vehicle starting concern and record DTCs under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, and Huf are approved Ford PATS keys).

NOTE: Only 8 PATS keys can be programmed into the IC during normal programming procedures (unless the unlimited key mode is enabled). If the N_KEYCODE (number of keys programmed) PID reads more than 2 and less than 8, the concern may be the PATS key being used is an unprogrammed key. Verify this by also viewing the MASTERKEY (master key) PID. It must read PRESNT for the key to be valid.

Test Step	Result / Action to Take
D1 RETRIEVE THE DTCs	
• Enter the following diagnostic mode on the scan tool: Clear the IC Continuous DTCs . • Ignition OFF. • Ignition ON. • Enter the following diagnostic mode on the scan tool: Retrieve the IC DTCs. • **Is DTC B1602 retrieved?**	**Yes** GO to D2 . **No** The system is OK. CHECK all the customer PATS keys by attempting to start the vehicle with each key to VERIFY all other PATS keys are programmed.
D2 INSTALL A NEW PATS IGNITION KEY	
NOTE: Check to make sure the customer and the new encoded PATS ignition keys (contains a transponder) are Ford approved PATS ignition keys. Unapproved PATS keys do not always operate correctly over different temperature ranges (Ford, Rotunda, Strattec, and Huf are the only approved PATS ignition keys). • Cut a new PATS ignition key. • Program a new PATS ignition key. Refer to Spare Key Programming - Using Diagnostic Equipment in this section. • Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B1602 retrieved?**	**Yes** GO to D3 . **No** If DTCs other than PATS DTCs are retrieved, REFER to Section 413-01 . If no PATS DTCs are retrieved, the system is OK.
D3 INSTALL A NEW PATS TRANSCEIVER	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again. • Clear the continuous IC DTCs. • Ignition OFF.	**Yes** GO to D4 . **No** The system is OK.

• Install a new PATS transceiver. Refer to Passive Anti-Theft System (PATS) Transceiver in this section. • Ignition ON. • Retrieve the IC DTCs. • **Are any PATS DTCs retrieved?**	
D4 CHECK FOR CORRECT IC OPERATION	
NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC . **NOTE:** When a new IC is installed, the parameters must be reset in the IC and the PCM. • Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . PROGRAM the PATS keys into the new IC . REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test E: DTC B1681

Refer to Wiring Diagrams Cell 112 , Passive Anti-Theft System for schematic and connector information.

Normal Operation

The Passive Anti-Theft System (PATS) transceiver receives voltage from the Smart Junction Box (SJB) on circuit CDC34 (WH/OG) and ground on circuit RRT25 (VT/WH). The PATS transceiver communicates with the PATS key. During each vehicle start sequence, the PATS transceiver reads the PATS key identification code and sends the data to the Instrument Cluster (IC). The IC and the PATS transceiver communicate on circuits VRT23 (VT/GY) and VRT24 (YE/OG). The IC then sends a message to the PCM to control the engine enable. The IC initiates the key interrogation sequence when the key is turned to the ON or START position.

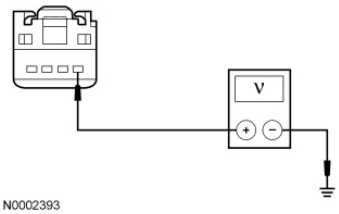
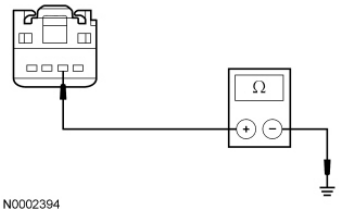
- DTC B1681 (PATS Transceiver Module Signal Is Not Received) - sets when the IC did not receive the PATS transceiver signal. Remote starter equipment can also cause this DTC.

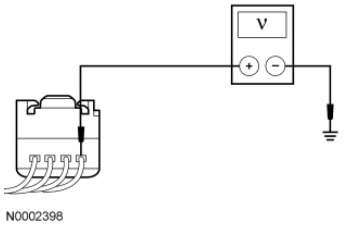
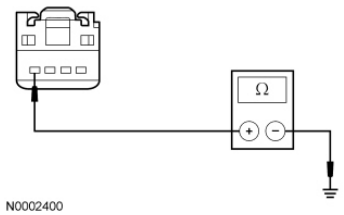
This pinpoint test is intended to diagnose the following:

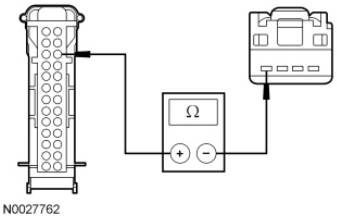
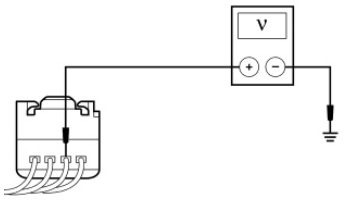
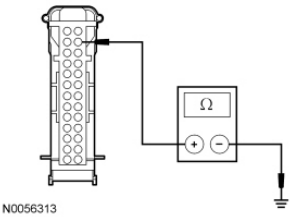
- Fuse
- Wiring, terminals or connectors
- PATS transceiver
- IC

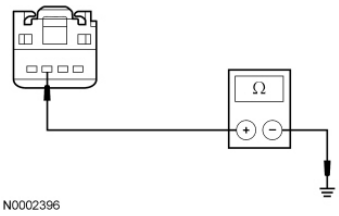
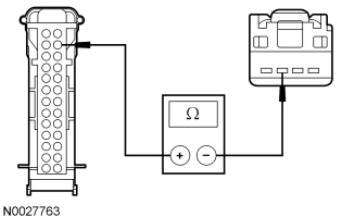
PINPOINT TEST E: DTC B1681

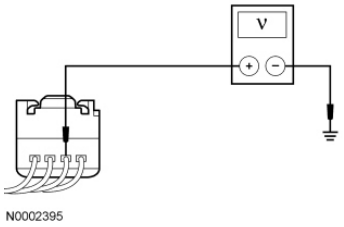
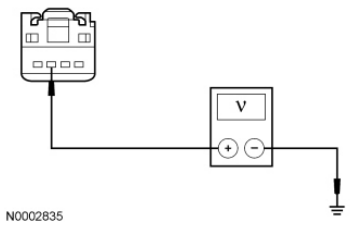
NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step	Result / Action to Take
E1 RETRIEVE THE DTCs	
• Clear the continuous IC DTCs. • Ignition OFF. • Ignition ON. • Retrieve the IC DTCs. • **Is DTC B1681 retrieved?**	**Yes** GO to E2 . **No** The system is OK.
E2 CHECK THE PATS TRANSCEIVER POWER CIRCUIT CDC34 (WH/OG) FOR VOLTAGE	
• Ignition OFF. • Disconnect: PATS Transceiver C2007. • Ignition ON. • Measure the voltage between the PATS transceiver C2007-1, circuit CDC34 (WH/OG), harness side and ground.  N0002393 • **Is the voltage greater than 10 volts?**	**Yes** GO to E3 . **No** VERIFY the SJB fuse 8 (15A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test. If not OK, REFER to the Wiring Diagrams Manual to identify the possible sources of the circuit short.
E3 CHECK THE PATS TRANSCEIVER GROUND CIRCUIT RRT25 (VT/WH) FOR AN OPEN	
• Ignition OFF. • Measure the resistance between the PATS transceiver C2007-2, circuit RRT25 (VT/WH), harness side and ground.  N0002394 • **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E4 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VRT23 (VT/GY) FOR VOLTAGE	

• Connect: PATS Transceiver C2007. • Ignition ON. • Measure the voltage by backprobing between the PATS transceiver C2007-4, circuit VRT23 (VT/GY), harness side and ground.  N0002398 • **Is the voltage greater than 9 volts?**	**Yes** GO to E6 . **No** GO to E5 .
E5 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VRT23 (VT/GY) FOR A SHORT TO GROUND	
• Ignition OFF. • Disconnect: PATS Transceiver C2007. • Measure the resistance between the PATS transceiver C2007-4, circuit VRT23 (VT/GY), harness side and ground.  N0002400 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E6 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. If the DTC sets again, GO to E13 .
E6 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VRT23 (VT/GY) FOR AN OPEN	
• Ignition OFF. • Disconnect: PATS Transceiver C2007. • Disconnect: IC C220. • Measure the resistance between the IC C220-24, circuit VRT23 (VT/GY), harness side and the PATS transceiver C2007-4, circuit VRT23 (VT/GY), harness side.	**Yes** GO to E7 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

 N0027762 • **Is the resistance less than 5 ohms?**	
E7 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT24 (YE/OG) FOR VOLTAGE	
• Ignition OFF. • Connect: PATS Transceiver C2007. • Connect: IC C220. • Ignition ON. • Measure the voltage by backprobing between the PATS transceiver C2007-3, circuit VRT24 (YE/OG), harness side and ground.  N0002395 • **Is the voltage greater than 9 volts?**	**Yes** GO to E11 . **No** GO to E8 .
E8 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT24 (YE/OG) FOR A SHORT TO GROUND WITH THE TRANSCEIVER CONNECTED	
• Ignition OFF. • Disconnect: IC C220. • Measure the resistance between the IC C220-25, circuit VRT24 (YE/OG), harness side and ground.  N0056313 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to E10 . **No** GO to E9 .
E9 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT24 (YE/OG)	

FOR A SHORT TO GROUND WITH THE TRANSCEIVER DISCONNECTED	
NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again. • Disconnect: PATS Transceiver C2007. • Measure the resistance between the PATS transceiver C2007-3, circuit VRT24 (YE/OG), harness side and ground.  N0002396 • **Is the resistance greater than 10,000 ohms?**	**Yes** INSTALL a new PATS transceiver. REFER to Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. REPEAT the self-test. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E10 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT24 (YE/OG) FOR AN OPEN	
• Disconnect: PATS Transceiver C2007. • Measure the resistance between the IC C220-25, circuit VRT24 (YE/OG), harness side and the PATS transceiver C2007-3, circuit VRT24 (YE/OG), harness side.  N0027763 • **Is the resistance less than 5 ohms?**	**Yes** GO to E13 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E11 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT24 (YE/OG) FOR VOLTAGE	

• Ignition ON. • Enter the following diagnostic mode on the scan tool: IC DataLogger. • Select the IC active command TRANSMIT. • Trigger TRANSMIT to ON. • Measure the voltage by backprobing between the PATS transceiver C2007-3, circuit VRT24 (YE/OG), harness side and ground.  N0002395 • **Is the voltage less than 5 volts?**	**Yes** INSTALL a new PATS transceiver, REFER to Passive Anti-Theft System (PATS) Transceiver in this section. CLEAR the DTCs. REPEAT the self-test. **No** GO to E12 .
E12 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT24 (YE/OG) FOR A SHORT TO VOLTAGE	
• Ignition OFF. • Disconnect: IC C220. • Disconnect: PATS Transceiver C2007. • Ignition ON. • Measure the voltage between the PATS transceiver C2007-3, circuit VRT24 (YE/OG), harness side and ground.  N0002835 • **Is voltage present?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. **No** GO to E13 .
E13 CHECK FOR CORRECT IC OPERATION	
NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC . **NOTE:** When a new IC is installed, the parameters must be reset in the IC and the PCM. • Disconnect the IC connector.	**Yes** INSTALL a new IC . REFER to Section 413-01 . RESET the parameters in the IC and the PCM. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. PROGRAM the PATS keys into the new IC . REFER to Key Programming Using Diagnostic Equipment in this section. REPEAT the self-test. **No**

• Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test F: The Anti-Theft Indicator Is Always/Never On

Refer to Wiring Diagrams Cell 112 , Passive Anti-Theft System for schematic and connector information.

Normal Operation

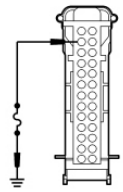
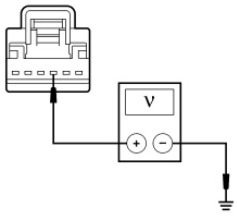
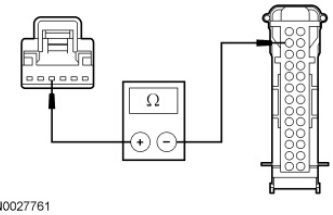
The Passive Anti-Theft System (PATS) uses a visual anti-theft indicator located in the autolamp/sunload sensor. This indicator proves out for 3 seconds when the key is turned to ON or START. If there is a PATS issue, this indicator flashes rapidly when the key is turned to ON or START. PATS also flashes the anti-theft indicator every 2 seconds at ignition OFF to act as a visual theft deterrent.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Anti-theft indicator
- Instrument Cluster (IC)

PINPOINT TEST F: THE ANTI-THEFT INDICATOR IS ALWAYS/NEVER ON

Test Step	Result / Action to Take
F1 CHECK THE IC DTCs	
• Retrieve the IC DTCs. • **Are there any IC DTCs present?**	**Yes** GO to the DTC Charts in this section. **No** GO to F2 .
F2 CHECK FOR CORRECT ANTI-THEFT INDICATOR OPERATION	
• Ignition OFF. • Disconnect: IC C220. • Connect and disconnect a fused jumper wire between the IC C220-12, circuit CRT04 (YE/BU), harness side and ground.	**Yes** REMOVE the fused jumper wire. GO to F5 . **No** REMOVE the fused jumper wire. If the anti-theft indicator is always on, REPAIR circuit CRT04 (YE/BU) for a short to ground. If the anti-theft indicator is never on, GO to F3 .

 N0057340 • **Does the anti-theft indicator illuminate with the jumper wire connected and turn off with the jumper wire disconnected?**	
F3 CHECK CIRCUIT SBP24 (VT/RD) FOR AN OPEN	
• Disconnect: Autolamp/Sunload Sensor C286. • Measure the voltage between the autolamp/sunload sensor C286-3, circuit SBP24 (VT/RD), harness side and ground.  A0063169 • **Is the voltage greater than 10 volts?**	**Yes** GO to F4 . **No** VERIFY the Smart Junction Box (SJB) fuse 24 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.
F4 CHECK CIRCUIT CRT04 (YE/BU) FOR AN OPEN	
• Measure the resistance between the autolamp/sunload sensor C286-4, circuit CRT04 (YE/BU), harness side and the IC C220-12, circuit CRT04 (YE/BU), harness side.  N0027761 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new autolamp/sunload sensor. REFER to Section 417-01 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
F5 CHECK FOR CORRECT IC OPERATION	
NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC .	**Yes** INSTALL a new IC . REFER to Section 413-01 . PROGRAM the PATS keys into the new IC . REFER to Key Programming Using Diagnostic

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM. • Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	Equipment in this section. CYCLE the ignition. REPEAT the self-test. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test G: DTC U1900

Refer to Wiring Diagrams Cell 14 , Module Communications Network for schematic and connector information.

Normal Operation

The Passive Anti-Theft System (PATS) uses a visual anti-theft indicator located in the Instrument Cluster (IC). This indicator proves out for 3 seconds when the key is turned to the ON or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to the ON or START position. PATS also flashes the anti-theft indicator every 2 seconds at key off to act as a visual theft deterrent. The anti-theft indicator operation is controlled by the IC .

If DTC U2510 is present, refer to DTC Charts.

- DTC U1900 (CAN Communication Bus Fault - Receive Error) - sets in continuous memory only when the IC loses communication with the PCM. The fault may not be present at the time of testing. This DTC may be caused by a High Speed Controller Area Network (HS-CAN) circuit issue or by the IC or the PCM.
- DTC U2511 (CAN - Data Mis-Match [Receive Data Does Not Match Expected]) - sets in continuous memory only when the IC does not receive the expected response from the PCM over the HS-CAN . The fault may not be present at the time of testing. The data sent by the PCM does not match the data expected by the IC and this DTC is set. This DTC can be caused by the HS-CAN circuits between the IC and the PCM, by either module, or if the battery voltage is low.

This pinpoint test is intended to diagnose the following:

- Low battery state of charge
- Wiring, terminals or connectors
- IC
- PCM

PINPOINT TEST G: DTC U1900

NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC .

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

Test Step	Result / Action to Take
G1 CHECK THE BATTERY STATE OF CHARGE	
• Ignition OFF. • Check the battery state of charge with the battery condition test. Refer to Section 414-01 . • **Does the battery pass the battery condition test?**	**Yes** GO to G2 . **No** REFER to Section 414-00 to diagnose the low battery voltage condition.
G2 CHECK FOR MODULE COMMUNICATION ON THE HS-CAN	
• Connect the scan tool. • Ignition ON. • Carry out the network test using the scan tool. • **Is the scan tool unable to communicate with any of the modules on the HS-CAN ?**	**Yes** REFER to Section 418-00 to diagnose the module that is not communicating with the scan tool. **No** GO to G3 .
G3 INSPECT THE HS-CAN CIRCUITRY	
• Ignition OFF. • Inspect all of the HS-CAN circuitry, including the pin crimps, connector fit, corroded/bent/pushed-out/damaged pins and splice integrity in the 8 splices and 10 connections (5 connectors) between the PCM and the IC. This includes: ♦ C175B (PCM) ♦ S122 ♦ S124 ♦ C126 ♦ C300 ♦ S317 ♦ S318 ♦ S319 ♦ S320 ♦ C214 ♦ S220 ♦ S224 ♦ C220 (IC) • **Does the HS-CAN circuitry pass the component inspection?**	**Yes** GO to G4 . **No** REPAIR the HS-CAN circuitry as necessary. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.
G4 CHECK FOR CORRECT PCM OPERATION	
NOTE: When a new PCM is installed, the	**Yes** INSTALL a new PCM. REFER to Section 303-14

PATS keys do not need to be programmed into the IC . **NOTE:** When a new PCM is installed, the parameters must be reset in the IC and the PCM. • Disconnect all the PCM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect all the PCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	. RESET the parameters in both the IC and the PCM. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation. If the concern is still present, GO to G5 . **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.
G5 CHECK FOR CORRECT IC OPERATION	
NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC . **NOTE:** When a new IC is installed, the parameters must be reset in the IC and the PCM. • Disconnect the IC connector. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC . REFER to Section 413-01 . RESET the parameters in both the IC and the PCM. REFER to Passive Anti-Theft System (PATS) Parameter Reset in this section. PROGRAM the PATS keys into the new IC . REFER to Key Programming Using Diagnostic Equipment in this section. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test H: The Vehicle Does Not Start

Normal Operation

The Passive Anti-Theft System (PATS) uses a visual anti-theft indicator located in the autolamp/sunload sensor. This indicator proves out for 3 seconds when the key is turned to the ON or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to the ON or START position. PATS also flashes the anti-theft indicator every 2 seconds at key off to act as a visual theft deterrent. The anti-theft indicator operation is controlled by the Instrument Cluster (IC).

This pinpoint test is intended to diagnose the following:

- Starting system concern
- PATS concern

PINPOINT TEST H: THE VEHICLE DOES NOT START

Test Step	Result / Action to Take
H1 CHECK FOR COMMUNICATION WITH THE PCM AND IC	
• Connect the scan tool. • Ignition ON. • Carry out the network test using the scan tool. • **Does the scan tool establish communication with the PCM and the IC ?**	**Yes** GO to H2 . **No** REFER to Section 418-00 to diagnose the module that is not communicating with the scan tool.
H2 CHECK FOR IC DTCs	
• Retrieve the IC continuous and on-demand DTCs. • **Are any IC DTCs present?**	**Yes** REFER to DTC Charts in this section. **No** The no-start condition is not PATS -related. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to diagnose the cause of the no-start condition.

Key Programming Using Two Programmed Keys

NOTE: This procedure only works if 2 or more programmed ignition keys are available. If 2 programmed keys are not available, refer to Key Programming Using Diagnostic Equipment in this section.

NOTE: The Instrument Cluster (IC) PID SPAREKEY must be enabled for this procedure to operate. If this IC PID is not enabled, refer to Key Programming Switch State Control in this section, then select SPAREKEY programming switch; ENABLED. The IC PID SPAREKEY is set to ENABLE when the vehicle is built.

NOTE: If the programming procedure is successful, the new key(s) will start the vehicle and the anti-theft indicator will prove-out for approximately 3 seconds. If the programming procedure is not successful and the new key(s) does not start the engine, leave the key in the ON position for at least 3 seconds, then turn the key off. Repeat the key programming procedure from Step 1. If the failure repeats, refer to Anti-Theft in the Diagnosis and Testing portion of this section to review the DTCs and carry out the appropriate pinpoint tests.

NOTE: A maximum of 8 Passive Anti-Theft System (PATS) keys can be programmed into the IC during this programming procedure, but only if the IC PID SPAREKEY is ENABLED.

NOTE: A minimum of 2 PATS keys must be programmed into the IC before the vehicle will start.

NOTE: If the vehicle is in unlimited key mode, this spare key programming procedure still functions. Any 2 keys that can start the vehicle can be used to program an additional unlimited key.

NOTE: If additional keys are to be programmed, and the remaining keys are with the customer, or are not available, instruct the customer to refer to the Owner's Literature for instructions on programming the remaining keys. In this case, the IC PID SPAREKEY must be enabled.

NOTE: If the steps are not carried out as outlined, the programming procedure will end.

NOTE: Ignition keys must have a correct mechanical key cut for the vehicle and must be PATS encoded keys (contain a transponder).

NOTE: This procedure is not necessary if only the PATS transceiver was replaced. Replacement of the transceiver does not erase the PATS key codes in the IC .

NOTE: When in the unlimited key mode, the N_KEYCODE PID will always read 2 (after the first 2 keys have been programmed), no matter how many keys are programmed to the vehicle.

1. Insert the first programmed key into the ignition lock cylinder and turn the key from the OFF position to the ON position (maintain the key in the ON position for a minimum of 3 seconds and less than 10 seconds).

2. Turn the key to the OFF position and remove the first key from the ignition lock cylinder.

3. Within 5 seconds of turning the key to the OFF position, insert the second programmed key into the ignition lock cylinder and turn the key from the OFF position to the ON position (maintain the key in the ON position for a minimum of 3 seconds and less than 10 seconds).

4. Turn the key to the OFF position and remove the key from the ignition lock cylinder.

5. Within 10 seconds of turning the key to the OFF position, insert the unprogrammed key (the new key) into the ignition lock cylinder and turn the key from the OFF position to the ON position (maintain the key in the ON position for a minimum of 3 seconds and less than 10 seconds).

6. If it is desired to program additional key(s) (only up to 8 keys total can be programmed into the IC), repeat Steps 1-5 for each additional key that needs to be programmed.

7. Start the vehicle with the new key(s).

Key Programming Using Diagnostic Equipment

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: This procedure is used when a customer needs keys programmed into the system and does not have 2 programmed ignition keys available. This procedure is also useful when a programmed ignition key(s) is lost or the ignition lock cylinder is replaced, and it is desired to erase key code(s) from the Passive Anti-Theft System (PATS) memory.

NOTE: This procedure erases all programmed ignition keys from the vehicle memory. The vehicle will not start until a minimum of 2 keys are programmed into the Instrument Cluster (IC).

NOTE: A minimum of 2 PATS keys must be programmed into the IC before the vehicle will start.

NOTE: Two PATS encoded (contains a transponder) keys with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the customer's original keys.

NOTE: If additional keys are to be programmed, refer to Key Programming Using Two Programmed Keys in this section. If the remaining keys are with the customer and are not available with the vehicle, instruct the customer to refer to the Owner's Literature for instructions on programming the remaining keys. In this case, the PID SPAREKEY must be enabled.

NOTE: This procedure is not necessary if only the PATS transceiver was replaced. Replacement of the transceiver does not erase the PATS key codes in the IC .

1. Turn the key from the OFF position to the ON position.
2. From the scan tool, enter TOOLBOX. Select BODY - SECURITY - PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.
3. From the scan tool menu select: "Ignition Key Code Erase" and follow the on-screen instructions.
4. Turn the key to the OFF position and disconnect the scan tool.
5. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.
6. Turn the first PATS key to the OFF position and remove the key from the ignition lock cylinder.
7. Insert the next PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.
8. The vehicle should now start with both PATS ignition keys.

9. If it is desired to program additional key(s) (only up to 8 keys total can be programmed into the IC), refer to Key Programming Using Two Programmed Keys in this section for each additional key that needs to be programmed.

Key Programming Switch State Control

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: The spare key programming switch is a programmable switch which provides the capability to enable/disable the normal customer spare key programming procedure detailed in the Owner's Literature. It must read ENABLE if more than 2 keys need to be programmed into the Instrument Cluster (IC). For additional information, refer to Key Programming Using Two Programmed Keys in this section. This programmable switch is provided as a convenience for rental company fleets or other fleet purchasers who may not want the spare key programming procedure available to the vehicle driver.

NOTE: The spare key programming switch state can be viewed with the IC PID SPAREKEY.

NOTE: If the SPAREKEY PID reads ENABLE, up to 8 keys total can be programmed into the IC using Key Programming Using Two Programmed Keys in this section. If the SPAREKEY PID reads DISABLED, the Key Programming Using Two Programmed Keys procedure will not function. This switch is set to ENABLE when the vehicle is built. This PID does not affect the Key Programming Using Diagnostic Equipment, the Spare Key Programming - Unlimited Key Mode or the Spare Key Programming - Using Diagnostic Equipment procedures.

1. Insert a programmed Passive Anti-Theft System (PATS) key into the ignition lock cylinder and turn the key from the OFF position to the ON position.

2. From the scan tool, enter TOOLBOX. Select BODY - SECURITY - PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.

3. **NOTE:** The default setting of the key programming switch on delivery of all new vehicles is ENABLED, when viewing the IC PID SPAREKEY.

   From the scan tool menu select: "Customer Spare Key Programming Enable" (or "Customer Spare Key Programming Disable"), and follow the on-screen instructions.

   - "Customer Spare Key Programming Enable" - the spare key programming procedure is accessible.
   - "Customer Spare Key Programming Disable" - the spare key programming procedure is not accessible.

Spare Key Programming - Using Diagnostic Equipment

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: This procedure is used when a customer needs to have an additional key programmed into the vehicle without erasing stored key codes, but does not have 2 programmed keys available. This procedure is also useful when attempting to determine if an ignition key is damaged, as a new key can be installed without erasing keys or without having 2 programmed keys available.

NOTE: Before programming, the new key must have the correct mechanical cut for the ignition lock cylinder.

NOTE: If 8 keys are already programmed, this procedure does not allow any more ignition keys to be programmed. The number of keys that are programmed into the Passive Anti-Theft System (PATS) can be determined by viewing the Instrument Cluster (IC) PID N_KEYCODE.

NOTE: When in the unlimited key mode, the N_KEYCODE PID will always read 2 (after the first 2 keys have been programmed), no matter how many keys are programmed to the vehicle.

1. Turn the unprogrammed PATS key from the OFF position to the ON position.

2. From the scan tool, enter TOOLBOX. Select BODY - SECURITY - PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.

3. **NOTE:** Make sure the selection made is "PROGRAM" (Program additional ignition key). If the "ERASE" (Ignition Key Code Erase) selection is made, all of the keys will be erased from the system.

   From the scan tool menu select: "Program additional ignition key" and follow the on-screen instructions.

4. Turn the key to the OFF position and disconnect the scan tool.

5. Start the vehicle with the new PATS key. The vehicle will now start with the new PATS key and also with the original PATS keys.

Spare Key Programming - Unlimited Key Mode

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Enabling Unlimited Key Mode

NOTE: Unlimited key mode is intended for use by those customers who need more than 8 keys for their vehicle.

NOTE: Before programming, the new key(s) must have the correct mechanical cut for the ignition lock cylinder(s).

NOTE: The unlimited key mode is set up by creating a special, unique unlimited transponder security key code and programming this key code into all of the vehicle keys so they contain the same key code.

NOTE: When in the unlimited key mode, the N_KEYCODE PID always reads 2, no matter how many keys are programmed to the vehicle (after the first 2 keys have been programmed).

1. The customer must choose an 8-digit number (except for 00000000 or 00000001) to be programmed into all of their vehicles keys (or, to all of the keys they want programmed to one vehicle). All customer vehicles keys (or all keys for one vehicle) need to use the same number. Valid digits are 0-9 and the letters A-F.

2. **NOTE:** If the Instrument Cluster (IC) UNL_KEY_ID PID is not available, unlimited key mode is turned on, and must be turned off before viewing the stored code. At this time, unlimited keys may be programmed to the vehicle(s). To view/change the stored code, follow the procedure for disabling the unlimited key mode below.

   Monitor the IC UNL_KEY_ID PID and compare its value against the code chosen in Step 1. It should not be the same key code.

3. From the scan tool, enter TOOLBOX. Select BODY-SECURITY-PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. This procedure takes approximately 10 minutes to carry out, during which time the ignition key must be in the ON position and the scan tool must be connected to the vehicle. For additional information, refer to Anti-Theft Security Access in this section.

4. Once in security access, select: "program unlimited key code" and follow the on-screen instructions. Enter the 8-digit code chosen by the customer in Step 1 of this procedure and follow the on-screen instructions.

5. Select: "unlimited key mode ON" and follow the on-screen instructions.

6. Select: "Ignition Key Code Erase" and follow the on-screen instructions.

7. Disconnect the scan tool and turn the ignition key to the OFF position (the key does not need to be removed at this time).

8. Turn the first Passive Anti-Theft System (PATS) key in the ignition lock cylinder to the ON position for 3 seconds.

9. Turn the first PATS key to the OFF position and remove the key from the ignition lock cylinder.

10. Insert the second PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.

11. The vehicle should now start with both PATS keys.

12. If it is desired to program additional key(s), refer to Key Programming Using Two Programmed Keys in this section for each additional key that needs to be programmed.

Disabling Unlimited Key Mode

NOTE: By disabling the unlimited key mode, the previous access code no longer operates the vehicle.

1. From the scan tool, enter TOOLBOX. Select BODY-SECURITY-PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. This procedure takes approximately 10 minutes to carry out, during which time the ignition key must be in the ON position and the scan tool must be connected to the vehicle. For additional information, refer to Anti-Theft Security Access in this section.

2. Select: "unlimited key mode OFF" and follow the on-screen instructions.

3. Select: "Ignition Key Code Erase" and follow the on-screen instructions.

4. Disconnect the scan tool and turn the ignition switch to the OFF position (the key does not need to be removed at this time).

5. Turn the first PATS key in the ignition lock cylinder to the ON position for 3 seconds.

6. Turn the first PATS key to the OFF position and remove the key from the ignition lock cylinder.

7. Insert the second PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds.

8. **NOTE:** With the unlimited key mode turned off, a maximum of 8 keys can be programmed into the Instrument Cluster (IC) using the Key Programming Using Two Programmed Keys procedure in this section. The IC SPAREKEY PID must be enabled.

   If it is desired to program additional key(s), refer to Key Programming Using Two Programmed Keys in this section for each additional key (up to 8 keys, total) that needs to be programmed. The IC SPAREKEY PID must be enabled.

Passive Anti-Theft System (PATS) Parameter Reset

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: A minimum of 2 Passive Anti-Theft System (PATS) keys must be programmed into the Instrument Cluster (IC) to complete this procedure and allow the vehicle to start.

1. Turn the key from the OFF position to the ON position.
2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.
3. From the scan tool, select: Parameter Reset and follow the on-screen instructions.
4. **NOTE:** If the IC or the IC and the PCM were replaced, updated or reconfigured, follow Steps 4-9. All vehicle keys are erased during the parameter reset procedure. Verify at least 2 vehicle keys are available prior to carrying out the PATS parameter reset. If only the PCM was replaced, go to Step 9.

   From the scan tool, select: Ignition Key Code Erase and follow the on-screen instructions.
5. Turn the key to the OFF position and disconnect the scan tool.
6. Turn the key to the ON position for 6 seconds.
7. Turn the key to the OFF position and remove the key.
8. Insert the second PATS key into the ignition lock cylinder and turn the key to the ON position for 6 seconds.
9. Both keys now start the vehicle.
10. If more keys are required to be programmed, refer to Key Programming Using Two Programmed Keys in this section.
11. Program the Remote Keyless Entry (RKE) transmitter portion of the Integrated Keyhead Transmitter (IKT) PATS keys. For additional information, refer to Section 501-14 .

Anti-Theft Security Access

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: The anti-theft security access procedure is used to obtain Passive Anti-Theft System (PATS) security access. PATS security access must be granted to erase ignition key codes, program ignition key codes, enable/disable unlimited key mode, set unlimited transponder key ID, reset Instrument Cluster (IC) or PCM parameters and enable/disable the spare key programming switch (PID SPAREKEY). The anti-theft security access procedure invokes a 10-minute time delay prior to granting security access during which the scan tool must remain connected to the vehicle. Once security access is granted, a security access command menu is displayed which offers various command options.

NOTE: Once security access has been granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids an additional security access procedure and the associated 10-minute time delay.

NOTE: If anti-theft security access has been entered to reset parameters, make sure to cycle the ignition several times, holding the key in each position for a minimum of 3 seconds. The vehicle may not start until the key has been cycled a minimum of 3 times. This allows the modules to send and receive the IDs after the parameter resets have occurred.

NOTE: When using the IDS , the IC and the PCM parameters are reset at the same time.

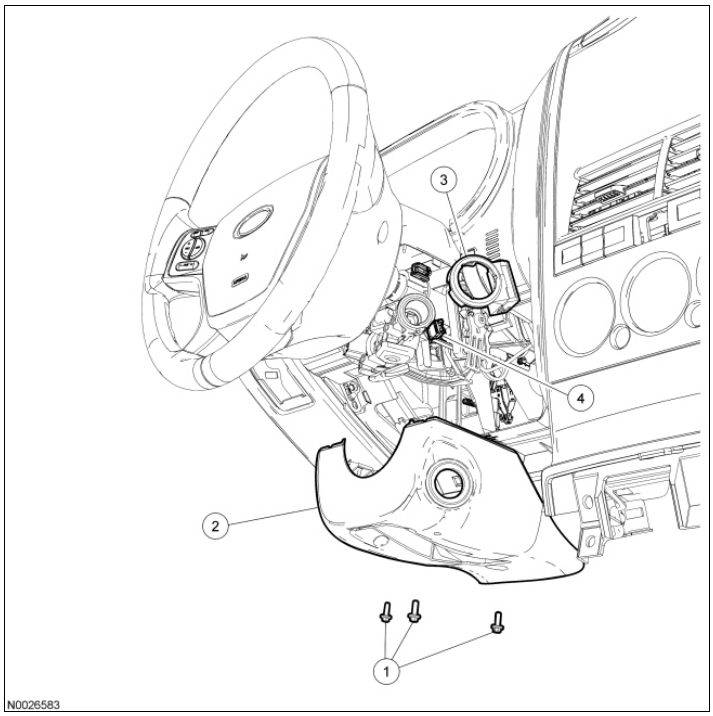
NOTE: Once security access has been granted for either the IC or the PCM, you can toggle between the 2 modules without having to wait an additional 10 minutes (if not using the IDS).

1. Turn the key from the OFF position to the ON position.

2. From the scan tool, enter TOOLBOX. Select BODY - SECURITY - PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to Anti-Theft Security Access in this section.

3. After the 10-minute security access procedure is completed, follow the on-screen instructions and a new menu is displayed with command options. Select only those functions required before exiting out of this menu. Do not select more functions than the procedure calls for. Once exited out of this menu, the security access procedure must be repeated again to carry out additional commands.

Passive Anti-Theft System (PATS) Transceiver



Item	Part Number	Description
1	-	Steering column shroud screws (3 required)
2	3530	Steering column shroud (lower)
3	15607	Passive Anti-Theft System (PATS) transceiver
4	-	PATS transceiver electrical connector (part of 14401)

Removal and Installation

1. Remove the steering column opening cover. For additional information, refer to Section 501-12 .

2. Remove the ignition lock cylinder. For additional information, refer to Section 501-14 .

3. Remove the 3 screws and the lower steering column shroud.

4. Remove the Passive Anti-Theft System (PATS) transceiver.
    1. Release the 2 tabs.
    2. Disconnect the electrical connector.

5. **NOTE:** Replacement of the PATS transceiver does not require the PATS keys to be programmed into the Instrument Cluster (IC) again.

   To install, reverse the removal procedure.

Universal Transmitter

Vehicles With Roof Opening Panel and Auxiliary A/C

The universal transmitter is an integral part of the LH sun visor.

All Other Vehicles

The universal transmitter is an integral part of the overhead console.

The universal transmitter provides a convenient way to substitute up to 3 hand-held transmitters with a single built-in device. The universal transmitter can learn the radio frequency codes of most current transmitters. The universal transmitter:

- operates garage doors, gates and home/office lighting and security systems.
- learns and transmits the radio frequency of up to 3 hand-held transmitters from any of the systems mentioned above.
- is powered by the vehicle battery and charging system.

Universal Transmitter

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Wiring, terminals or connectors • Universal transmitter • Receiver unit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and GO to Symptom Chart .

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: The Universal Transmitter Is Inoperative

Refer to Wiring Diagrams Cell 89 , Interior Lamps for schematic and connector information.

Normal Operation

Vehicles with roof opening panel and auxiliary A/C will have the universal transmitter located as an integral part of the LH sun visor. For all other vehicles, the universal transmitter is integral to the overhead console. The universal transmitter can be programmed to operate up to 3 garage doors, entry gates, security systems, and home or office lighting. Voltage is supplied from the battery saver relay in the Smart Junction Box (SJB) to the universal transmitter through circuit CLN01 (GN/VT) and the universal transmitter is grounded on circuit GD133 (BK).

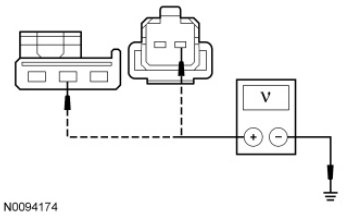
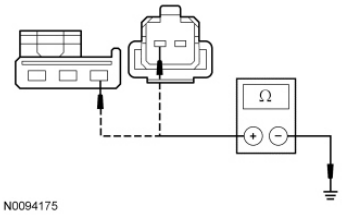
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Universal transmitter
- Receiver unit

PINPOINT TEST A: THE UNIVERSAL TRANSMITTER IS INOPERATIVE

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
A1 CHECK THE UNIVERSAL TRANSMITTER	
• Press any of the buttons on the universal transmitter. • **Does the universal transmitter LED illuminate?**	**Yes** GO to A2 . **No** GO to A3 .
A2 PROGRAM A HAND-HELD TRANSMITTER INTO THE UNIVERSAL TRANSMITTER	
• Program the universal transmitter. Refer to Universal Transmitter Programming in this section. • **Does the universal transmitter program successfully?**	**Yes** The universal transmitter is OK. VERIFY the receiver operates correctly. **No** INSTALL a new universal transmitter. For vehicles with roof opening panel and auxiliary A/C, REFER to Headliner in Section 501-05 . For all other vehicles, REFER to Overhead Console in Section 501-12 . TEST the system for normal operation.
A3 CHECK CIRCUIT CLN01 (GN/VT) FOR AN OPEN	

• Ignition OFF. • Disconnect: LH Vanity Mirror Lamp C907 (with roof opening panel and auxiliary A/C) or Universal Transmitter C928 (all other vehicles). • Ignition ON. • Measure the voltage between the universal transmitter C907-1 (with roof opening panel and auxiliary A/C) or C928-2 (all other vehicles), circuit CLN01 (GN/VT), harness side and ground.  N0094174 • **Is the voltage greater than 10 volts?**	**Yes** GO to A4 . **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK CIRCUIT GD133 (BK) FOR AN OPEN	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the universal transmitter C907-2 (with roof opening panel and auxiliary A/C) or C928-1 (all other vehicles), circuit GD133 (BK), harness side and ground.  N0094175 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new universal transmitter. For vehicles with roof opening panel and auxiliary A/C, REFER to Headliner in Section 501-05 . For all other vehicles, REFER to Overhead Console in Section 501-12 . TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

Universal Transmitter Programming

NOTE: A new battery in the hand-held transmitter may allow quicker and easier training due to a more accurate transmission of the radio frequency signal.

1. Verify the hand-held transmitter is operative.

2. Turn the key to the ON position.

3. Prepare for programming the universal transmitter by erasing all 3 channels by holding down the 2 outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.

4. Select 1 of the 3 universal transmitter buttons to be used for programming.

5. Hold the end of the hand-held transmitter 25-76 mm (1-3 in) away from the front surface of the universal transmitter so that the universal transmitter red light can still be seen.

6. **NOTE:** During programming, the hand-held transmitter may automatically stop transmitting after 2 seconds, which may not be long enough to program the universal transmitter. If programming with this type of hand-held transmitter, continue to hold the button on the universal transmitter while pressing and releasing the hand-held transmitter button every 2 seconds.

   At the same time, press the hand-held transmitter button and the desired button on the universal transmitter until the red light on the universal transmitter flashes first slowly, and then rapidly. Release both buttons when the rapid flashing begins.

7. Firmly press and hold for 5 seconds, then release the just-trained universal transmitter button up to 2 separate times to activate the door. If after 2 separate times, the door still does not activate, press and hold the just-trained universal transmitter button and observe the indicator light.
   - If the indicator light stays on constantly, programming is complete and the device should activate when the universal transmitter button is pressed and released.
   - If the indicator light blinks rapidly for 2 seconds and then turns to a constant light, follow the Training a Garage Door Opener Equipped With "Rolling Codes" procedure to complete the programming of a rolling code equipped device.

Training a Garage Door Opener Equipped With "Rolling Codes"

1. At the garage door opener receiver (motor-head unit) in the garage, locate the "learn" or "smart" button. This can usually be found where the hanging antenna wire is attached to the motor-head unit.

2. Firmly press and release the "learn" or "smart" button. (The name and color of the button may vary by manufacturer.) There are 30 seconds to initiate step 3.

3. Return to the vehicle and firmly press, hold for 2 seconds and release the programmed universal transmitter button. Repeat the press/hold/release sequence a second time, and depending on the brand of the garage door opener (or other rolling code equipped device), repeat this sequence a third time to complete the programming process.

Torque Specifications

Description	Nm	lb-in
Parking brake control bolts	20	177

Module Controlled Functions

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The 2 multifunction electronic modules on this vehicle are the:

- Driver Seat Module (DSM)
- Smart Junction Box (SJB)

Driver Seat Module (DSM)

The Driver Seat Module (DSM) is located under the driver seat. The DSM controls the memory functions of the memory seat positions and the adjustable pedals. The memory driver seat feature allows the driver to program a personalized seat position that can be recalled using the memory switches or the Remote Keyless Entry (RKE) transmitter. Refer to Section 501-14 .

Smart Junction Box (SJB)

The SJB (located under the instrument panel on the driver side) is a combination of a multifunction electronic module and an interior junction box. The SJB functions control multiple systems, which include:

- Accessory delay
- Battery saver
- Exterior lighting
- Heated rear window and mirrors
- Horn
- Illuminated entry and interior lighting
- Power door locks
- RKE system/keyless entry keypad
- Tire Pressure Monitoring System (TPMS)
- Warning chimes
- Windshield wiper

Diagnostic Trouble Code (DTC) Chart

NOTE: Most powertrain (P-code) DTCs are diagnosed in the Powertrain Control/Emissions Diagnosis (PC/ED) manual. If the P-code retrieved is not listed below, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual to continue diagnostics.

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

NOTE: Some of these modules utilize a 5-character DTC followed by a 2-character failure-type code. The failure-type code provides information about specific fault conditions such as opens, or shorts to ground. Continuous memory DTCs have an additional 2-character DTC status code suffix to assist in determining DTC history.

DTC	Description	Source	Action
B1031	SDARS Satellite Antenna Open	Satellite Digital Audio Receiver System (SDARS) module	REFER to Section 415-00 .
B1032	SDARS Satellite Antenna Short	SDARS module	REFER to Section 415-00 .
B106A	TPMS Sensor Pressure Range Bit Incorrect State	Smart Junction Box (SJB)	REFER to Section 204-04 .
B106B	Tire Pressure Sensor Low Battery	SJB	REFER to Section 204-04 .
B106D	TPMS Initiators Not Configured	SJB	REFER to Section 204-04 .
B106E	Module Output Pin Disabled To Protect From External Fault	SJB	REFER to Smart Junction Box (SJB) in this section.
B106F	Module Disabled Due to External Fault	SJB	REFER to Smart Junction Box (SJB) in this section.
B1085	Restraint System - Seatbelt Load Limiter Status	Restraints Control Module (RCM)	REFER to Section 501-20B .
B1117	Audio Steering Wheel Button Stuck	Audio Control Module (ACM)	REFER to Section 415-00 .
B1118	Passenger Front Crash Sensor Mount/Communication Fault	RCM	REFER to Section 501-20B .
B1119	Audio Disc DVD Player Thermal Shutdown	Rear Entertainment Module (RETM)	REFER to Section 415-00 .
B111F	LCD Thermal Shutdown	RETM	REFER to Section 415-00 .
B1135	Passenger Front Crash Sensor Internal Fault	RCM	REFER to Section 501-20B .
B1162	Power Running Board Hall Effect Sensor Power Circuit Short to Battery	Power Running Board (PRB) module	REFER to Section 501-08 .
B1163	Left Power Running Board Hall Effect Sensor Failure	PRB module	REFER to Section 501-08 .

B1164	Power Running Board Hall Effect Sensor Power Circuit Short to Ground	PRB module	REFER to Section 501-08 .
B1167	Left Power Running Board Deploy and or Stow Circuit Short to Battery	PRB module	REFER to Section 501-08 .
B1168	Left Power Running Board Stow Circuit Short to Ground	PRB module	REFER to Section 501-08 .
B1169	LH Motor Traveled Too Far	PRB module	REFER to Section 501-08 .
B116A	RH Motor Traveled Too Far	PRB module	REFER to Section 501-08 .
B116B	LH Power Running Board Motor Short	PRB module	REFER to Section 501-08 .
B116C	RH Power Running Board Motor Short	PRB module	REFER to Section 501-08 .
B116D	LH Power Running Board Motor Line Open	PRB module	REFER to Section 501-08 .
B116E	RH Power Running Board Motor Line Open	PRB module	REFER to Section 501-08 .
B1170	Right Power Running Board Hall Effect Sensor Failure	PRB module	REFER to Section 501-08 .
B1171	Left Power Running Board Hall Effect Signal Noisy	PRB module	REFER to Section 501-08 .
B1172	Right Power Running Board Hall Effect Signal Noisy	PRB module	REFER to Section 501-08 .
B1175	Right Power Running Board Stow Circuit Short to Ground	PRB module	REFER to Section 501-08 .
B1178	Right Power Running Board Deploy and or Stow Circuit Short to Battery	PRB module	REFER to Section 501-08 .
B119F:01	GPS Antenna: General Electrical Failure	ACM	REFER to Section 415-00 .
B119F:13	GPS Antenna: Circuit Open	ACM	REFER to Section 415-00 .
B11BA:1C	Steering Wheel Audio Switch Pack: Circuit Voltage Out Of Range	ACM	REFER to Section 415-00 .
B11BA:63	Steering Wheel Audio Switch Pack: Circuit / Component Protection Time-Out	ACM	REFER to Section 415-00 .
B1201:1C	Steering Wheel Audio Switch Pack 2: Circuit Voltage Out Of Range	ACM	REFER to Section 415-00 .
B1201:1C	Steering Wheel Audio Switch Pack 2: Circuit Voltage Out of Range	APIM	REFER to Section 415-00 .
B1201:63	Steering Wheel Audio Switch Pack 2: Circuit / Component Protection Time-Out	ACM	REFER to Section 415-00 .
B1201:63	Steering Wheel Audio Switch Pack 2: Circuit / Component	APIM	REFER to Section 415-00 .

	Protection Time-Out		
B1203	Fuel Sender Circuit Short to Battery	Instrument Cluster (IC)	REFER to Section 413-01 .
B1204	Fuel Sender Circuit Short to Ground	IC	REFER to Section 413-01 .
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	IC	REFER to Section 419-01 .
B1217	Horn Relay Coil Circuit Failure	SJB	REFER to Section 413-06 .
B1218	Horn Relay Coil Circuit Short to Vbatt	SJB	REFER to Section 413-06 .
B121C:01	Hard Drive: General Electrical Failure	ACM	REFER to Section 415-00 .
B1231	Event Threshold Exceeded	Occupant Classification System Module (OCSM)	REFER to Section 501-20B .
B1231	Event Threshold Exceeded	RCM	REFER to Section 501-20B .
B1251	Air Temperature Internal Sensor Circuit Open	HVAC module	REFER to Section 412-00 .
B1252:04	USB Port: System Internal Failure	APIM	REFER to Section 415-00 .
B1252:11	USB Port: Circuit Short to Ground	APIM	REFER to Section 415-00 .
B1253	Air Temperature Internal Sensor Circuit Short to Ground	HVAC module	REFER to Section 412-00 .
B1255	Air Temperature External Sensor Circuit Open	HVAC module	REFER to Section 412-00 .
B1255	Air Temperature External Sensor Circuit Open	IC	REFER to Section 413-01 .
B1257	Air Temperature External Sensor Circuit Short to Ground	HVAC module	REFER to Section 412-00 .
B1257	Air Temperature External Sensor Circuit Short to Ground	IC	REFER to Section 413-01 .
B1259	Solar Radiation Sensor Circuit Open	HVAC module	REFER to Section 412-00 .
B1261	Solar Radiation Sensor Circuit Short to Ground	HVAC module	REFER to Section 412-00 .
B1299	Power Supply Sensor Circuit Short to Ground	Parking Aid Module (PAM)	REFER to Section 413-13 .
B1300	Power Door Lock Circuit Failure	SJB	REFER to Section 501-14 .
B1302	Accessory Delay Relay Coil Circuit Failure	SJB	REFER to Section 501-11 .
B1304	Accessory Delay Relay Coil Circuit Short to Battery	SJB	REFER to Section 501-11 .
B1316	Battery Saver Relay Coil Circuit Short to Ground	SJB	REFER to Section 417-02 .
B1317	Battery Voltage High	4X4 control module	REFER to Section 308-07A .
B1317	Battery Voltage High	Driver Seat Module (DSM)	REFER to Driver Seat Module (DSM) in this section.

B1317	Battery Voltage High	IC	REFER to Section 413-01 .
B1317	Battery Voltage High	OCSM	REFER to Section 501-20B .
B1317	Battery Voltage High	PAM	REFER to Section 413-13 .
B1317	Battery Voltage High	PRB module	REFER to Section 501-08 .
B1317	Battery Voltage High	RCM	REFER to Section 501-20B .
B1317	Battery Voltage High	RETM	REFER to Section 415-00 .
B1317	Battery Voltage High	SJB	REFER to Smart Junction Box (SJB) in this section.
B1318	Battery Voltage Low	4X4 control module	REFER to Section 308-07A .
B1318	Battery Voltage Low	ACM	REFER to Section 415-00 .
B1318	Battery Voltage Low	DSM	REFER to Driver Seat Module (DSM) in this section.
B1318	Battery Voltage Low	IC	REFER to Section 413-01 .
B1318	Battery Voltage Low	OCSM	REFER to Section 501-20B .
B1318	Battery Voltage Low	PAM	REFER to Section 413-13 .
B1318	Battery Voltage Low	PRB module	REFER to Section 501-08 .
B1318	Battery Voltage Low	RCM	REFER to Section 501-20B .
B1318	Battery Voltage Low	RETM	REFER to Section 415-00 .
B1318	Battery Voltage Low	SDARS module	REFER to Section 415-00 .
B1318	Battery Voltage Low	SJB	REFER to Smart Junction Box (SJB) in this section.
B1319	Driver Door Ajar Circuit Failure	4X4 control module	REFER to Section 308-07A .
B1319	Driver Door Ajar Circuit Failure	SJB	REFER to Section 417-02 .
B1322	Driver Door Ajar Circuit Short to Ground	4X4 control module	REFER to Section 308-07A .
B1327	Passenger Door Ajar Circuit Failure	SJB	REFER to Section 417-02 .
B1335	Door Ajar RR Ajar Circuit Failure	SJB	REFER to Section 417-02 .
B1342	ECU is Faulted	4X4 control module	REFER to Section 308-07A .
B1342	ECU is Faulted	ABS module	REFER to Section 206-09 .
B1342	ECU is Faulted	ACM	REFER to Section 415-00 .
B1342	ECU is Faulted	DSM	REFER to Driver Seat Module (DSM) in this section.
B1342	ECU is Faulted	HVAC module	REFER to Section 501-11 .
B1342	ECU is Faulted	IC	REFER to Section 413-01 .
B1342	ECU is Faulted	OCSM	REFER to Section 501-20B .
B1342	ECU is Faulted	PAM	REFER to Section 413-13 .
B1342	ECU is Faulted	PCM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTCs. REPEAT the self-test.
B1342	ECU is Faulted	PRB module	REFER to Section 501-08 .
B1342	ECU is Faulted	RCM	REFER to Section 501-20B .
B1342	ECU is Faulted	RETM	REFER to Section 415-00 .
B1342	ECU is Faulted	SDARS module	REFER to Section 415-00 .

B1342	ECU is Faulted	SJB	REFER to Smart Junction Box (SJB) in this section.
B1345	Heated Backlite Input/Circuit Short to Ground	SJB	REFER to Section 501-11 .
B1347	Heated Backlite Relay Circuit Failure	SJB	REFER to Section 501-11 .
B1349	Heated Backlite Relay Circuit Failure	SJB	REFER to Section 501-11 .
B1359	Ignition Run/Acc Circuit Failure	SJB	REFER to Section 211-05 .
B1363	Ignition Start Circuit Failure	SJB	REFER to Section 211-05 .
B1374	Illuminated Entry Relay Short to Ground	SJB	REFER to Section 417-02 .
B1396	Power Door Lock Circuit Short to Battery	SJB	REFER to Section 501-14 .
B1397	Power Door Unlock Circuit Short to Battery	SJB	REFER to Section 501-14 .
B1472	Lamp Headlamp Input Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1483	Brake Pedal Input Circuit Failure	ABS module	REFER to Section 206-09 .
B1499	Lamp Turn Signal Left Circuit Failure	SJB	REFER to Section 417-01 .
B1502	Lamp Turn Signal Left Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1503	Lamp Turn Signal Right Circuit Failure	SJB	REFER to Section 417-01 .
B1506	Lamp Turn Signal Right Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1510	Flash-To-Pass Switch Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1530	Memory Set Switch Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1534	Memory 1 Switch Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1538	Memory 2 Switch Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1555	Ignition Run/Start Circuit Failure	4X4 control module	REFER to Section 308-07A .
B1555	Ignition Run/Start Circuit Failure	SJB	REFER to Section 211-05 .
B1570	Lamp Headlamp High-Beam Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1571	Door Ajar LR Circuit Failure	SJB	REFER to Section 417-02 .
B1578	Lamp Park Input Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1600	PATS Ignition Key Transponder Signal is Not Received	IC	REFER to Section 419-01 .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	IC	REFER to Section 419-01 .
B1602		IC	REFER to Section 419-01 .

	PATS Received Invalid Format Of Key-Code From Ignition Key Transponder		
B1663	Seat Driver Front Up/Down Motor Stalled	DSM	REFER to Section 501-10 .
B1664	Seat Driver Rear Up/Down Motor Stalled	DSM	REFER to Section 501-10 .
B1665	Seat Driver Forward/Backward Motor Stalled	DSM	REFER to Section 501-10 .
B1666	Seat Driver Recline Motor Stalled	DSM	REFER to Section 501-10 .
B1676	Battery Pack Voltage Out of Range	ABS module	REFER to Section 206-09 .
B1676	Battery Pack Voltage Out of Range	HVAC module	REFER to Section 412-00 .
B1681	PATS Transceiver Module Signal is not Received	IC	REFER to Section 419-01 .
B1687	Lamp Dome Input Circuit Short to Battery	SJB	REFER to Section 417-02 .
B1688	Lamp Dome Input Circuit Short to Ground	SJB	REFER to Section 417-02 .
B1696	Autolamp On Circuit Short-to-ground	SJB	REFER to Section 417-01 .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1791	Autolamp Sensor Input Circuit Open	SJB	REFER to Section 417-01 .
B1793	Autolamp Sensor Input Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1795	Lamp Headlamp Low Beam Circuit Open	SJB	REFER to Section 417-01 .
B1797	Lamp Headlamp Low Beam Circuit Short to Ground	SJB	REFER to Section 417-01 .
B1868	Lamp Air Bag Warning Indicator Circuit Failure	IC	REFER to Section 413-01 .

B1884	PAD Warning Lamp Circuit Failure	RCM	REFER to Section 501-20B .
B1890	PAD Warning Lamp Circuit Short to Battery	RCM	REFER to Section 501-20B .
B1915	Air Bag Driver Circuit Failure	IC	REFER to Section 413-01 .
B1952	Seat Rear Up/Down Feedback Position Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1953	Seat Rear Up/Down Feedback Position Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1957	Seat Front Up/Down Position Feedback Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1960	Seat Recline Forward/Backward Feedback Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1961	Seat Recline Forward/Backward Feedback Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	DSM	REFER to Section 501-10 .
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	DSM	REFER to Section 501-10 .
B1982	Driver's Door Unlock Relay Coil Circuit Failure	SJB	REFER to Section 501-14 .
B1983	Driver's Door Unlock Relay Coil Circuit Short to Battery	SJB	REFER to Section 501-14 .
B1A01:01	Speaker #1: General Electrical Failure	ACM	REFER to Section 415-00 .
B1A02:01	Speaker #2: General Electrical Failure	ACM	REFER to Section 415-00 .
B1A03:01	Speaker #3: General Electrical Failure	ACM	REFER to Section 415-00 .
B1A04:01	Speaker #4: General Electrical Failure	ACM	REFER to Section 415-00 .
B1A05:01	Speaker #5: General Electrical Failure	ACM	REFER to Section 415-00 .
B1A56:21	Antenna: Signal Amplitude	ACM	REFER to Section 415-00 .
B1A89:01	Satellite Antenna: General Electrical Failure	ACM	REFER to Section 415-00 .
B1A89:13	Satellite Antenna: Circuit Open	ACM	REFER to Section 415-00 .
B1D19:49	Compact Disc Unit: Internal Electronic Failure	ACM	REFER to Section 415-00 .
B1D19:4B	Compact Disc Unit: Over Temperature	ACM	REFER to Section 415-00 .
B1D78:13	Auxiliary Input: Circuit Open	ACM	REFER to Section 415-00 .
B1D79:01	Microphone Input: General Electrical Failure	ACM	REFER to Section 415-00 .

B1D79:01	Microphone Input: General Electrical Failure	APIM	REFER to Section 415-00 .
B2008	Wipers on Signal Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2026	Incandescent Backlighting Output Circuit Failure	SJB	REFER to Section 413-00 .
B2027	LED Backlighting Output Circuit Failure	SJB	REFER to Section 413-00 .
B2030	Front Fog Lamps Relay Coil Circuit Failure	SJB	REFER to Section 417-01 .
B2048	Left Rear Turn Lamp Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2049	Left Rear Turn Lamp Circuit Open	SJB	REFER to Section 417-01 .
B2050	Right Rear Turn Lamp Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2051	Right Rear Turn Lamp Circuit Open	SJB	REFER to Section 417-01 .
B2070	Trailer Tow Relay Coil(s) Circuit Failure	SJB	REFER to Section 417-01 .
B2071	Hazard Switch/Circuit Short to Ground	SJB	REFER to Section 417-01 .
B2077	Lift Gate Ajar Switch/Circuit Failure	SJB	REFER to Section 417-02 .
B2084	Memory SET Indicator Short to Ground	DSM	REFER to Section 501-10 .
B2089	Puddle/Approach Lamp Fault	SJB	REFER to Section 417-02 .
B2097	Compass Module Failure	IC	REFER to Section 413-01 .
B2103	Antenna Not Connected	ACM	REFER to Section 415-00 .
B2103	Antenna Not Connected	IC	REFER to Section 419-01 .
B2121	Illumination Switch Short to Battery	SJB	REFER to Section 413-00 .
B2132	Dimmer Switch Circuit Short to Ground	SJB	REFER to Section 413-00 .
B2139	Data Mismatch (Receive Data Does Not Match What Was Expected)	PRB module	REFER to Section 501-08 .
B2141	NVM Configuration Failure	IC	REFER to Section 419-01 .
B2141	NVM Configuration Failure	SJB	REFER to Smart Junction Box (SJB) in this section.
B2143	NVM Memory Failure	DSM	REFER to Driver Seat Module (DSM) in this section.
B2143	NVM Memory Failure	IC	REFER to Section 413-01 .
B2250	All Door's Unlock Relay Circuit Failure	SJB	REFER to Section 501-14 .
B2254	Front Fog Lamp Switch Failure	SJB	REFER to Section 417-01 .
B2266	Left Side Blend Door Circuit Failure	HVAC module	REFER to Section 412-00 .
B2267		HVAC module	REFER to Section 412-00 .

	Right Side Blend Door Circuit Failure		
B2276	Less Than 2 Transmitters Programmed	SJB	REFER to Section 501-14 .
B2281	Right Turn Switch Short to Ground	SJB	REFER to Section 417-01 .
B2282	Left Turn Switch Short to Ground	SJB	REFER to Section 417-01 .
B2290	Occupant Classification System Fault	OCSM	REFER to Section 501-20B .
B2290	Occupant Classification System Fault	RCM	REFER to Section 501-20B .
B2292	Restraint System - Seatbelt Pretensioner Fault	RCM	REFER to Section 501-20B .
B2293	Restraint System - Airbag Fault	RCM	REFER to Section 501-20B .
B2294	Restraint System - Curtain Fault	RCM	REFER to Section 501-20B .
B2295	Restraint System - Side Airbag Fault	RCM	REFER to Section 501-20B .
B2296	Restraint System - Impact Sensor Fault	RCM	REFER to Section 501-20B .
B229A	Occupant Classification Sensor Contamination	OCSM	REFER to Section 501-20B .
B229B	Occupant Classification System Obstruction	OCSM	REFER to Section 501-20B .
B2382	Backup Light Relay Circuit Open	SJB	REFER to Section 417-01 .
B2404	Audio Steering Wheel Switch Circuit Fault	ACM	REFER to Section 415-00 .
B2405	Audio Disc CD Player Thermal Shutdown Fault	ACM	REFER to Section 415-00 .
B2406	Audio Disc CD Player Internal Fault	ACM	REFER to Section 415-00 .
B2407	Backup Light Relay Circuit High	SJB	REFER to Section 417-01 .
B2425	Remote Keyless Entry Out of Synchronization	SJB	REFER to Section 501-14 .
B2431	Transponder Programming Failed	IC	REFER to Section 419-01 .
B2434	Driver Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2435	Driver Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Section 501-20B .
B2438	Passenger Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2439	Passenger Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Section 501-20B .
B2477	Module Configuration Failure	ABS module	REFER to Section 418-01 .
B2477	Module Configuration Failure	ACM	REFER to Section 418-01 .
B2477	Module Configuration Failure	DSM	REFER to Section 418-01 .
B2477	Module Configuration Failure	HVAC module	REFER to Section 418-01 .
B2477	Module Configuration Failure	IC	REFER to Section 418-01 .

B2477	Module Configuration Failure	OCSM	REFER to Section 501-20B .
B2477	Module Configuration Failure	PAM	REFER to Section 418-01 .
B2477	Module Configuration Failure	RCM	REFER to Section 418-01 .
B2477	Module Configuration Failure	RETM	REFER to Section 418-01 .
B2477	Module Configuration Failure	SDARS module	REFER to Section 418-01 .
B2477	Module Configuration Failure	SJB	REFER to Section 418-01 .
B2501	LF Lamp Low Beam Circuit Failure	SJB	REFER to Section 417-01 .
B2503	RF Lamp Low Beam Circuit Failure	SJB	REFER to Section 417-01 .
B2505	LF Lamp High Beam Circuit Failure	SJB	VERIFY the bulbs meet OEM specifications. REFER to Section 417-01 .
B2507	RF Lamp High Beam Circuit Failure	SJB	VERIFY the bulbs meet OEM specifications. REFER to Section 417-01 .
B2512	Front Fog Lamps Relay Coil Circuit Short to Battery	SJB	REFER to Section 417-01 .
B2574	Driver's Door LOCK Switch Short to Ground	SJB	REFER to Section 501-14 .
B2575	Driver's Door UNLOCK Switch Short to Ground	SJB	REFER to Section 501-14 .
B2607	Harness/Configuration Mismatch	RCM	REFER to Section 501-20B .
B2656	DVD (Digital Versatile Disk) Error	RETM	REFER to Section 415-00 .
B2667	Liftglass Release Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2670	Liftglass Release Relay Coil Short to Vbatt	SJB	REFER to Section 501-14 .
B2671	Liftglass Release Relay Coil Circuit Failure	SJB	REFER to Section 501-14 .
B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver Seat	RCM	REFER to Section 501-20B .
B2692	Front Passenger Seat Belt Buckle Switch Circuit Fault	RCM	REFER to Section 501-20B .
B2695	Keypad_A Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2696	Keypad_B Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2697	Keypad_C Switch Circuit Failure	SJB	REFER to Section 501-14 .
B2741	Sensor Cluster Defective	ABS module	REFER to Section 206-09 .
B2792	Cross Link Between Firing Loops	RCM	REFER to Section 501-20B .
B2794	Third Row Power Fold Circuit Failure	SJB	VERIFY the module is configured on for this option. REFER to Section 501-10 .
B2813	LH Power Running Board Stow Time Fail	PRB module	REFER to Section 501-08 .
B2814	LH Power Running Board Deploy Time Fail	PRB module	REFER to Section 501-08 .

B2816	RH Power Running Board Stow Time Fail	PRB module	REFER to Section 501-08 .
B2817	RH Power Running Board Deploy Time Fail	PRB module	REFER to Section 501-08 .
B2868	Left Front Tire Pressure Sensor Fault	SJB	CARRY OUT the TPMS sensor training in order to clear the DTC. REFER to Section 204-04 .
B2869	Right Front Tire Pressure Sensor Fault	SJB	CARRY OUT the TPMS sensor training in order to clear the DTC. REFER to Section 204-04 .
B2870	Right Rear Tire Pressure Sensor Fault	SJB	CARRY OUT the TPMS sensor training in order to clear the DTC. REFER to Section 204-04 .
B2871	Left Rear Tire Pressure Sensor Fault	SJB	CARRY OUT the TPMS sensor training in order to clear the DTC. REFER to Section 204-04 .
B2872	Tire Pressure Sensor Fault	SJB	Replacement of the SJB will not resolve this concern. REFER to Section 204-04 .
B287A	Tire Pressure System Fault	SJB	REFER to Section 204-04 .
B2900	VIN Mismatch	ABS module	REFER to Section 418-01 .
B2924	Audio Button Stuck	ACM	REFER to Section 415-00 .
B2924	Audio Button Stuck	RETM	REFER to Section 415-00 .
B2965	Audio System Speaker Circuit Fault	ACM	REFER to Section 415-00 .
B2984	Deployable Steering Column Circuit Open	RCM	REFER to Section 501-20B .
B2985	Deployable Steering Column Circuit Short to Battery	RCM	REFER to Section 501-20B .
B2986	Deployable Steering Column Circuit Short to Ground	RCM	REFER to Section 501-20B .
B2987	Deployable Steering Column Circuit Resistance Low on Squib	RCM	REFER to Section 501-20B .
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS module	REFER to Section 206-09 .
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS module	REFER to Section 206-09 .
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS module	REFER to Section 206-09 .
C1165	Speed Wheel Sensor RR Input Circuit Failure	ABS module	REFER to Section 206-09 .
C1175	Speed Wheel Sensor LR Input Circuit Failure	ABS module	REFER to Section 206-09 .
C1233	Speed Wheel LF Input Signal Missing	ABS module	REFER to Section 206-09 .
C1234	Speed Wheel RF Input Signal Missing	ABS module	REFER to Section 206-09 .
C1235	Speed Wheel RR Input Signal Missing	ABS module	REFER to Section 206-09 .

C1236	Speed Wheel LR Input Signal Missing	ABS module	REFER to Section 206-09 .
C1277	Steering Wheel Angle 1 and 2 Circuit Failure	ABS module	REFER to Section 206-09 .
C1278	Steering Wheel Angle 1 and 2 Signal Faulted	ABS module	REFER to Section 206-09 .
C1279	Yaw Rate Sensor Circuit Failure	ABS module	REFER to Section 206-09 .
C1280	Yaw Rate Sensor Signal Fault	ABS module	REFER to Section 206-09 .
C1281	Lateral Accelerometer Circuit Failure	ABS module	REFER to Section 206-09 .
C1282	Lateral Accelerometer Signal Fault	ABS module	REFER to Section 206-09 .
C1285	Booster Solenoid Circuit Failure	ABS module	REFER to Section 206-09 .
C1287	Booster Pedal Force Switch Circuit Failure	ABS module	REFER to Section 206-09 .
C1288	Pressure Transducer Main/Primary Input Circuit Failure	ABS module	REFER to Section 206-09 .
C1414	Incorrect Module Design Level	RCM	REFER to Section 501-20B .
C1440	Pressure Transducer Main/Primary Signal Faulted	ABS module	REFER to Section 206-09 .
C1446	Brake Switch Circuit Failure	SJB	REFER to Section 417-01 .
C1470	TCS Function Temporarily Disabled (Thermal Brake Protection)	ABS module	REFER to Section 206-09 .
C1516	Roll Rate Sensor Signal Fault	ABS module	REFER to Section 206-09 .
C1517	Roll Rate Sensor Circuit Failure	ABS module	REFER to Section 206-09 .
C1699	Left Rear Sensor Circuit Short to Vbat	PAM	REFER to Section 413-13 .
C1700	Left Rear Sensor Circuit Failure or Blockage	PAM	REFER to Section 413-13 .
C1701	Left Rear Sensor Circuit Fault	PAM	REFER to Section 413-13 .
C1702	Right Rear Sensor Circuit Short to Vbat	PAM	REFER to Section 413-13 .
C1703	Right Rear Sensor Circuit Failure or Blockage	PAM	REFER to Section 413-13 .
C1704	Right Rear Sensor Circuit Fault	PAM	REFER to Section 413-13 .
C1705	Left Rear Center Sensor Circuit Short to Vbat	PAM	REFER to Section 413-13 .
C1706	Left Rear Center Sensor Circuit Failure	PAM	REFER to Section 413-13 .
C1707	Left Rear Center Sensor Circuit Fault	PAM	REFER to Section 413-13 .
C1708	Right Rear Center Sensor Circuit Short to Vbat	PAM	REFER to Section 413-13 .
C1709	Right Rear Center Sensor Circuit Failure	PAM	REFER to Section 413-13 .
C1710	Right Rear Center Sensor Circuit Fault	PAM	REFER to Section 413-13 .

C1729	Transfer Case Unable to Transition Between 4H and 4L	4X4 control module	REFER to Section 308-07A .
C1742	Rear Sounder Circuit Failure	PAM	REFER to Section 413-13 .
C1743	Rear Sounder Circuit Short to Vbatt	PAM	REFER to Section 413-13 .
C1788	Stoplamp Relay Output Circuit Short to Ground	SJB	REFER to Section 417-01 .
C1805	Mismatched PCM and/or ABS-TC Module	ABS module	REFER to Section 206-09 .
C1941	Zero Seat Weight Test Failure	OCSM	REFER to Section 501-20B .
C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	REFER to Section 501-20B .
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	REFER to Section 501-20B .
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	REFER to Section 501-20B .
C1961	Park Lamp Relay Coil Circuit Failure	SJB	REFER to Section 417-01 .
C1963	Stability Control Inhibit Warning	ABS module	REFER to Section 206-09 .
C1970	4x4 Low Mode Switch LED Short to Battery	4X4 control module	REFER to Section 308-07A .
C1971	4x4 Low Mode Switch LED Circuit Failure	4X4 control module	REFER to Section 308-07A .
C1981	Front Driver's Seat Track Position Switch Circuit Fault	RCM	REFER to Section 501-20B .
C1991	Module Calibration Failure	ABS module	REFER to Section 206-09 .
C1996	Active Yaw and Roll Stability Control Disabled	ABS module	REFER to Section 206-09 .
C2769	Longitudinal Acceleration Sensor Electrical Failure	ABS module	REFER to Section 206-09 .
C2770	Longitudinal Acceleration Sensor Plausibility Failure	ABS module	REFER to Section 206-09 .
C2777	Sensor Cluster BUS Failure	ABS module	REFER to Section 206-09 .
C2778	Sensor Power Supply Failure	ABS module	REFER to Section 206-09 .
C2780	ECU in Manufacturer Sub-State	SJB	CARRY OUT the TPMS sensor training in order to clear the DTC. REFER to Section 204-04 .
P0218	Transmission Fluid Over Temperature Condition	Transmission Control Module (TCM)	REFER to Section 307-01B .
P0512	Starter Request Circuit	PCM	REFER to Section 303-06 .
P0562	System Voltage Low	TCM	REFER to Section 307-01B .
P0563	System Voltage High	TCM	REFER to Section 307-01B .
P0605	Powertrain Control Module EEPROM Error	TCM	REFER to Section 307-01B .
P0613	Transmission Control Module Processor	TCM	REFER to Section 307-01B .

P0620	Generator Control Circuit	PCM	REFER to Section 414-00 .
P062F	Powertrain Control Module EEPROM Error	TCM	REFER to Section 307-01B , Mechatronic Assembly.
P0634	PCM/ ECM / TCM Internal Temperature Too High	TCM	REFER to Section 307-01B .
P0641	Sensor Reference Voltage A Circuit/Open	TCM	REFER to Section 307-01B .
P0657	Actuator Supply Voltage A Circuit/Open	TCM	REFER to Section 307-01B .
P0658	Actuator Supply Voltage A Circuit Low	TCM	REFER to Section 307-01B .
P0659	Actuator Supply Voltage A Circuit High	TCM	REFER to Section 307-01B .
P0667	PCM/ ECM / TCM Internal Temperature Sensor Range/Performance	TCM	REFER to Section 307-01B .
P0701	Transmission Control System Range/Performance	TCM	REFER to Section 307-01B .
P0705	Transmission Range Sensor A Circuit (PRNDL Input)	PCM	REFER to Section 307-01A .
P0705	Transmission Range Sensor A Circuit (PRNDL Input)	TCM	REFER to Section 307-01B .
P0708	Transmission Range Sensor A Circuit High	PCM	REFER to Section 307-01A .
P0711	Transmission Fluid Temperature Sensor A Circuit Range/Performance	PCM	REFER to Section 307-01A .
P0711	Transmission Fluid Temperature Sensor A Circuit Range/Performance	TCM	REFER to Section 307-01B .
P0712	Transmission Fluid Temperature Sensor A Circuit Low	PCM	REFER to Section 307-01A .
P0712	Transmission Fluid Temperature Sensor A Circuit Low	TCM	REFER to Section 307-01B .
P0713	Transmission Fluid Temperature Sensor A Circuit High	PCM	REFER to Section 307-01A .
P0713	Transmission Fluid Temperature Sensor A Circuit High	TCM	REFER to Section 307-01B .
P0714	Transmission Fluid Temperature Sensor A Circuit Intermittent	TCM	REFER to Section 307-01B .
P0715	Turbine/Input Shaft Speed Sensor A Circuit	PCM	REFER to Section 307-01A .
P0715	Turbine/Input Shaft Speed Sensor A Circuit	TCM	REFER to Section 307-01B .
P0716	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance	TCM	REFER to Section 307-01B .
P0717	Turbine/Input Shaft Speed Sensor A Circuit No Signal	PCM	REFER to Section 307-01A .
P0717		TCM	REFER to Section 307-01B .

	Turbine/Input Shaft Speed Sensor A Circuit No Signal		
P0718	Turbine/Input Shaft Speed Sensor A Circuit Intermittent	PCM	REFER to Section 307-01A .
P0720	Output Shaft Speed Sensor Circuit	PCM	REFER to Section 307-01A .
P0720	Output Shaft Speed Sensor Circuit	TCM	REFER to Section 307-01B .
P0721	Output Shaft Speed Sensor Circuit Range/Performance	PCM	REFER to Section 307-01A .
P0721	Output Shaft Speed Sensor Circuit Range/Performance	TCM	REFER to Section 307-01A .
P0722	Output Shaft Speed Sensor Circuit No Signal	PCM	REFER to Section 307-01A .
P0722	Output Shaft Speed Sensor Circuit No Signal	TCM	REFER to Section 307-01B .
P0723	OSS Signal Intermittent	TCM	REFER to Section 307-01B .
P0729	Gear 6 Incorrect Ratio	TCM	REFER to Section 307-01B .
P0731	Gear 1 Incorrect Ratio	PCM	REFER to Section 307-01A .
P0731	Gear 1 Incorrect Ratio	TCM	REFER to Section 307-01B .
P0732	Gear 2 Incorrect Ratio	PCM	REFER to Section 307-01A .
P0732	Gear 2 Incorrect Ratio	TCM	REFER to Section 307-01B .
P0733	Gear 3 Incorrect Ratio	PCM	REFER to Section 307-01A .
P0733	Gear 3 Incorrect Ratio	TCM	REFER to Section 307-01B .
P0734	Gear 4 Incorrect Ratio	PCM	REFER to Section 307-01A .
P0734	Gear 4 Incorrect Ratio	TCM	REFER to Section 307-01B .
P0735	Gear 5 Incorrect Ratio	PCM	REFER to Section 307-01A .
P0735	Gear 5 Incorrect Ratio	TCM	REFER to Section 307-01B .
P0736	Reverse Incorrect Ratio	TCM	REFER to Section 307-01B .
P0740	Torque Converter Clutch Solenoid Circuit/Open	PCM	REFER to Section 307-01A .
P0740	Torque Converter Clutch Solenoid Circuit/Open	TCM	REFER to Section 307-01B .
P0741	Torque Converter Clutch Solenoid Circuit Performance Or Stuck Off	PCM	REFER to Section 307-01A .
P0741	Torque Converter Clutch Solenoid Circuit Performance Or Stuck Off	TCM	REFER to Section 307-01B .
P0743	Torque Converter Clutch Solenoid Circuit Electrical	PCM	REFER to Section 307-01A .
P0745	Pressure Control Solenoid A	PCM	REFER to Section 307-01A .
P0748	Pressure Control Solenoid A Electrical	PCM	REFER to Section 307-01A .
P0750	Shift Solenoid A	PCM	REFER to Section 307-01A .
P0753	Shift Solenoid A Electrical	PCM	REFER to Section 307-01A .
P0755	Shift Solenoid B	PCM	REFER to Section 307-01A .
P0758	Shift Solenoid B Electrical	PCM	REFER to Section 307-01A .
P0760	Shift Solenoid C	PCM	REFER to Section 307-01A .
P0763	Shift Solenoid C Electrical	PCM	REFER to Section 307-01A .

P0765	Shift Solenoid D	PCM	REFER to Section 307-01A .
P0768	Shift Solenoid D Electrical	PCM	REFER to Section 307-01A .
P0770	Shift Solenoid E	TCM	REFER to Section 307-01B .
P0775	Pressure Control Solenoid B	PCM	REFER to Section 307-01A .
P0778	Pressure Control Solenoid B Electrical	PCM	REFER to Section 307-01A .
P0781	1-2 Shift	TCM	REFER to Section 307-01B .
P0782	2-3 Shift	TCM	REFER to Section 307-01B .
P0783	3-4 Shift	TCM	REFER to Section 307-01B .
P0784	4-5 Shift	TCM	REFER to Section 307-01B .
P0791	Intermediate Shaft Speed Sensor A Circuit	PCM	REFER to Section 307-01A .
P0794	Intermediate Shaft Speed Sensor A Circuit Intermittent	PCM	REFER to Section 307-01A .
P0795	Pressure Control Solenoid C	PCM	REFER to Section 307-01A .
P0798	Pressure Control Solenoid C Electrical	PCM	REFER to Section 307-01A .
P0829	5-6 Shift	TCM	REFER to Section 307-01B .
P0960	Pressure Control Solenoid A Control Circuit / Open	PCM	REFER to Section 307-01A .
P0960	Pressure Control Solenoid A Control Circuit / Open	TCM	REFER to Section 307-01B .
P0962	Pressure Control Solenoid A Control Circuit Low	PCM	REFER to Section 307-01A .
P0963	Pressure Control Solenoid A Control Circuit High	PCM	REFER to Section 307-01A .
P0963	Pressure Control Solenoid A Control Circuit High	TCM	REFER to Section 307-01B .
P0964	Pressure Control Solenoid B Control Circuit / Open	PCM	REFER to Section 307-01A .
P0966	Pressure Control Solenoid B Control Circuit Low	PCM	REFER to Section 307-01A .
P0967	Pressure Control Solenoid B Control Circuit High	PCM	REFER to Section 307-01A .
P0968	Pressure Control Solenoid C Control Circuit / Open	PCM	REFER to Section 307-01A .
P0970	Pressure Control Solenoid C Control Circuit Low	PCM	REFER to Section 307-01A .
P0971	Pressure Control Solenoid C Control Circuit High	PCM	REFER to Section 307-01A .
P0972	Shift Solenoid A Control Circuit Range/Performance	TCM	REFER to Section 307-01B .
P0973	Shift Solenoid A Control Circuit Low	TCM	REFER to Section 307-01B .
P0974	Shift Solenoid A Control Circuit High	TCM	REFER to Section 307-01B .
P0975	Shift Solenoid B Control Circuit	TCM	REFER to Section 307-01B .

	Range/Performance		
P0976	Shift Solenoid B Control Circuit Low	TCM	REFER to Section 307-01B .
P0977	Shift Solenoid B Control Circuit High	TCM	REFER to Section 307-01B .
P0978	Shift Solenoid C Control Circuit Range/Performance	TCM	REFER to Section 307-01B .
P0979	Shift Solenoid C Control Circuit Low	TCM	REFER to Section 307-01B .
P0980	Shift Solenoid C Control Circuit High	TCM	REFER to Section 307-01B .
P0981	Shift Solenoid D Control Circuit Range/Performance	TCM	REFER to Section 307-01B .
P0982	Shift Solenoid D Control Circuit Low	TCM	REFER to Section 307-01B .
P0983	Shift Solenoid D Control Circuit High	TCM	REFER to Section 307-01B .
P0985	Shift Solenoid E Control Circuit Low	TCM	REFER to Section 307-01B .
P0986	Shift Solenoid E Control Circuit High	TCM	REFER to Section 307-01B .
P1116	ECT Sensor Out Of OBD Range	PCM	REFER to Section 307-01A .
P1124	TP Sensor Voltage High/Low For OBD Test	PCM	REFER to Section 307-01A .
P1260	Theft Detected, Vehicle Immobilized	PCM	REFER to Section 419-01 .
P1460	A/C Clutch Cycling Pressure Switch Error	PCM	REFER to Section 307-01A .
P1501	Vehicle Speed Sensor Out Of Self Test Range	PCM	REFER to Section 307-01A .
P1572	BPP Switch Circuit Failed	PCM	REFER to Section 307-01A .
P1636	Inductive Signature Chip Communication Error	PCM	REFER to Section 307-01A .
P1700	Transmission Indeterminate Failure (Failed to Neutral)	PCM	REFER to Section 307-01A .
P1702	Transmission Range Sensor Circuit Intermittent	PCM	REFER to Section 307-01A .
P1703	BPP Switch Circuit Failed	PCM	REFER to Section 307-01A .
P1704	Transmission Range Circuit Not Indicating Park/Neutral During Self Test	PCM	REFER to Section 307-01A .
P1705	Transmission Range Circuit Not Indicating Park/Neutral During Self Test	PCM	REFER to Section 307-01A .
P1707	Transfer Case Neutral or Park/Neutral Indication Circuit	4X4 control module	REFER to Section 308-07A .
P1707	Transfer Case Neutral or Park/Neutral Indication Circuit	TCM	REFER to Section 307-01B .

P1711	Transmission Fluid Temperature Sensor Out Of Self Test Range	PCM	REFER to Section 307-01A .
P1714	Shift Solenoid A Inductive Signature	PCM	REFER to Section 307-01A .
P1715	Shift Solenoid B Inductive Signature	PCM	REFER to Section 307-01A .
P1716	Shift Solenoid C Inductive Signature	PCM	REFER to Section 307-01A .
P1717	Shift Solenoid D Inductive Signature	PCM	REFER to Section 307-01A .
P1740	Torque Converter Clutch Solenoid Inductive Signature	PCM	REFER to Section 307-01A .
P1780	Transmission Control Switch (O/D Cancel) Circuit Out Of Self Test Range	PCM	REFER to Section 307-01A .
P1783	Transmission Overtemperature Condition	PCM	REFER to Section 307-01A .
P1812	4-Wheel Drive Mode Select Circuit Failure	4X4 control module	REFER to Section 308-07A .
P1815	4-Wheel Drive Mode Select Switch Circuit Short to Ground	4X4 control module	REFER to Section 308-07A .
P1816	Transmission Neutral Safety Switch Circuit Failure	4X4 control module	REFER to Section 308-07A .
P1819	Transmission Neutral Safety Switch Circuit Short to Ground	4X4 control module	REFER to Section 308-07A .
P1824	4-Wheel Drive Clutch Relay Circuit Failure	4X4 control module	REFER to Section 308-07A .
P1825	4-Wheel Drive Clutch Relay Open Circuit	4X4 control module	REFER to Section 308-07A .
P1826	4-Wheel Drive Low Clutch Relay Short to Battery	4X4 control module	REFER to Section 308-07A .
P1827	4-Wheel Drive Low Clutch Relay Short to Ground	4X4 control module	REFER to Section 308-07A .
P1849	Transfer Case Contact Plate 'A' Short Circuit to Ground	4X4 control module	REFER to Section 308-07A .
P1853	Transfer Case Contact Plate 'B' Short Circuit to Ground	4X4 control module	REFER to Section 308-07A .
P1857	Transfer Case Contact Plate 'C' Short Circuit to Ground	4X4 control module	REFER to Section 308-07A .
P1861	Transfer Case Contact Plate 'D' Short Circuit to Ground	4X4 control module	REFER to Section 308-07A .
P1867	Transfer Case Contact Plate General Circuit Failure	4X4 control module	REFER to Section 308-07A .
P1891	Transfer Case Contact Plate Ground Return Open Circuit	4X4 control module	REFER to Section 308-07A .
P1910	Reverse Solenoid Circuit Failure	TCM	REFER to Section 307-01B .
P1911	Reverse Solenoid Signal Circuit Shorted To Ground	TCM	REFER to Section 307-01B .

P1912	Reverse Solenoid Circuit Shorted To Power	TCM	REFER to Section 307-01B .
P2763	Torque Converter Clutch Pressure Control Solenoid Control Circuit High	TCM	REFER to Section 307-01B .
P2764	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low	TCM	REFER to Section 307-01B .
PXXXX	All other DTCs	PCM	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
U0073	CAN Communication Bus Fault-Receive Error	TCM	REFER to Section 418-00 .
U0100	Lost Communication With ECM /PCM	TCM	REFER to Section 307-01B .
U0100:00	Lost Communication With ECM /PCM: No Sub Type Information	APIM	REFER to Section 415-00 .
U0102	Lost Communication with Transfer Case Control Module (4x4CM)	TCM	REFER to Section 418-00 .
U0121	Lost Communication With ABS Control Module	TCM	REFER to Section 418-00 .
U0140	Lost Communication With Body Control Module (GEM)	ACM	REFER to Section 415-00 .
U0140	Lost Communication With Body Control Module (GEM)	IC	REFER to Section 413-01 .
U0140	Lost Communication With Body Control Module (GEM)	PAM	REFER to Section 413-13 .
U0140	Lost Communication With Body Control Module (GEM)	RETM	REFER to Section 415-00 .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	ACM	REFER to Section 415-00 .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0155	Lost Communication with Instrument Panel Cluster (IC) Control Module	ACM	REFER to Section 415-00 .
U0155	Lost Communication with Instrument Panel Cluster (IC) Control Module	PAM	REFER to Section 413-13 .
U0155	Lost Communication with Instrument Panel Cluster (IC) Control Module	SJB	REFER to Smart Junction Box (SJB) in this section.
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type	ACM	REFER to Section 415-00 .

	Information		
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0159	Lost Communication With Parking Assist Control Module (PAM)	IC	REFER to Section 413-01 .
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	ACM	REFER to Section 415-00 .
U0164	Lost Communication With HVAC Control Module (EATC)	SJB	REFER to Smart Junction Box (SJB) in this section.
U0184	Lost Communication With Radio (ACM)	RETM	REFER to Section 415-00 .
U0184	Lost Communication With Radio (ACM)	SDARS module	REFER to Section 415-00 .
U0184:00	Lost Communication With Radio: No Sub Type Information	APIM	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	ACM	REFER to Section 415-00 .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	RETM	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	ACM	REFER to Section 415-00 .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	SDARS module	REFER to Section 415-00 .
U0196:00	Lost Communication With Entertainment Control Module-Rear "A": No Sub Type Information	ACM	REFER to Section 415-00 .
U0196:00	Lost Communication With Entertainment Control Module-Rear "A": No Sub Type Information	APIM	REFER to Section 415-00 .
U0197	Lost Communication With Telephone Control Module	ACM	REFER to Section 415-00 .
U0197	Lost Communication With Telephone Control Module	SDARS module	REFER to Section 415-00 .
U0197:00	Lost Communication With Telephone Control Module: No Sub Type Information	ACM	REFER to Section 415-00 .
U0208	Lost Communication With Seat Control Module (DSM)	IC	REFER to Section 413-01 .
U0244	Lost Communication With Running Board Control Module (PRB)	IC	REFER to Section 413-01 .
U0300	Internal Control Module Software Incompatibility	RCM	REFER to Section 501-20B .

U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0423:00	Invalid Data Received From Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	APIM	REFER to Section 415-00 .
U0485:00	Invalid Data Received From Radio: No Sub Type Information	APIM	REFER to Section 415-00 .
U1900	CAN Communication Bus Fault - Receive Error	4X4 control module	REFER to Section 418-00 .
U1900	CAN Communication Bus Fault - Receive Error	ABS module	REFER to Section 418-00 .
U1900	CAN Communication Bus Fault - Receive Error	DSM	REFER to Section 418-00 .
U1900	CAN Communication Bus Fault - Receive Error	IC	REFER to Section 418-00 .
U1900	CAN Communication Bus Fault - Receive Error	OCSM	REFER to Section 501-20B .
U1900	CAN Communication Bus Fault - Receive Error	PRB module	REFER to Section 418-00 .
U1900	CAN Communication Bus Fault - Receive Error	RCM	REFER to Section 501-20B .
U1901	CAN Network #2 Communication Bus Fault - Receive Error	ABS module	REFER to Section 206-09 .
U2013	Compass Module is Not Responding	IC	REFER to Section 413-01 .
U2013:63	Switch Pack: Circuit / Component Protection Time-Out	ACM	REFER to Section 415-00 .
U2014:09	Control Module Hardware: Component Failure	ACM	REFER to Section 415-00 .
U2014:41	Control Module Hardware: General Checksum Failure	ACM	REFER to Section 415-00 .
U2014:96	Control Module Hardware: Component Internal Failure	ACM	REFER to Section 415-00 .
U201A:51	Control Module Main Calibration Data: Not Programmed	ACM	REFER to Section 415-00 .
U2023	Fault Received From External Node	4X4 control module	REFER to Section 308-07A .
U2023	Fault Received From External Node	ABS module	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2023	Fault Received From External Node	IC	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2023	Fault Received From External Node	PAM	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2050	No Application Present	4X4 control module	REFER to Section 418-01 .

U2050	No Application Present	ABS module	REFER to Section 206-09 .
U2050	No Application Present	ACM	REFER to Section 415-00 .
U2050	No Application Present	DSM	REFER to Section 418-01 .
U2050	No Application Present	HVAC module	REFER to Section 418-01 .
U2050	No Application Present	IC	REFER to Section 418-01 .
U2050	No Application Present	OCSM	REFER to Section 501-20B .
U2050	No Application Present	PAM	REFER to Section 418-01 .
U2050	No Application Present	PRB module	REFER to Section 501-08 .
U2050	No Application Present	RCM	REFER to Section 418-01 .
U2050	No Application Present	RETM	REFER to Section 415-00 .
U2050	No Application Present	SDARS module	REFER to Section 415-00 .
U2050	No Application Present	SJB	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	ACM	REFER to Section 415-00 .
U2051	One or More Calibration Files Missing/Corrupt	IC	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	OCSM	REFER to Section 501-20B .
U2051	One or More Calibration Files Missing/Corrupt	PAM	REFER to Section 418-01 .
U2051	One or More Calibration Files Missing/Corrupt	RCM	REFER to Section 418-01 .
U2100:00	Initial Configuration Not Complete: No Sub Type Information	APIM	REFER to Section 415-00 .
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	ACM	REFER to Section 415-00 .
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	APIM	REFER to Section 415-00 .
U2471	Unexpected PRNDL State	PAM	REFER to Section 413-13 .
U2472	Unexpected Ignition State	PAM	REFER to Section 413-13 .
U2473	Unexpected Vehicle Speed (VSS)	PAM	REFER to Section 413-13 .
U2510	CAN - Invalid Data For Vehicle Security	IC	REFER to Section 419-01 .
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	IC	REFER to Section 419-01 .
U261A	CAN Data / Configuration Setup Mismatch	IC	REFER to Section 419-01 .
U3000:04	Control Module: System Internal Failure	APIM	REFER to Section 415-00 .
U3000:42	Control Module: General Memory Failure	APIM	REFER to Section 415-00 .
U3000:88	Control Module: Bus Off	APIM	REFER to Section 415-00 .
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	ACM	REFER to Section 415-00 .

U3003:16	Battery Voltage: Circuit Voltage Below Threshold	APIM	REFER to Section 415-00 .
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	ACM	REFER to Section 415-00 .
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	APIM	REFER to Section 415-00 .

Smart Junction Box (SJB)

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also known as the Generic Electronic Module (GEM).

The SJB receives inputs and delivers outputs to electronically-controlled features of the vehicle. The SJB constantly monitors the systems under its control and reports a concern in the form of a DTC. The DTC can be retrieved with a scan tool through the Medium Speed Controller Area Network (MS-CAN).

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Battery Junction Box (BJB) fuses: ♦ 1 (50A) ♦ 2 (50A) ♦ 3 (50A) • Smart Junction Box (SJB) fuse 2 (5A) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB .

9. If the DTCs retrieved are related to the concern, refer to Diagnostic Trouble Code (DTC) Chart in this section.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B106E	Module Output Pin Disabled To Protect From External Fault	**NOTE:** External fault must be repaired before this DTC is cleared. GO to Pinpoint Test A .
B106F	Module Disabled Due to External Fault	GO to Pinpoint Test A .
B1317	Battery Voltage High	GO to Pinpoint Test B .
B1318	Battery Voltage Low	GO to Pinpoint Test C .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation.
B2141	NVM Configuration Failure	CONFIGURE the SJB . REFER to Section 418-01 . CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module

		configuration. If DTC B2141 is retrieved again, INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section. REPEAT the self-test.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	GO to Pinpoint Test D .
U0164	Lost Communication With HVAC Control Module (EATC)	Replacement of the SJB will not resolve this concern. CLEAR the DTCs. REPEAT the self-test. If the DTC is retrieved again, GO to Pinpoint Test E .
All other DTCs	-	REFER to Diagnostic Trouble Code (DTC) Chart in this section.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test A: DTC B106E/B106F

Normal Operation

The Smart Junction Box (SJB) controls the output of the Daytime Running Lamps (DRL), fog lamps, one-touch down driver power window, accessory delay relay, windshield wiper park/run, windshield wiper speed, and windshield washer. When a repetitive fault causing a circuit overload is detected on any of the output circuits, the SJB disables the circuit by removing voltage, or ground, to the affected circuit. The circuit remains disabled until the fault is corrected and an on-demand self-test is run. After the on-demand self-test has been run, any DTCs related to the fault will be cleared.

- DTC B106E (Module Output Pin Disabled To Protect From External Fault) - sets when the SJB has temporarily disabled a circuit due to a repetitive fault causing a circuit overload. A corresponding DTC for the circuit in question will also set as follows:
  - DTC B106F (Module Disabled Due to External Fault) - sets when one or more output functions are permanently disabled due to a repetitive circuit overload fault. DTC B106F will be set with DTC B106E. When DTC B106F is present, the SJB must be replaced after the fault condition has been corrected.
  - DTC B1304 (Accessory Delay Relay Coil Circuit Short to Battery) - Accessory delay relay circuit short to battery voltage
  - DTC B2512 (Front Fog Lamp Relay Ckt Short to Battery) - Fog lamp relay circuit short to battery voltage
  - DTC B2973 (Daytime Running Lamp Output Shorted to Ground) - DRL output short to ground

This pinpoint test is intended to diagnose the following:

- Output circuit short to ground or voltage
- SJB

PINPOINT TEST A: DTCs B106E/B106F

NOTICE: **If DTC B106F is present and the Smart Junction Box (SJB) is to be replaced, the fault condition must be corrected first. Failure to correct the fault condition first may cause damage to the new SJB , resulting in a repeat repair.**

Test Step	Result / Action to Take
A1 CHECK FOR DTC B106E	
• Review the DTCs from the SJB self-test. • **Is DTC B106E present?**	**Yes** GO to A2 . **No** GO to A3 .
A2 CHECK FOR OTHER DTCs	
• Review the DTCs from the SJB self-test. • **Are any SJB DTCs present other than DTC B106E?**	**Yes** CORRECT any other DTCs. REFER to the Diagnostic Trouble Code (DTC) Chart in this section. REPEAT the self-test (on-demand DTCs). **No** CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.
A3 CHECK FOR DTC B106F	
• Review the DTCs from the SJB self-test. • **Is DTC B106F present?**	**Yes** CORRECT any other DTCs. REFER to Diagnostic Trouble Code (DTC) Chart in this section. INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern was caused by a fault in one of the output circuits.

Pinpoint Test B: DTC B1317

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) monitors the voltage from the battery to determine if it goes above or below specific thresholds and sets DTC B1317 in continuous memory if the SJB detects high battery voltage above 15 volts on circuit SBB01 (RD).

- DTC B1317 (Battery Voltage High) - a continuous memory DTC that sets when the SJB detects battery voltage above 15 volts on circuit SBB01 (RD).

This pinpoint test is intended to diagnose the following:

- Charging system concern
- SJB

PINPOINT TEST B: DTC B1317

NOTE: DTC B1317 may be stored in the module memory due to previous battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
B1 CHECK FOR DTC B1317, B1676 OR P0563 SET IN OTHER MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: (All Modules) Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC B1317, B1676 or P0563 (PCM) set in more than one module?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to B2 .
B2 CHECK THE BATTERY VOLTAGE	
• Turn off all interior/exterior lights and accessories. • Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage. • **Does the battery voltage rise to 15 volts or higher?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to B3 .
B3 RECHECK FOR DTC B1317	
• Turn the engine off. • Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the continuous memory DTCs. • Carry out the SJB self-test. • **Is DTC B1317 present?**	**Yes** INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation. **No** The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test C: DTC B1318

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The Smart Junction Box (SJB) monitors the voltage from the battery to determine if it goes above or below specific thresholds and sets DTC B1318 in continuous memory if the SJB detects low battery voltage below 10 volts on circuit SBB01 (RD).

- DTC B1318 (Battery Voltage Low) - a continuous memory DTC that sets when the SJB detects battery voltage below 10 volts on circuit SBB01 (RD).

This pinpoint test is intended to diagnose the following:

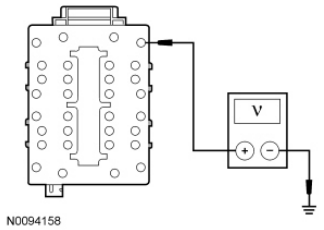
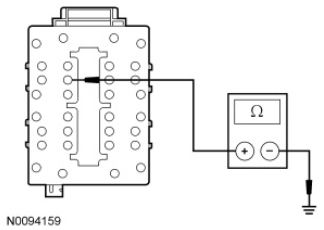
- Wiring, terminals or connectors
- High circuit resistance
- SJB

PINPOINT TEST C: DTC B1318

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

Test Step	Result / Action to Take
C1 RECHECK THE SJB DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: SJB Self-Test. • Clear the DTCs. Repeat the SJB self-test. • **Is DTC B1318 still present?**	**Yes** GO to C2 . **No** The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.
C2 CHECK FOR CHARGING SYSTEM DTCs IN THE PCM	
• Enter the following diagnostic mode on the scan tool: PCM Self-Test. • Retrieve the continuous memory DTCs from the PCM. • **Is DTC P0620, P0625, P0626 or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to C3 .
C3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Ignition OFF. • Check the battery condition and verify the battery is fully charged. Refer to Section 414-01 , Battery Condition Test. • **Is the battery OK and fully charged?**	**Yes** GO to C4 . **No** REFER to Section 414-00 .
C4 CHECK THE SJB VOLTAGE SUPPLY	

• Measure and record the voltage at the battery. • Disconnect: SJB C2280E. • Ignition ON. • Measure the voltage between the SJB C2280E-32, circuit SBB01 (RD), harness side and ground.  • **Is the voltage within 0.2 volt of the recorded battery voltage?**	**Yes** GO to C5 . **No** REPAIR the circuit for high resistance. CLEAR the DTC. REPEAT the self-test.
C5 CHECK THE SJB GROUND CIRCUIT	
• Ignition OFF. • Disconnect: Negative Battery Cable. • Measure the resistance between the SJB C2280E-22, circuit GD108 (BK/VT), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to C6 . **No** REPAIR the circuit for high resistance. CONNECT the negative battery cable. TEST the system for normal operation.
C6 CHECK FOR CORRECT SJB OPERATION	
• Disconnect the SJB connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: DTC U0155

Normal Operation

- DTC U0155 (Lost Communication With Instrument Panel Cluster (IC) Control Module) - set by the SJB whenever it receives invalid data from the Instrument Cluster (IC).

This pinpoint test is intended to diagnose the following:

- Module communication
- SJB
- IC

PINPOINT TEST D: DTC U0155

Test Step	Result / Action to Take
D1 VERIFY CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to D2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
D2 CHECK THE COMMUNICATION NETWORK	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the IC pass the network test?**	**Yes** GO to D3 . **No** REFER to Section 418-00 .
D3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded SJB DTCs from the self-test. • **Is DTC B1317 or B1318 recorded?**	**Yes** For DTC B1317, GO to Pinpoint Test B . For DTC B1318, GO to Pinpoint Test C . **No** GO to D4 .
D4 RECHECK THE SJB DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the SJB self-test. • **Is DTC U0155 still present?**	**Yes** GO to D5 . **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
D5 CHECK FOR DTC U0155 SET IN OTHER MODULES	
• Clear all DTCs.	**Yes** INSTALL a new IC . REFER to

• Ignition OFF. • Ignition ON. • Wait 10 seconds. • Enter the following diagnostic mode on the scan tool: Self-Test. • Retrieve the continuous memory DTCs from all modules. • **Is DTC U0155 set in the ACM , DSM , audio DSP module or PAM ?**	Section 413-01 . **No** INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section.

Pinpoint Test E: DTC U0164

Normal Operation

- DTC U0164 (Lost Communication With HVAC Control Module (EATC)) - set by the Smart Junction Box (SJB) if data messages received from the (module name) over the (network name) are missing for (insert specified time).

This pinpoint test is intended to diagnose the following:

- Module communication
- SJB
- HVAC module

PINPOINT TEST E: DTC U0164

Test Step	Result / Action to Take
E1 VERIFY CUSTOMER CONCERN	
• Ignition ON. • Verify that there is an observable symptom present. • **Is an observable symptom present?**	**Yes** GO to E2 . **No** The system is operating normally at this time. The DTC may have been set due to high network traffic or intermittent fault condition.
E2 CHECK THE COMMUNICATION NETWORK	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: Network Test. • Carry out the network test. • **Does the (insert sending module name) pass the network test?**	**Yes** GO to E3 . **No** REFER to Section 418-00 .
E3 RETRIEVE THE RECORDED DTCs FROM THE SELF-TEST	
• Check for recorded SJB DTCs from the self-test. • **Is DTC B1317 or B1318 recorded?**	**Yes** For DTC B1317, GO to Pinpoint Test B . For DTC B1318, GO to Pinpoint

	Test C . **No** GO to E4 .
E4 RECHECK THE SJB DTCs	
NOTE: If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during Programmable Module Installation (PMI) or the PMI may not have been carried out. • Clear the DTCs. Repeat the SJB self-test. • **Is DTC U0164 still present?**	**Yes** INSTALL a new HVAC module. TEST the system for normal operation. REPEAT the SJB self-test. If DTC U0164 is still present, INSTALL a new SJB . REFER to Smart Junction Box (SJB) in this section. **No** The system is operating correctly at this time. The DTC may have been set due to high network traffic or intermittent fault condition.

Driver Seat Module (DSM)

Special Tool(s)

 ST1137-A	73III Automotive Meter 105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST2574-A	Flex Probe Kit 105-R025C or equivalent

Principles of Operation

The Driver Seat Module (DSM) controls the memory driver seat positions and the memory adjustable pedals. The DSM receives inputs from the memory set switches in order to program the 2 separate, personalized memory positions for the seats and (if equipped) the adjustable pedals. These positions can be recalled by either pressing the memory switches or by unlocking the vehicle with the remote transmitters.

The DSM also receives inputs from the driver seat switch and outputs the requested command to the seats. If the vehicle has memory, the DSM will also receive inputs from the adjustable pedal switch and outputs the requested commands to the adjustable pedal motor. The memory driver seat feature allows the driver to program a personalized seat position that can be recalled using the memory switches or the Remote Keyless Entry (RKE) transmitter. Refer to Section 501-14 for the remote memory activation general procedure.

The DSM is on the Medium Speed Controller Area Network (MS-CAN). The DSM supports inter-module and scan tool communications.

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Battery Junction Box (BJB) fuse 14 (30A)

- Smart Junction Box (SJB) fuse 1 (20A)
- Wiring, terminals or connectors
- Driver Seat Module (DSM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **NOTE:** Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM .

   If the scan tool does not communicate with the VCM :

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM .
   - Refer to Section 418-00 , No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to Section 418-00 to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to Section 418-00 .
   - If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM .

9. If the DTCs retrieved are related to the concern, refer to Diagnostic Trouble Code (DTC) Chart in this section.

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart .

DTC Charts

Driver Seat Module (DSM) DTC Chart

DTC	Description	Action
B1317	Battery Voltage High	GO to Pinpoint Test F .
B1318	Battery Voltage Low	GO to Pinpoint Test G .
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new DSM . REFER to Driver Seat Module (DSM) in this section. TEST the system for normal operation.
B2143		

	NVM Memory Failure	CONFIGURE the DSM . REFER to Section 418-01 . CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC B2143 is retrieved again, INSTALL a new DSM . REFER to Driver Seat Module (DSM) in this section. REPEAT the self-test.
All other DTCs	-	REFER to Diagnostic Trouble Code (DTC) Chart in this section.

Symptom Chart

Symptom Chart

Pinpoint Tests

Pinpoint Test F: DTC B1317

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The Driver Seat Module (DSM) monitors the voltage from the battery to determine if it goes above or below specific thresholds and sets DTC B1317 in continuous memory if the DSM detects high battery voltage above 15 volts on circuit SBB14 (BN/RD).

- DTC B1317 (Battery Voltage High) - a continuous memory DTC that sets when the DSM detects battery voltage above 15 volts on circuit SBB14 (BN/RD).

This pinpoint test is intended to diagnose the following:

- Charging system concern
- DSM

PINPOINT TEST F: DTC B1317

NOTE: DTC B1317 may be stored in the module memory due to previous battery charging or vehicle jump starting events.

Test Step	Result / Action to Take
F1 CHECK FOR DTCs B1317, B1676 OR P0563 SET IN OTHER MODULES	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: (All Modules) Self-Test. • Retrieve the continuous memory DTCs from all modules.	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to F2 .

• **Is DTC B1317, B1676 or P0563 (PCM) set in more than one module?**	
F2 CHECK THE BATTERY VOLTAGE	
• Turn off all interior/exterior lights and accessories. • Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage. • **Does the battery voltage rise to 15 volts or higher?**	**Yes** REFER to Section 414-00 to diagnose an overcharging condition. **No** GO to F3 .
F3 RECHECK FOR DTC B1317	
• Turn the engine off. • Ignition ON. • Enter the following diagnostic mode on the scan tool: DSM Self-Test. • Clear the continuous memory DTCs. • Carry out the DSM self-test. • **Is DTC B1317 present?**	**Yes** INSTALL a new DSM . REFER to Driver Seat Module (DSM) in this section. TEST the system for normal operation. **No** The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Pinpoint Test G: DTC B1318

Refer to Wiring Diagrams Cell 117 , Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The Driver Seat Module (DSM) monitors the voltage from the battery to determine if it goes above or below specific thresholds and sets DTC B1318 in continuous memory if the DSM detects low battery voltage below 10 volts on circuit SBB14 (BN/RD).

- DTC B1318 (Battery Voltage Low) - a continuous memory DTC that sets when the DSM detects battery voltage below 10 volts on circuit SBB14 (BN/RD).

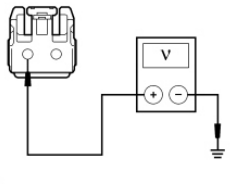
This pinpoint test is intended to diagnose the following:

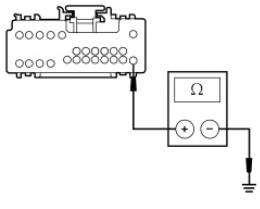
- Wiring, terminals or connectors
- High circuit resistance
- DSM

PINPOINT TEST G: DTC B1318

NOTICE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: Failure to disconnect the battery when instructed will result in false resistance readings. Refer to Section 414-01 .

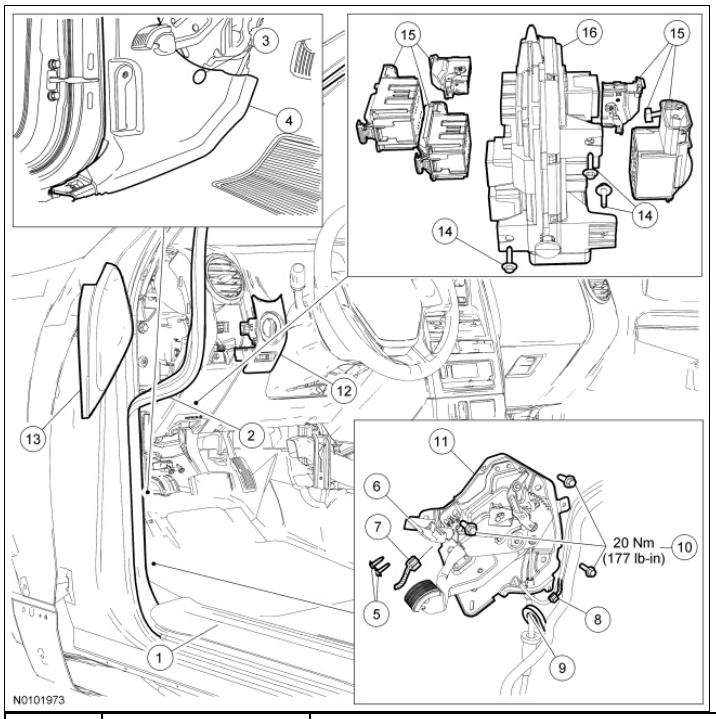
Test Step	Result / Action to Take
G1 RECHECK THE DSM DTCs	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DSM Self-Test. • Clear the DTCs. Repeat the DSM self-test. • **Is DTC B1318 still present?**	**Yes** GO to G2 . **No** The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.
G2 CHECK FOR CHARGING SYSTEM DTCs IN THE PCM	
• Enter the following diagnostic mode on the scan tool: PCM Self-Test. • Retrieve the continuous memory DTCs from the PCM. • **Is DTC P0620, P0625, P0626 or P065B set in the PCM?**	**Yes** REFER to Section 414-00 . **No** GO to G3 .
G3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE	
• Ignition OFF. • Check the battery condition and verify the battery is fully charged. Refer to Section 414-01 , Battery Condition Test. • **Is the battery OK and fully charged?**	**Yes** GO to G4 . **No** REFER to Section 414-00 .
G4 CHECK THE DSM VOLTAGE SUPPLY	
• Measure and record the voltage at the battery. • Disconnect: DSM C341A. • Ignition ON. • Measure the voltage between the DSM C341A-2, circuit SBB14 (BN/RD), harness side and ground.  N0094160 • **Is the voltage within 0.2 volt of the recorded battery voltage?**	**Yes** GO to G5 . **No** REPAIR the circuit for high resistance. CLEAR the DTC. REPEAT the self-test.
G5 CHECK THE DSM GROUND CIRCUIT	

• Ignition OFF. • Disconnect: Negative Battery Cable. • Disconnect: DSM C341C. • Measure the resistance between the DSM C341C-13, circuit GD143 (BK/VT), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** CONNECT the negative battery cable. GO to G6 . **No** REPAIR the circuit for high resistance. CONNECT the negative battery cable. TEST the system for normal operation.
G6 CHECK FOR CORRECT DSM OPERATION	
• Disconnect the DSM connectors. • Check for: ♦ corrosion ♦ damaged pins ♦ pushed-out pins • Connect the DSM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new DSM . REFER to Driver Seat Module (DSM) in this section. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Smart Junction Box (SJB)

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool



Item	Part Number	Description
1	13208	Driver door scuff plate
2	-	LH door weather seal
3	-	Cowl side trim panel pushpin
4	7802344	Cowl side trim panel
5	W707628	Parking brake release handle bolts (2 required)
6	-	Parking brake release handle
7	-	Parking brake switch electrical connector
8	-	Hood release cable pushpin
9	-	Harness clip
10	N806497	Parking brake control bolts (3 required)
11	2780	Parking brake control
12	11654	Headlight switch assembly
13	7804481	LH instrument panel side finish panel
14	-	Smart Junction Box (SJB) bolts (3 required)

15	-	SJB electrical connectors (5 required)
16	15604	SJB

Removal

NOTICE: **If the Smart Junction Box (SJB) is dropped, damage to the internal components may occur. A new SJB must be installed.**

NOTICE: **Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.**

NOTE: Prior to the replacement of the module, it is necessary to upload the module configuration information into the appropriate scan tool. This information must be downloaded into the new module after installation. For additional information, refer to Section 418-01 .

NOTE: The Tire Pressure Monitoring System (TPMS) functionality is integral to the SJB . The steps in this procedure are critical to restoring the vehicle security and the TPMS to normal operation. A new SJB is delivered in a manufacturing mode with 6 pre-set DTCs related to the TPMS . To clear the DTCs, successful configuration of the SJB must occur, followed by successful TPMS sensor training, and a successful self-test, including clearing of the DTCs. The DTCs are as follows:

- B2477 (Module Configuration Failure)
- B2868 (Left Front Tire Pressure Sensor Fault)
- B2869 (Right Front Tire Pressure Sensor Fault)
- B2870 (Right Rear Tire Pressure Sensor Fault)
- B2871 (Left Rear Tire Pressure Sensor Fault)
- C2780 (ECU in Manufacturer Sub-State)

1. **NOTE:** This step is necessary only if the SJB is being replaced.

   Upload the module configuration information from the SJB . For additional information, refer to Section 418-01 .

2. Remove the driver door scuff plate. For additional information, refer to Section 501-05 .

3. Position the LH door opening weather seal aside.

4. **NOTE:** While pulling the trim panel rearward, pull the hood release lever rearward in order for the release lever to slide through the trim panel.

   Remove the pushpin and the cowl side trim panel.

5. Remove the 2 bolts and the parking brake release handle.

6. Disconnect the parking brake switch electrical connector.

7. Release the hood release cable pushpin from the parking brake control bracket.

8. Release the harness clip from the parking brake cable housing.

9. **NOTE:** Rotating the parking brake control counterclockwise allows enough access to clear the instrument panel reinforcement.

   Remove the 3 bolts and position the parking brake control assembly under the brake pedal.

10. *NOTICE:* **The lower side of the headlight switch bezel includes 2 tabs that slide down onto the instrument panel and may be broken if any prying force is exerted in the lower area of the bezel.**

    Using a suitable tool (such as a trim removal tool), pry the mid-to-upper side of the headlight switch bezel away from the instrument panel (then lift it upward to disengage the lower tangs from the instrument panel), disconnect 2 electrical connectors and position the bezel assembly aside.

11. If necessary, push the LH instrument panel side finish panel out and position it aside.

12. Through the headlight switch bezel opening, remove the 2 SJB bolts.

13. From under the instrument panel, remove the third (lower right) SJB bolt.

14. Pull the SJB down out of the 2 locating pins, disconnect the electrical connectors and remove the SJB .

Installation

NOTE: When a new SJB is installed, all customer Remote Keyless Entry (RKE) transmitters may be required to be present in order to program the RKE transmitters to the new SJB .

1. Position the SJB into the 2 locating pins and connect the electrical connectors.

2. From under the instrument panel, install the lower right SJB bolt.

3. Through the headlight switch bezel opening, install the 2 SJB bolts.

4. If necessary, install the LH instrument panel side finish panel.

5. Connect the electrical connectors and install the headlight switch bezel assembly into the instrument panel.

6. Position the parking brake control assembly and install the 3 bolts.
   - Tighten to 20 Nm (177 lb-in).

7. Install the harness clip on the parking brake cable housing.

8. Install the hood release cable pushpin into the parking brake control bracket.

9. Connect the parking brake switch electrical connector.

10. Position the parking brake release handle and install the 2 bolts.

11. **NOTE:** While installing the trim panel, pull the hood release lever rearward in order for the release lever to slide through the trim panel.

    Position the cowl side trim panel and install the pushpin.

12. Position the LH door opening weather seal.

13. **NOTE:** If the SJB was not replaced, this is the last step that is necessary.

    Install the driver door scuff plate. For additional information, refer to Section 501-05 .

14. **NOTE:** When successful, this step programs the remote transmitters into the new SJB . In the event the remote transmitters do not program to the new SJB , all of the remote transmitters needs to be present and refer to Section 501-14 . This action programs the remote transmitters into the new SJB .

    Download the SJB configuration information from the scan tool into the new SJB . For additional information, refer to Section 418-01 .

15. Train the tire pressure sensors. For additional information, refer to Section 204-04 .

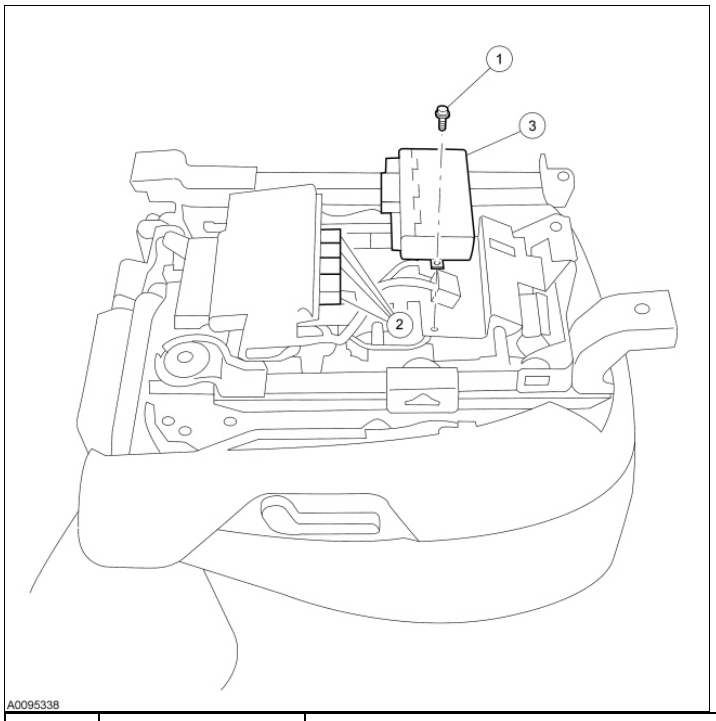
16. **NOTE:** DTC C2780 does not clear if any of the pre-set DTCs are still present in the SJB . When successful, this step clears DTC C2780.

    Carry out the SJB self-test (must include an on-demand) by clearing DTCs, and then retrieving DTCs to confirm all DTCs have been cleared.

Driver Seat Module (DSM)

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool



Item	Part Number	Description
1	-	Driver Seat Module (DSM) screws (2 required)
2	-	DSM electrical connectors (part of 14C719)
3	13C789	DSM

Removal and Installation

NOTICE: **Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.**

NOTE: Prior to the removal of the module, it is necessary to upload the module configuration information to a scan tool. This information must be downloaded into the new Driver Seat Module (DSM) after installation. For additional information, refer to Section 418-01 .

1. **NOTE:** This step is necessary only if the DSM is being replaced.

   Upload the module configuration information from the DSM . For additional information, refer to Section 418-01 .

2. Remove the driver seat. For additional information, refer to Section 501-10 .

3. Remove the 2 DSM screws.

4. Disconnect the electrical connectors and remove the DSM .

5. **NOTE:** When a new DSM is installed, it is necessary to download the module configuration information from the scan tool into the new DSM . For additional information, refer to Section 418-01 .

   To install, reverse the removal procedure.

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Occupant Classification Sensor

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Side Impact Sensor - C-Pillar, Explorer Sport Trac

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Camshaft Journal to Bearing Clearance - OHC Engines

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SECTION 303-01A:
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Hydraulic Timing Chain Tensioner - LH

Hydraulic Timing Chain Tensioner - RH

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Hydraulic Lash Adjuster

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DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

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GROUP 03: Engine

SECTION 303-01B:
Engine - 4.6L (3V)

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Engine Cylinder Identification

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LH Variable Camshaft Timing (VCT) Housing, VCT Solenoid and Timing Chain Tensioner

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Variable Camshaft Timing (VCT) Housing

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Lower End Components - Exploded View, Crankshaft Pulley and Crankshaft Front Seal

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Crankshaft Rear Seal

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Hydraulic Lash Adjuster

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Engine Lubrication Components - Exploded View

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Oil Pump Screen and Pickup Tube

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GROUP 03: Engine

SECTION 303-03:
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Coolant Flow Diagram 4.0L SOHC With Oil Cooler and Without Auxiliary Heater

Coolant Flow Diagram 4.0L SOHC Without Oil Cooler and With Rear Heater

Coolant Flow Diagram 4.0L SOHC With Oil Cooler and With Auxiliary Heater

Coolant Flow Diagram 4.6L (3V) Without Auxiliary Heater

Coolant Flow Diagram 4.6L (3V) With Auxiliary Heater

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Thermostat

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Filling and Bleeding with RADIATOR REFILLER

Filling and Bleeding without RADIATOR REFILLER

Cooling System Flushing

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Thermostat and Thermostat Housing - Exploded View, 4.0L SOHC

Thermostat - 4.0L SOHC

Thermostat Housing - 4.0L SOHC

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GROUP 03: Engine

SECTION 303-04A:
Fuel Charging and Controls - 4.0L SOHC

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Fuel Injectors

Fuel Pressure and Temperature Sensor

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Fuel Charging and Controls

REMOVAL AND INSTALLATION

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Fuel Rail and Fuel Injector - Exploded View

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Fuel Injectors

Fuel Rail Supply Tube

Fuel Pump Driver Module (FPDM) - Explorer, Mountaineer

Fuel Pump Driver Module (FPDM) - Explorer Sport Trac

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GROUP 03: Engine

SECTION 303-04B:
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SPECIFICATIONS

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Fuel Pump Driver Module (FPDM) - Explorer, Mountaineer

Fuel Pump Driver Module (FPDM) - Explorer Sport Trac

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GROUP 03: Engine

SECTION 303-05:
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Drive Belt - Incorrect Installation

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Belt Tensioner - Dynamics

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Accessory Drive Belt Idler Pulley - 4.6L (3V)

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GROUP 03: Engine

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Starter Motor - Motor Feed Circuit

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SECTION 303-07A:
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Engine Ignition Components - Exploded View

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GROUP 03: Engine

SECTION 303-07B:
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SPECIFICATIONS

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GROUP 03: Engine

SECTION 303-08:
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Exhaust Gas Recirculation (EGR) System Module - 4.0L SOHC

Exhaust Gas Recirculation (EGR) System Module Tube - 4.0L SOHC

Positive Crankcase Ventilation (PCV) Valve - 4.0L SOHC

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GROUP 03: Engine

SECTION 303-12:
Intake Air Distribution and Filtering

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GROUP 03: Engine

SECTION 303-13:
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GROUP 03: Engine

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Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor - Exploded View, 4.0L SOHC

Heated Oxygen Sensor (HO2S) and Catalyst Monitor Sensor - Exploded View, 4.6L (3V)

Heated Oxygen Sensor (HO2S)

Catalyst Monitor Sensor

Knock Sensor (KS) - 4.0L SOHC

Knock Sensor (KS) - 4.6L (3V)

Mass Air Flow (MAF) Sensor - 4.0L SOHC

Mass Air Flow (MAF) Sensor - 4.6L (3V)

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GROUP 04: Suspension

SECTION 204-00:
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Poor Returnability/Sticky Steering

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Symptom Chart - NVH

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Front Ride Height Measurement

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Toe Adjustment - Rear

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GROUP 04: Suspension

SECTION 204-01A:
Front Suspension - Rear Wheel Drive (RWD)

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GROUP 04: Suspension

SECTION 204-01B:
Front Suspension - Four Wheel Drive (4WD)

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GROUP 04: Suspension

SECTION 204-02:
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Stabilizer Bar and Link - Explorer, Mountaineer

Stabilizer Bar and Link - Explorer Sport Trac

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GROUP 04: Suspension

SECTION 204-04:
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Tire Pressure Monitoring System (TPMS) Module

Tire Pressure Monitoring System (TPMS) Pressure Sensor

Tire Pressure Monitoring System (TPMS) Pressure Sensor Cradle

Tire Pressure Monitoring System (TPMS) Pressure Sensor Strap

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Loaded Runout Measurement (Hunter Road Force® 9700 Series Wheel Balancer)

Runout Measurement (Dial Indicator)

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Wheel-to-Hub Optimization

Tire Pressure Monitoring System

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Ambient Temperature Change and Tire Pressure

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

Tire Pressure Monitoring System (TPMS) Indicator Flashes

Tire Pressure Monitoring System (TPMS) PID Definitions and Intermittent Troubleshooting

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Tire Pressure Monitoring System (TPMS) Sensor Activation

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Wheel and Tire

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GROUP 05: Driveline

SECTION 205-00:
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Symptom Chart - NVH

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Tooth Contact Pattern Check - Gearset

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Driveshaft Runout and Balancing

Driveshaft Inspection

Driveshaft Runout

Driveshaft Balancing - Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)

Driveshaft Balancing - Hose Clamp Method

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GROUP 05: Driveline

SECTION 205-01:
Driveshaft

SPECIFICATIONS

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Driveshaft - Rear, One-Piece, 4.6L (3V)

Driveshaft - Rear, Two-Piece, Four Wheel Drive (4WD)

Driveshaft - Rear, Two-Piece, Rear Wheel Drive (RWD)

Driveshaft Slip Yoke Boot

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Driveshaft Universal Joint - Snap Ring Type

Driveshaft Center Bearing

Driveshaft Universal Joint - Stake Type

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GROUP 05: Driveline

SECTION 205-02:
Rear Drive Axle/Differential - Ford 8.8-Inch Ring Gear

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Rear Drive Axle and Differential

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Drive Pinion Flange and Drive Pinion Seal

Stub Shaft Pilot Bearing and Seal

REMOVAL AND INSTALLATION

Axle Assembly

Rear Axle Housing Support Insulator

Differential Ring And Pinion

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GROUP 05: Driveline

SECTION 205-03:
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SPECIFICATIONS

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Stub Shaft Pilot Bearing and Seal

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GROUP 05: Driveline

SECTION 205-04:
Front Drive Halfshafts

SPECIFICATIONS

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Front Drive Halfshafts

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GROUP 05: Driveline

SECTION 205-05:
Rear Drive Halfshafts

SPECIFICATIONS

DESCRIPTION AND OPERATION

Rear Drive Halfshafts

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Rear Drive Halfshafts

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Halfshaft

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Halfshaft Joint

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GROUP 06: Brake System

SECTION 206-00:
Brake System - General Information

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DIAGNOSIS AND TESTING

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Red Brake Warning Indicator

Inspection And Verification

Symptom Chart

Symptom Chart - Brake System

Symptom Chart - NVH

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Brake Master Cylinder - Bypass Condition

Brake Master Cylinder - Compensator Port

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Brake System Inspection

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Brake Discs

Brake Calipers

Brake Caliper Guide Pins

Brake Flexible Hoses and Tubes

Brake Master Cylinder

Brake Booster

Brake Disc Machining

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Brake System Bleeding

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GROUP 06: Brake System

SECTION 206-03:
Front Disc Brake

SPECIFICATIONS

DESCRIPTION AND OPERATION

Front Disc Brake

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Front Disc Brake

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Brake Caliper

Brake Caliper Anchor Plate

Brake Disc

Brake Disc Shield

Brake Flexible Hose

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GROUP 06: Brake System

SECTION 206-04:
Rear Disc Brake

SPECIFICATIONS

DESCRIPTION AND OPERATION

Rear Disc Brake

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Rear Disc Brake

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Brake Pads

Brake Disc

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GROUP 06: Brake System

SECTION 206-05:
Parking Brake and Actuation

SPECIFICATIONS

DESCRIPTION AND OPERATION

Parking Brake

DIAGNOSIS AND TESTING

Parking Brake

Principles of Operation

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Symptom Chart

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GENERAL PROCEDURES

Parking Brake Cable Tension Release

Parking Brake Shoe Adjustment

REMOVAL AND INSTALLATION

Parking Brake Control

Parking Brake Cable - Front

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GROUP 13: Instrumentation and Warning Systems

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GROUP 13: Instrumentation and Warning Systems

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Generator - 4.6L (2V)

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GROUP 14: Battery and Charging System

SECTION 414-01:
Battery, Mounting and Cables

SPECIFICATIONS

DESCRIPTION AND OPERATION

Battery and Cables

DIAGNOSIS AND TESTING

Principles of Operation

Inspection And Verification

Pinpoint Test

Component Test

Battery - Drain Tests

GENERAL PROCEDURES

Battery Disconnect

REMOVAL AND INSTALLATION

Battery and Battery Tray - Exploded View

Battery

Battery Tray

Battery Cables - 4.0L

Battery Cables - 4.6L

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GROUP 15: Audio Systems

SECTION 415-00:
Information and Entertainment Systems

SPECIFICATIONS

DESCRIPTION AND OPERATION

Information and Entertainment System

DIAGNOSIS AND TESTING

Information and Entertainment System

Principles of Operation

Inspection and Verification

DTC Charts

Audio Front Control Module (ACM) - Without Navigation DTC Chart

Audio Front Control Module (ACM) - With Navigation DTC Chart

Satellite Digital Audio Receiver System (SDARS) Module DTC Chart

Rear Entertainment Module (RETM) DTC Chart

Accessory Protocol Interface Module (APIM) - V1 DTC Chart

Accessory Protocol Interface Module (APIM) - V2 DTC Chart

Symptom Chart - General Audio System

Symptom Chart - Sound Quality

Symptom Chart - Satellite Radio

Symptom Chart - Navigation

Symptom Chart - SYNC System

Symptom Chart - Family Entertainment System

Pinpoint Tests

GENERAL PROCEDURES

Accessory Protocol Interface Module (APIM) Software Level Check

Audio Control Module (ACM) Self-Diagnostic Mode

Audio Systems Without Navigation

Satellite Radio Electronic Serial Number (ESN) Retrieval - Vehicles Without Navigation

Audio Systems With Navigation

REMOVAL AND INSTALLATION

Antenna - AM/FM

Antenna - Satellite Radio

Antenna Cable - Satellite Radio

Antenna Lead-In Cable

Audio Input Jack

Audio Amplifier

Audio Control Module (ACM)

Rear Entertainment Module (RETM)

Speaker - Door

Satellite Digital Audio Receiver System (SDARS) Module

Steering Wheel Controls

Subwoofer Speaker - Explorer, Mountaineer

Subwoofer Speaker - Explorer Sport Trac

Accessory Protocol Interface Module (APIM)

Universal Serial Bus (USB) Cable and Port

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GROUP 17: Lighting

SECTION 417-01:
Exterior Lighting

DESCRIPTION AND OPERATION
Exterior Lighting

DIAGNOSIS AND TESTING

Diagnostic Trouble Code (DTC) Chart

Headlamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Autolamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Stoplamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Turn Signal and Hazard Lamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Parking, Rear and License Plate Lamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Fog Lamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Reversing Lamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Trailer Lamps

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

Daytime Running Lamps (DRL)

Principles of Operation

Inspection and Verification

Symptom Chart

Pinpoint Tests

GENERAL PROCEDURES

Headlamp Adjustment

Headlamp Aiming

Photometric Aiming

Screen Method Aiming

Front Fog Lamp Adjustment

Autolamps Time Delay Adjustment

REMOVAL AND INSTALLATION

Headlamp Assembly

Headlamp Bulb

Parking Lamp Bulb - Front

Fog Lamp

Fog Lamp Bulb

Side Marker Lamp

Stoplamp Switch

Light Sensor

Headlamp Switch

Puddle Lamp

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GROUP 17: Lighting

SECTION 417-02:
Interior Lighting

DESCRIPTION AND OPERATION
Interior Lighting

DIAGNOSIS AND TESTING

Interior Lighting

Principles of Operation

Inspection and Verification

DTC Charts

Symptom Chart

Pinpoint Tests

REMOVAL AND INSTALLATION

Interior Lamp - Front

Interior Lamp - Rear

Cargo Lamp

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GROUP 18: Electrical Distribution

SECTION 418-00:
Module Communications Network

DESCRIPTION AND OPERATION
Communications Network

DIAGNOSIS AND TESTING

Communications Network

Principles of Operation

Inspection and Verification

DTC Charts

Symptom Chart

Pinpoint Tests

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GROUP 18: Electrical Distribution

SECTION 418-01:
Module Configuration

DIAGNOSIS AND TESTING
Module Configuration
Principles of Operation

Inspection and Verification

GENERAL PROCEDURES

Programmable Module Installation (PMI)

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is Available

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is NOT Available

Accessory Protocol Interface Module (APIM) Programming

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GROUP 19: Electronic Feature Group

SECTION 419-01:
Anti-Theft - Passive Anti-Theft System (PATS)

DESCRIPTION AND OPERATION
Anti-Theft

DIAGNOSIS AND TESTING

Anti-Theft

Principles of Operation

Inspection and Verification

DTC Charts

Instrument Cluster (IC) DTC Chart

PCM DTC Chart

Symptom Chart

Pinpoint Tests

GENERAL PROCEDURES

Key Programming Using Two Programmed Keys

Key Programming Using Diagnostic Equipment

Key Programming Switch State Control

Spare Key Programming - Using Diagnostic Equipment

Spare Key Programming - Unlimited Key Mode

Passive Anti-Theft System (PATS) Parameter Reset

Anti-Theft Security Access

REMOVAL AND INSTALLATION

Passive Anti-Theft System (PATS) Transceiver

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GROUP 19: Electronic Feature Group

SECTION 419-02:
Remote Convenience

DESCRIPTION AND OPERATION
Universal Transmitter

DIAGNOSIS AND TESTING

Universal Transmitter

Inspection and Verification

Symptom Chart

Pinpoint Tests

GENERAL PROCEDURES

Universal Transmitter Programming

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GROUP 19: Electronic Feature Group

SECTION 419-10:
Multifunction Electronic Modules

SPECIFICATIONS

DESCRIPTION AND OPERATION

Module Controlled Functions

DIAGNOSIS AND TESTING

Diagnostic Trouble Code (DTC) Chart

Smart Junction Box (SJB)

Principles of Operation

Inspection and Verification

DTC Charts

Symptom Chart

Pinpoint Tests

Driver Seat Module (DSM)

Principles of Operation

Inspection and Verification

DTC Charts

Symptom Chart

Pinpoint Tests

REMOVAL AND INSTALLATION

Smart Junction Box (SJB)

Driver Seat Module (DSM)

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-- SPECIFICATIONS --

Acceleration Control

Accessory Drive

Anti-Lock Brake System (ABS) and Stability Control

Automatic Transaxle/Transmission External Controls

Automatic Transaxle/Transmission - 5R55S

Automatic Transaxle/Transmission - 6R80

Auxiliary Climate Control

Battery, Mounting and Cables

Body Closures

Body Repairs

Body System - General Information

Brake System - General Information

Bumpers

Charging System

Climate Control

Climate Control System - General Information and Diagnostics

Driveline System - General Information

Driveshaft

Electronic Engine Controls

Engine Cooling

Engine Emission Control

Engine Ignition - 4.0L SOHC

Engine Ignition - 4.6L (3V)

Engine System - General Information

Engine - 4.0L SOHC

Engine - 4.6L (3V)

Evaporative Emissions

Exhaust System

Exterior Trim and Ornamentation

Four Wheel Drive (4WD) Systems

Front Disc Brake

Front Drive Axle/Differential - Dana 30

Front Drive Halfshafts

Front End Body Panels

Front Suspension - Four Wheel Drive (4WD)

Front Suspension - Rear Wheel Drive (RWD)

Fuel Charging and Controls - 4.0L SOHC

Fuel Charging and Controls - 4.6L (3V)

Fuel System - General Information

Fuel Tank and Lines

Full Frame and Body Mounting

Glass, Frames and Mechanisms

Handles, Locks, Latches and Entry Systems

Horn

Hydraulic Brake Actuation

Information and Entertainment Systems

Instrument Panel and Console

Intake Air Distribution and Filtering

Interior Trim and Ornamentation

Multifunction Electronic Modules

Parking Aid

Parking Brake and Actuation

Pickup Bed and Platform Body

Power Brake Actuation

Power Steering

Rear Disc Brake

Rear Drive Axle/Differential - Ford 8.8-Inch Ring Gear

Rear Drive Halfshafts

Rear Suspension

Rear View Mirrors

Roof Opening Panel

Safety Belt System

Seating

Starting System

Steering Column

Steering Column Switches

Steering System

Supplemental Restraint System

Suspension System - General Information

Transaxle/Transmission Cooling

Transfer Case

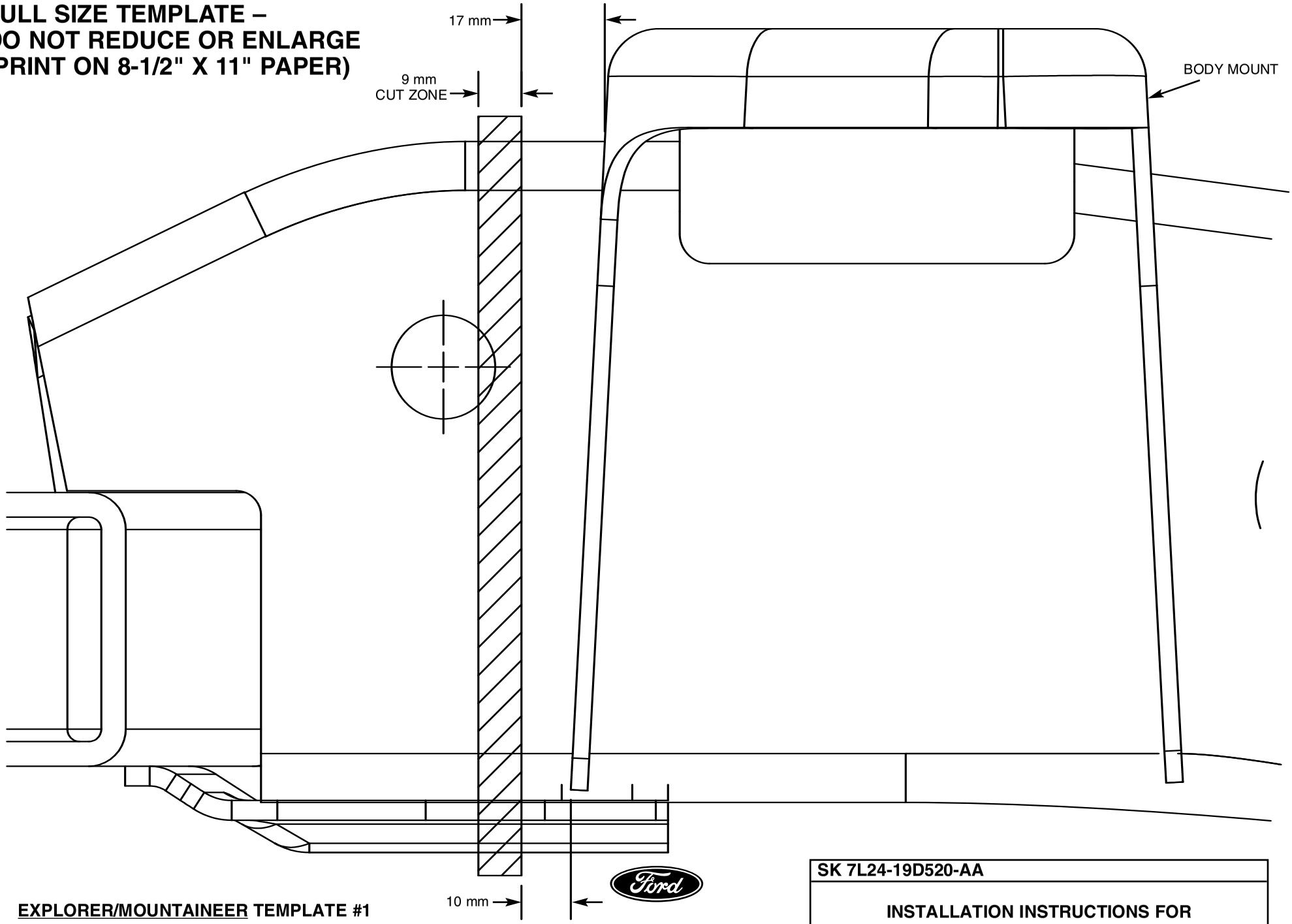
Wheels and Tires

Wipers and Washers

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FULL SIZE TEMPLATE –
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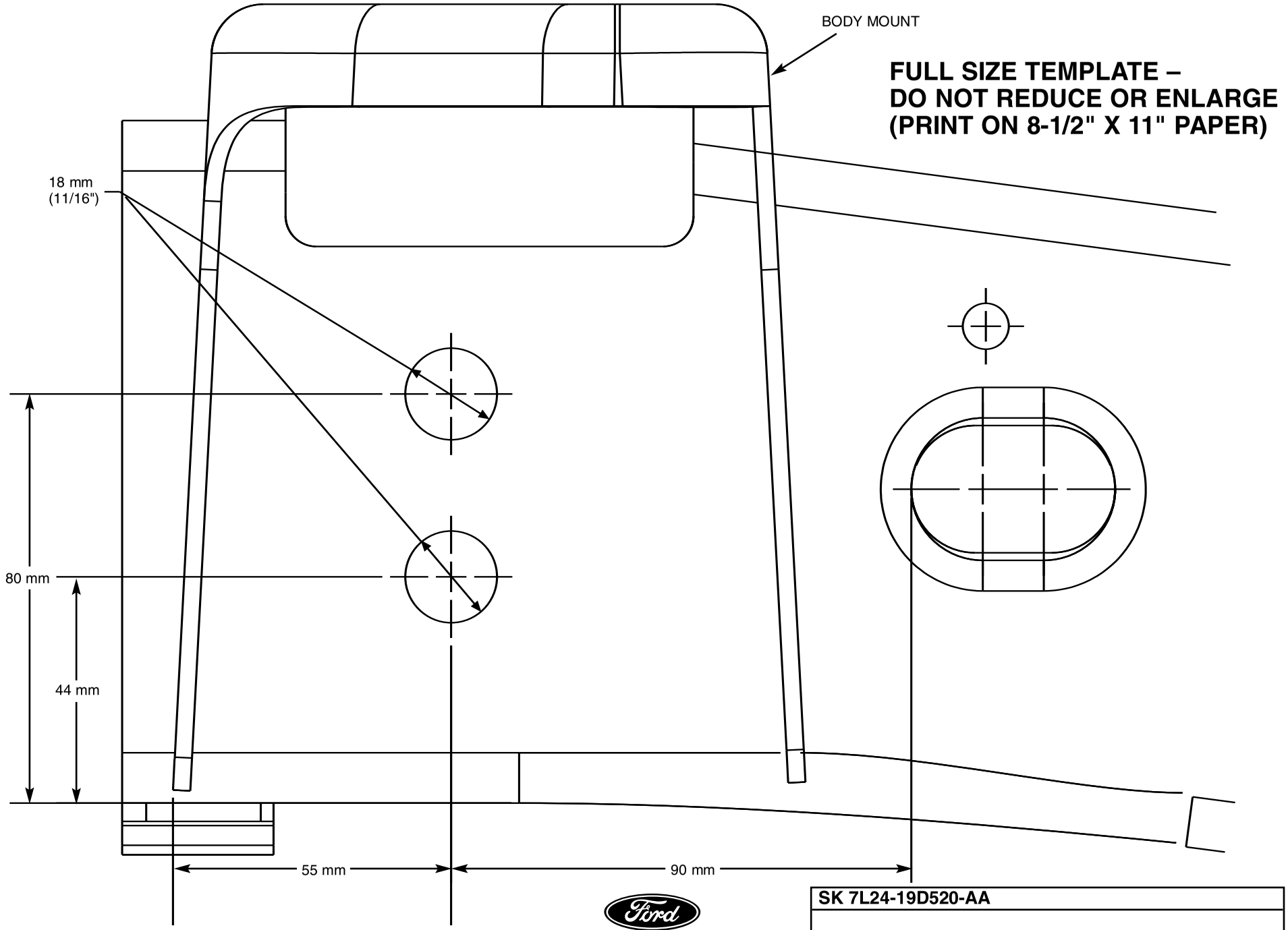


EXPLORER/MOUNTAINEER TEMPLATE #1
LEFT HAND INNER SIDE VIEW
RIGHT HAND SYMMETRICALLY OPPOSITE

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5-06

SK 7L24-19D520-AA

INSTALLATION INSTRUCTIONS FOR EXPLORER/MOUNTAINEER/SPORT TRAC REAR TRAILER HITCH CROSSMEMBER



FULL SIZE TEMPLATE –
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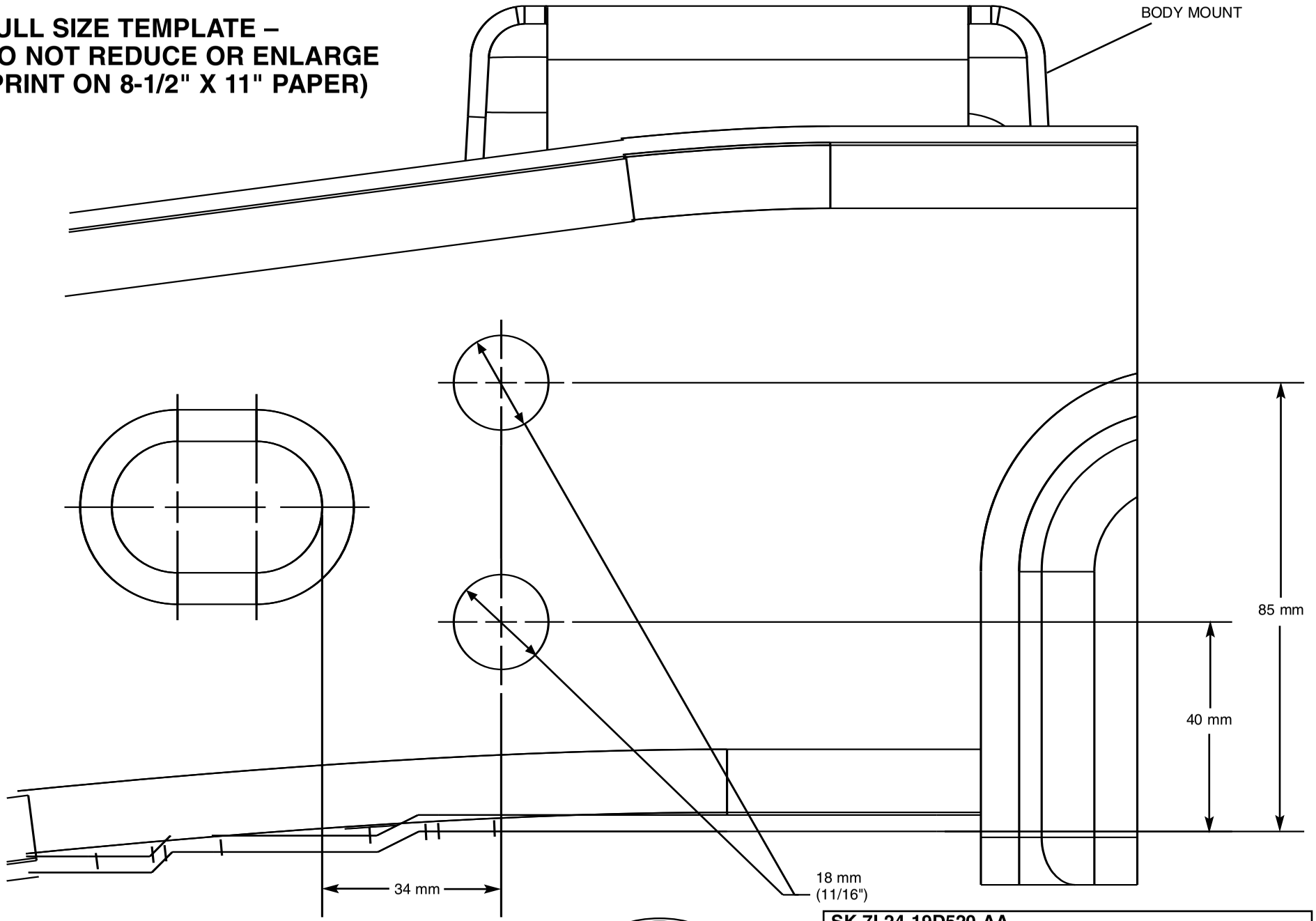
EXPLORER/MOUNTAINEER TEMPLATE #2
LEFT HAND INNER SIDE VIEW
RIGHT HAND INNER SYMMETRICALLY OPPOSITE TO LEFT HAND INNER

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INSTALLATION INSTRUCTIONS FOR EXPLORER/MOUNTAINEER/SPORT TRAC REAR TRAILER HITCH CROSSMEMBER

FULL SIZE TEMPLATE –
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EXPLORER/MOUNTAINEER TEMPLATE #3
LEFT HAND OUTER SIDE VIEW

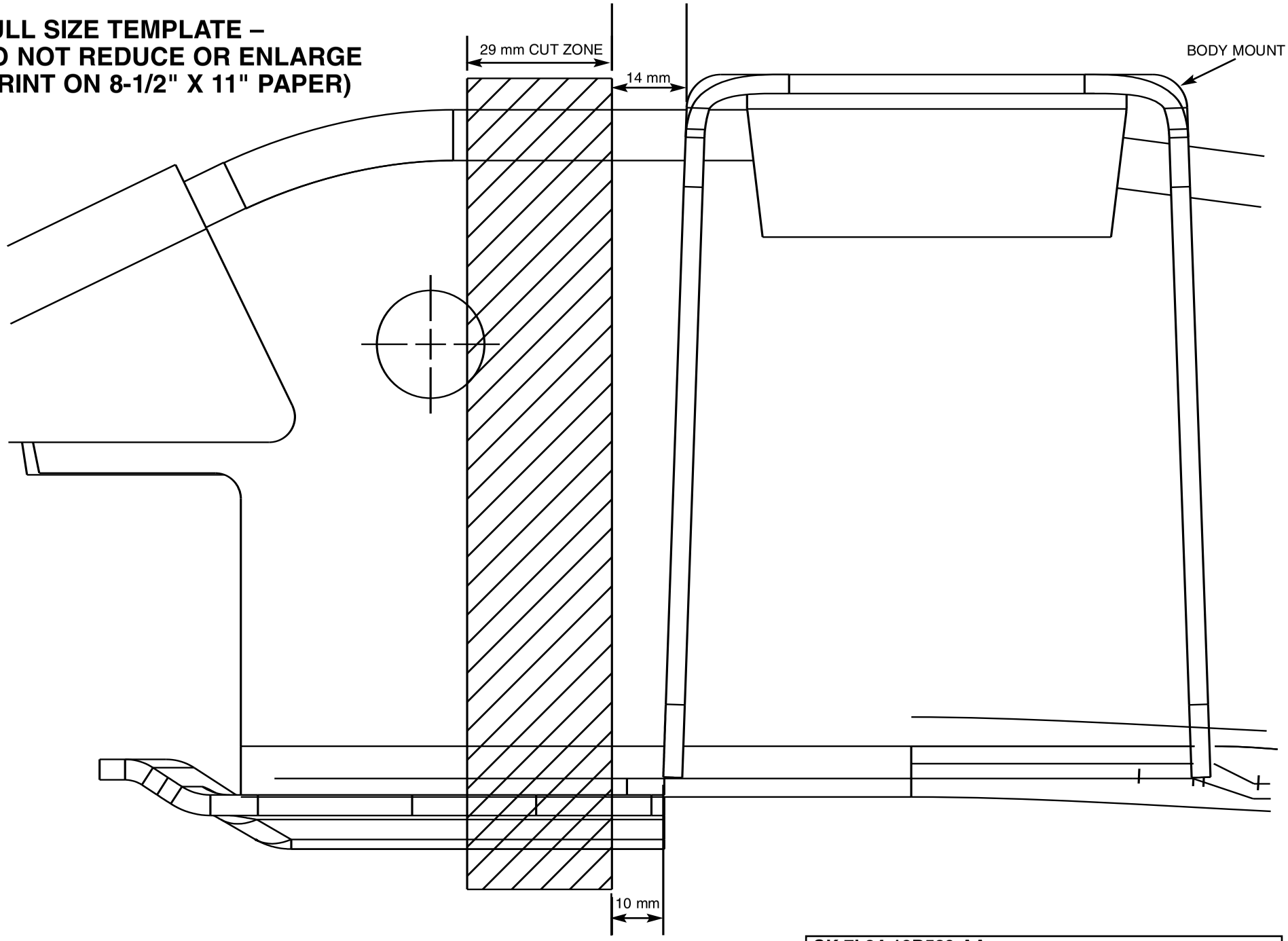
RIGHT HAND INNER SYMMETRICALLY OPPOSITE TO LEFT HAND INNER

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INSTALLATION INSTRUCTIONS FOR EXPLORER/MOUNTAINEER/SPORT TRAC REAR TRAILER HITCH CROSSMEMBER

FULL SIZE TEMPLATE –
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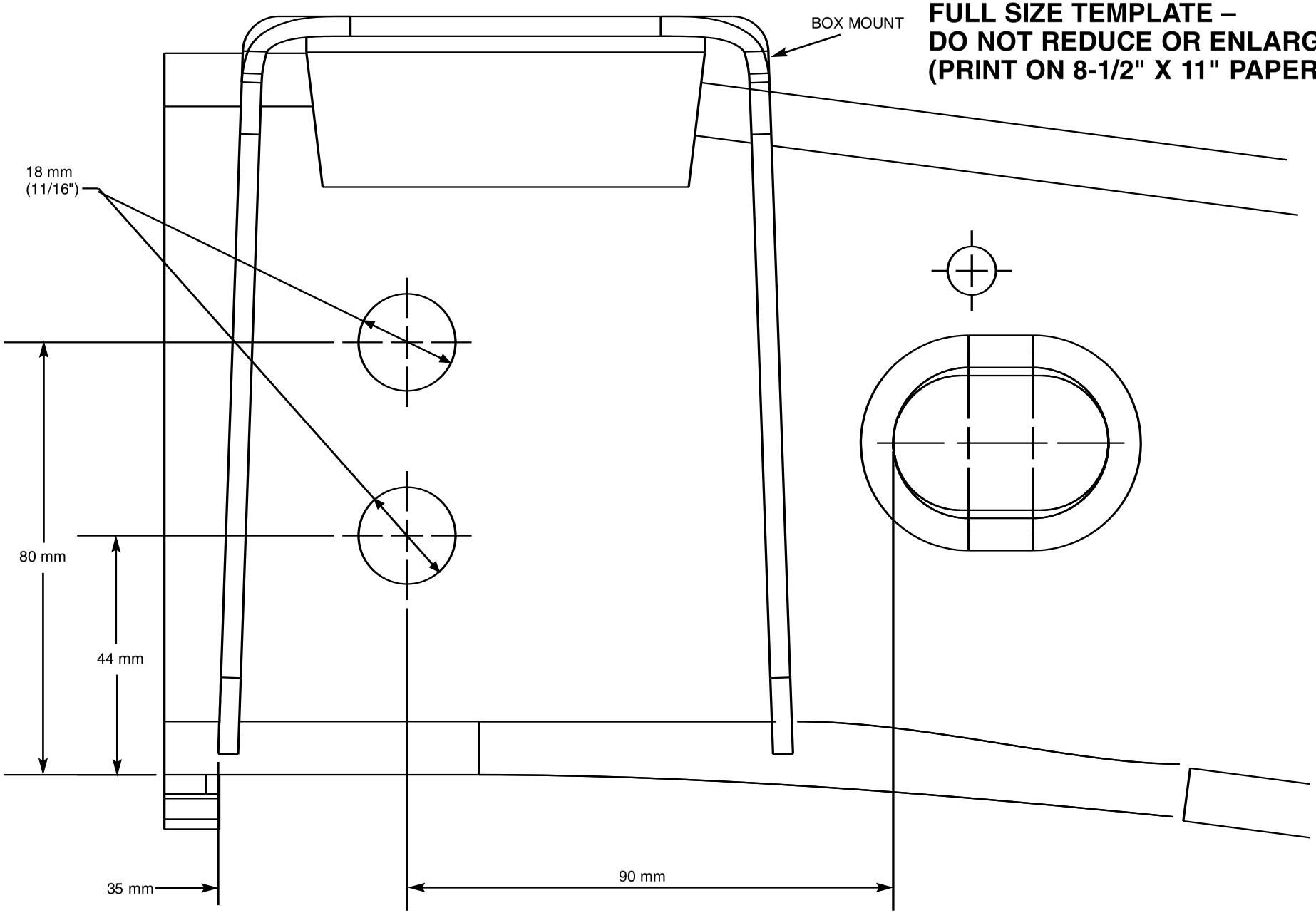
SPORT TRAC TEMPLATE #1
LEFT HAND INNER SIDE VIEW
RIGHT HAND SYMMETRICALLY OPPOSITE

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INSTALLATION INSTRUCTIONS FOR EXPLORER/MOUNTAINEER/SPORT TRAC REAR TRAILER HITCH CROSSMEMBER

**FULL SIZE TEMPLATE –
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(PRINT ON 8-1/2" X 11" PAPER)**



SPORT TRAC TEMPLATE #2
LEFT HAND INNER SIDE VIEW

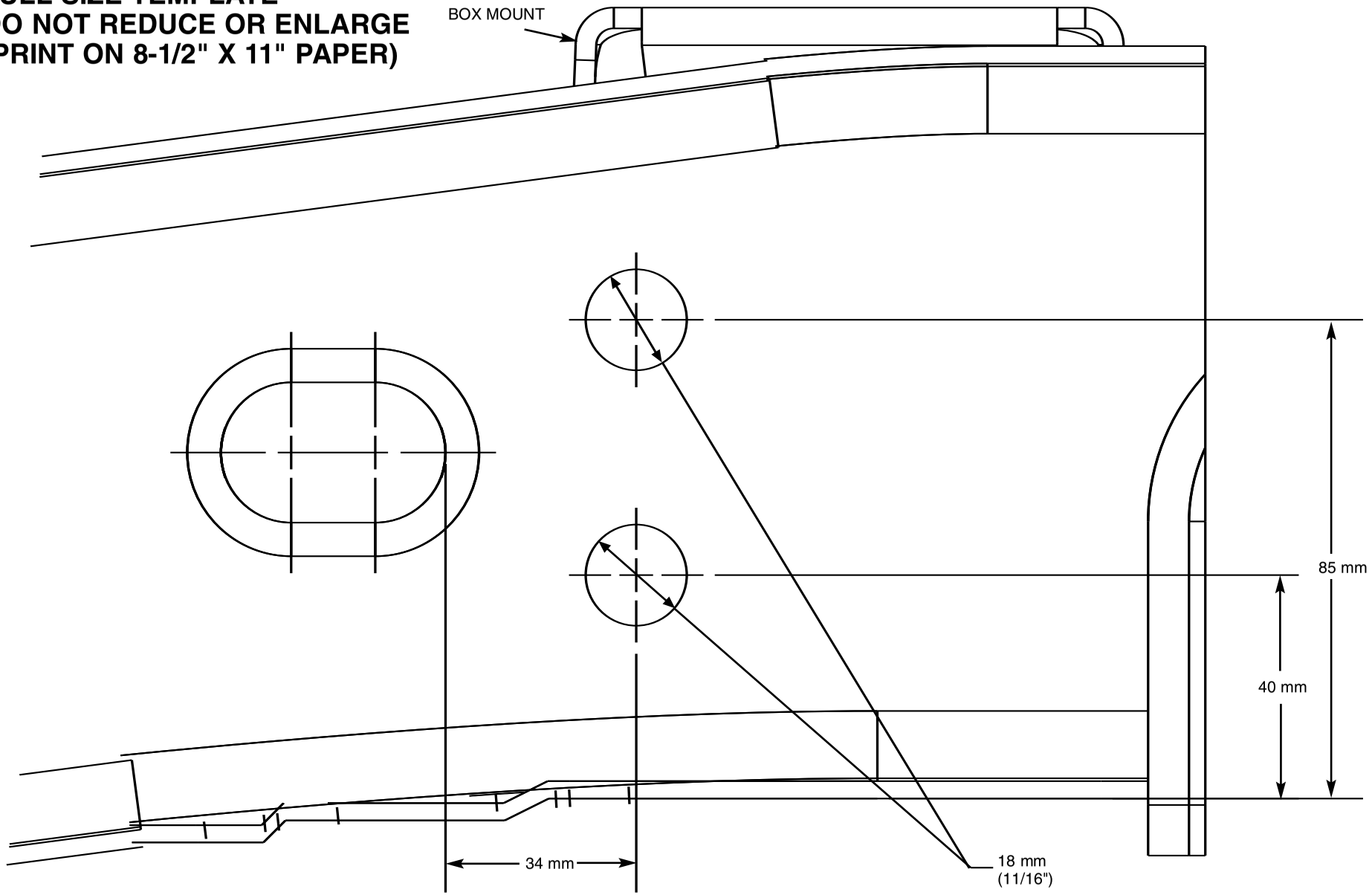
**RIGHT HAND INNER
SYMMETRICALLY OPPOSITE
TO LEFT HAND INNER**

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SK 7L24-19D520-AA

**INSTALLATION INSTRUCTIONS FOR
EXPLORER/MOUNTAINEER/SPORT TRAC REAR
TRAILER HITCH CROSSMEMBER**

FULL SIZE TEMPLATE –
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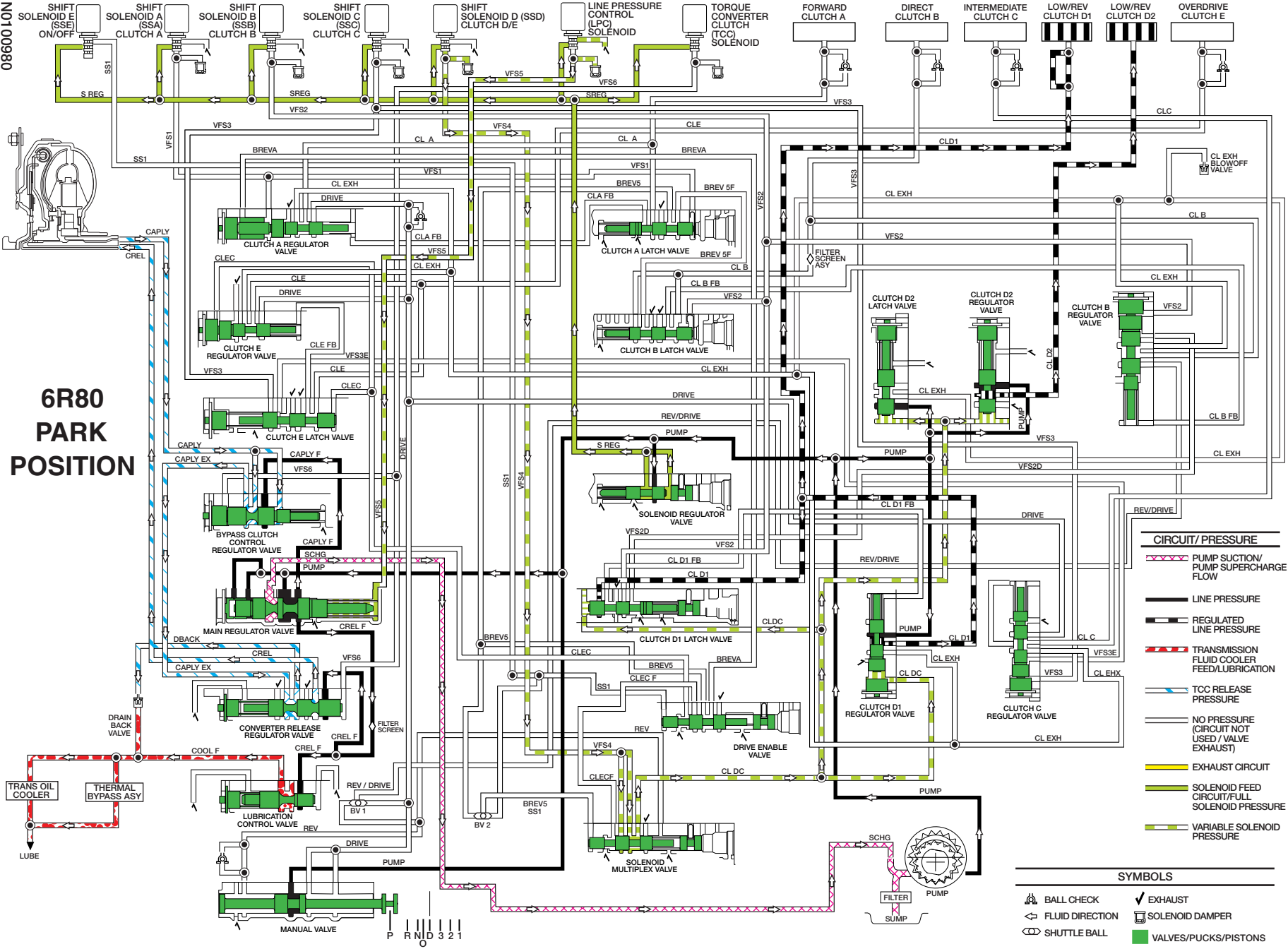


SPORT TRAC TEMPLATE #3
LEFT HAND OUTER SIDE VIEW
RIGHT HAND INNER SYMMETRICALLY OPPOSITE TO LEFT HAND INNER

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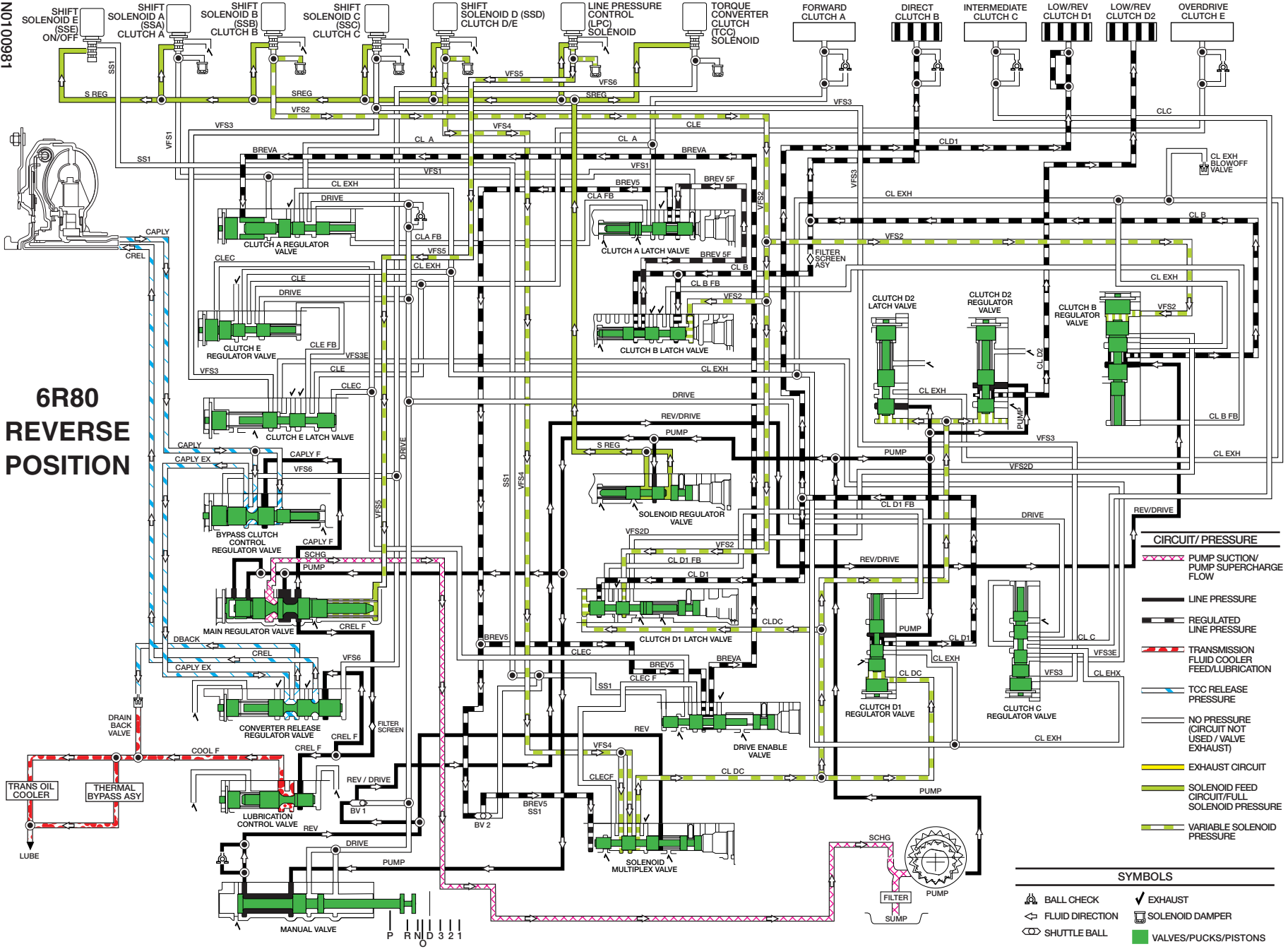
SK 7L24-19D520-AA

INSTALLATION INSTRUCTIONS FOR EXPLORER/MOUNTAINEER/SPORT TRAC REAR TRAILER HITCH CROSSMEMBER


N0109880
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
6R80 PARK POSITION
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
BYPASS CLUTCH CONTROL REGULATOR VALVE
SOLENOID REGULATOR VALVE
MAIN REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CONVERTER RELEASE REGULATOR VALVE
DRAIN BACK VALVE
FILTER SCREEN
DRIVE ENABLE VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
LUBRICATION CONTROL VALVE
BV 1
BV 2
SOLENOID MULTIPLEX VALVE
MANUAL VALVE
P R N D 3 2 1 O
FILTER
PUMP
SUMP
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS

N0100981

6R80 REVERSE POSITION

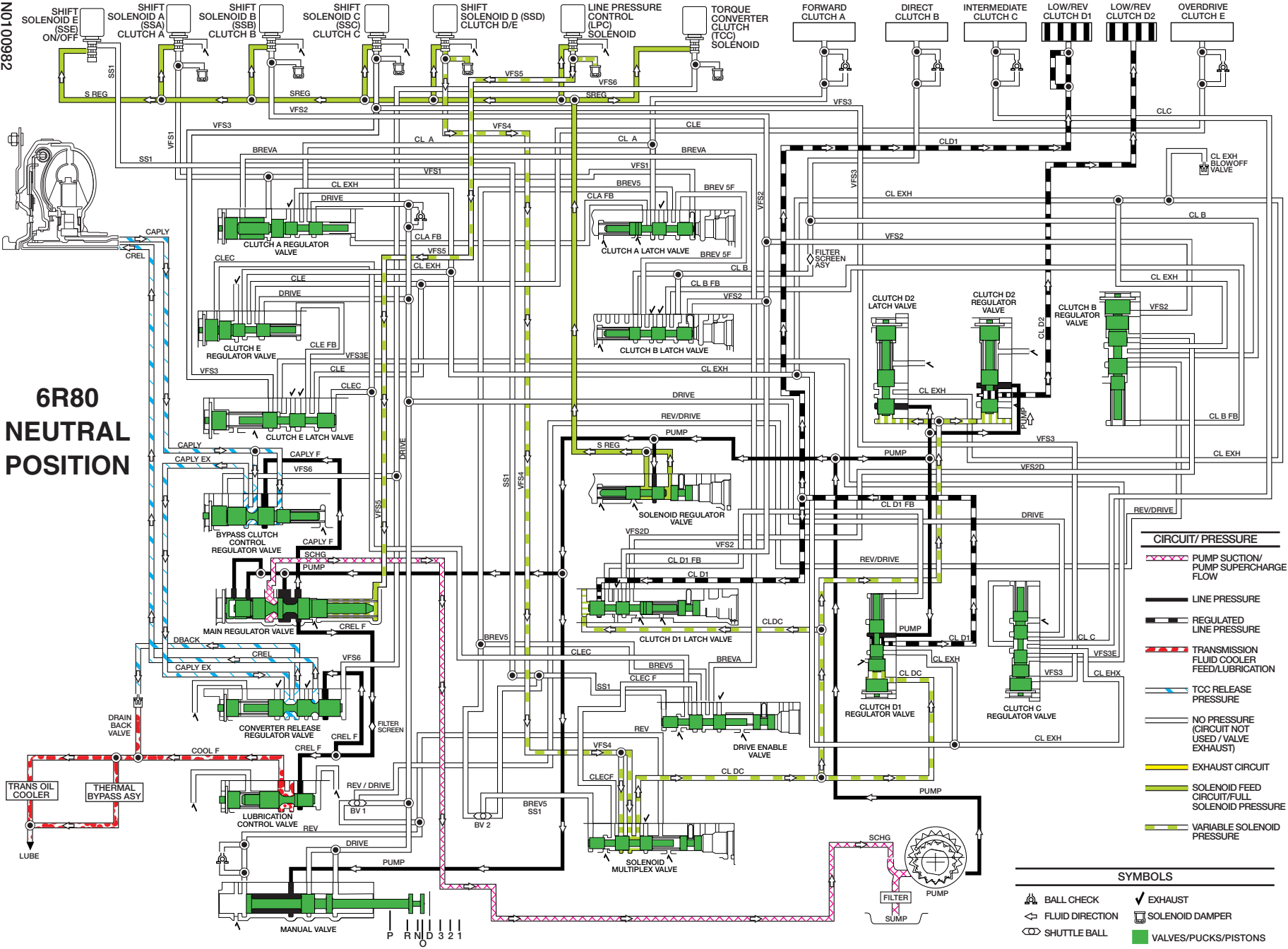


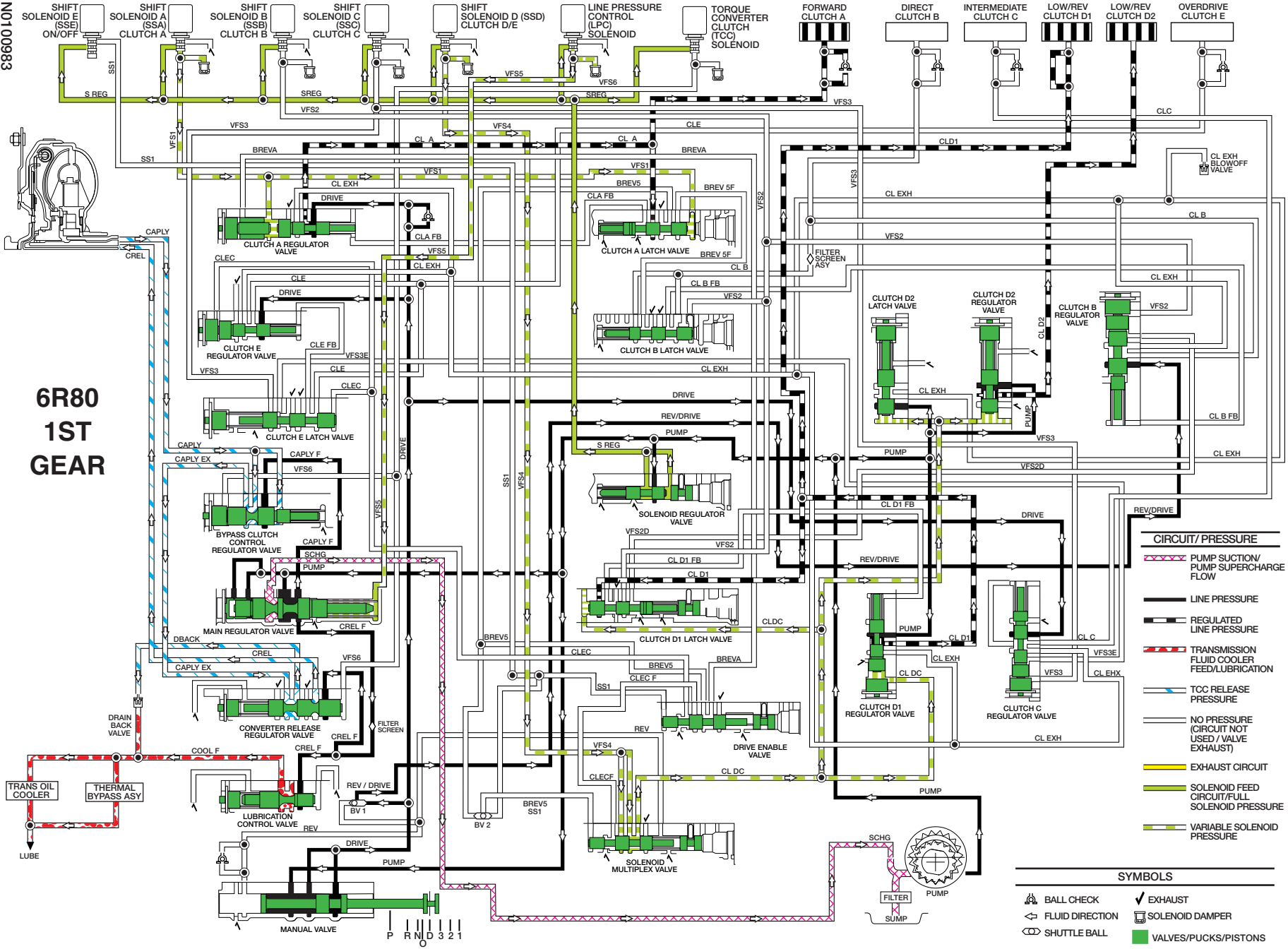
CIRCUIT/ PRESSURE

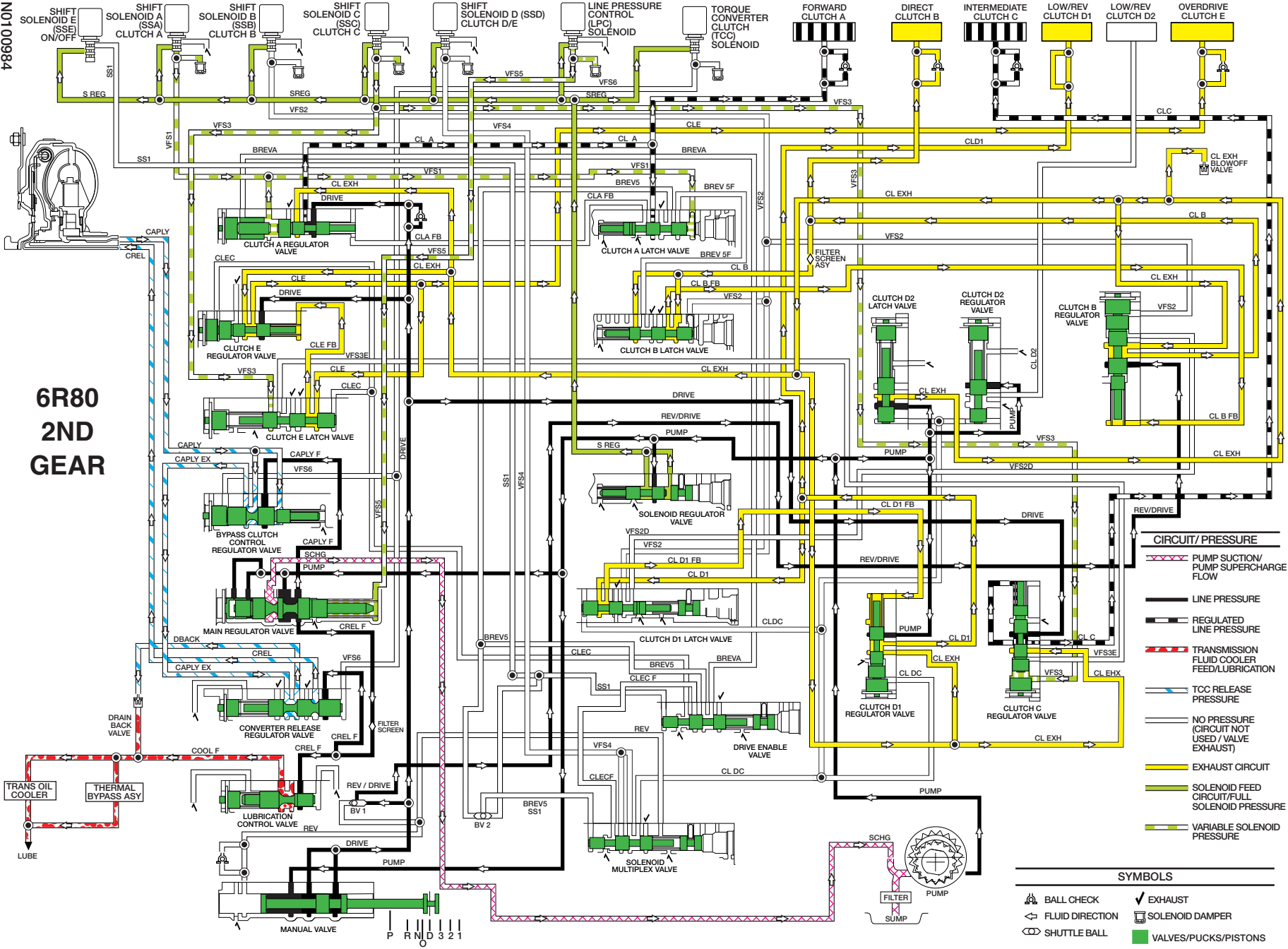
- PUMP SUCTION/ PUMP SUPERCHARGE FLOW
- LINE PRESSURE
- REGULATED LINE PRESSURE
- TRANSMISSION FLUID COOLER FEED/LUBRICATION
- TCC RELEASE PRESSURE
- NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
- EXHAUST CIRCUIT
- SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
- VARIABLE SOLENOID PRESSURE

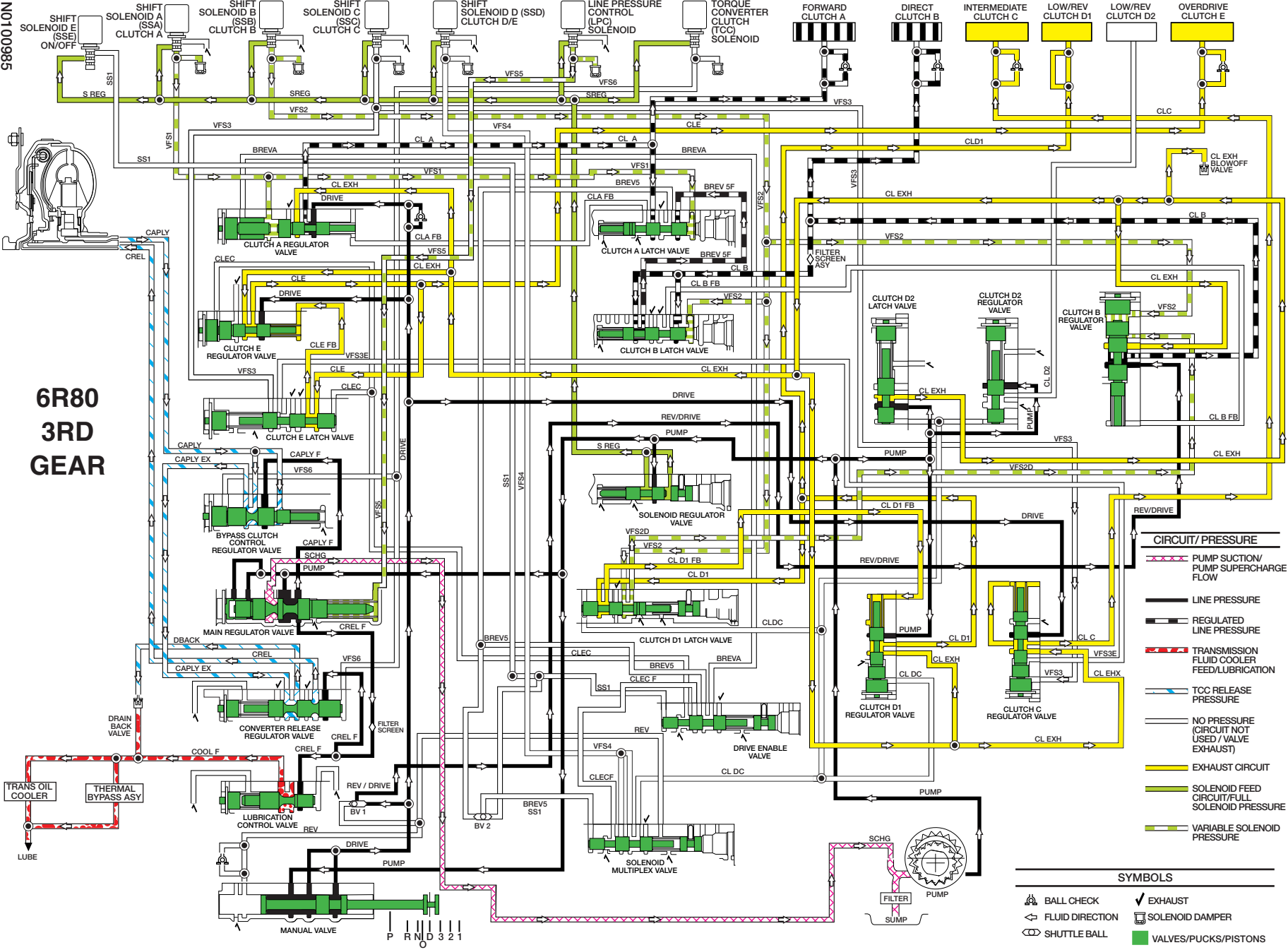
SYMBOLS

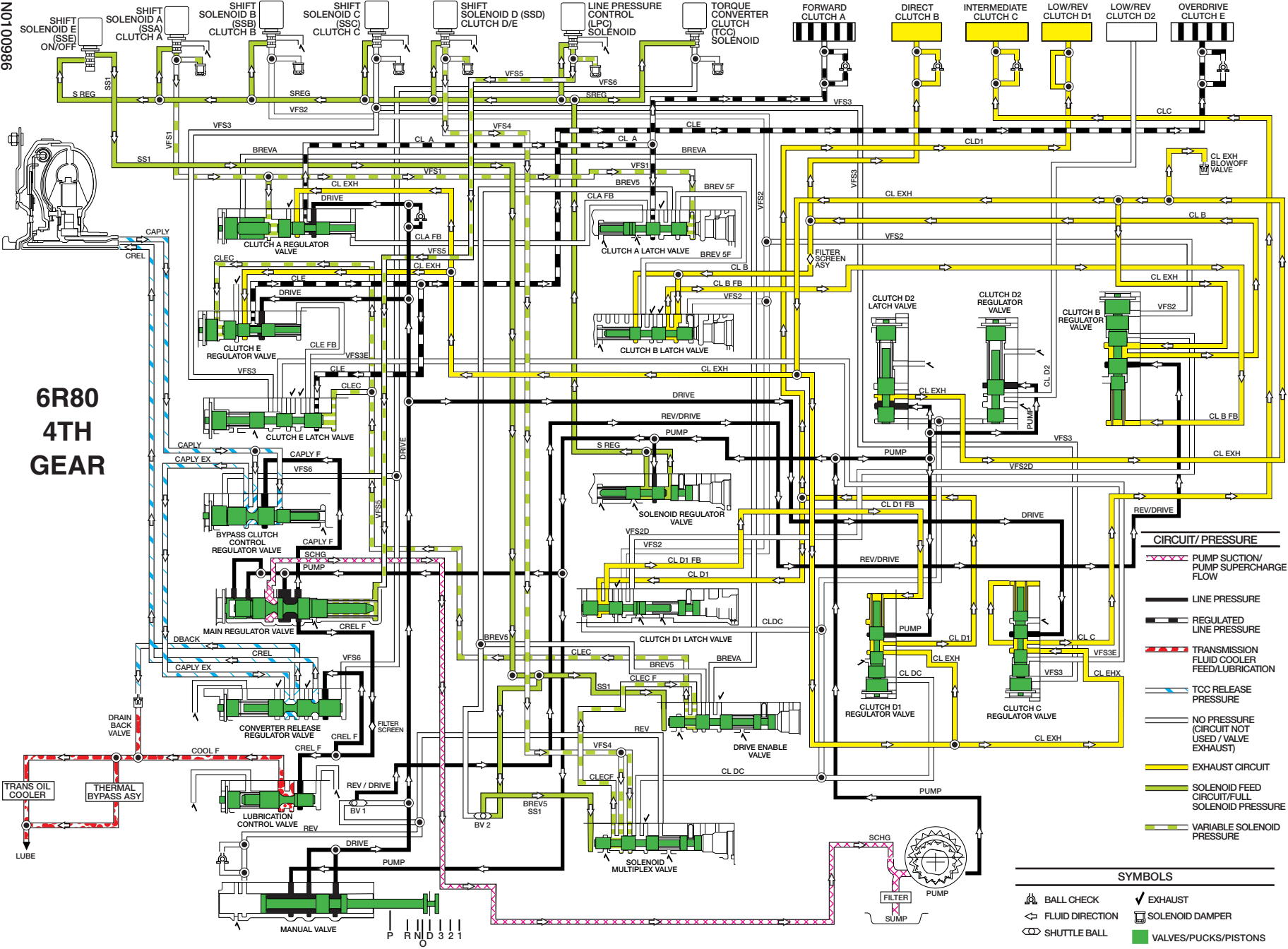
- BALL CHECK
- FLUID DIRECTION
- SHUTTLE BALL
- EXHAUST
- SOLENOID DAMPER
- VALVES/PUCKS/PISTONS

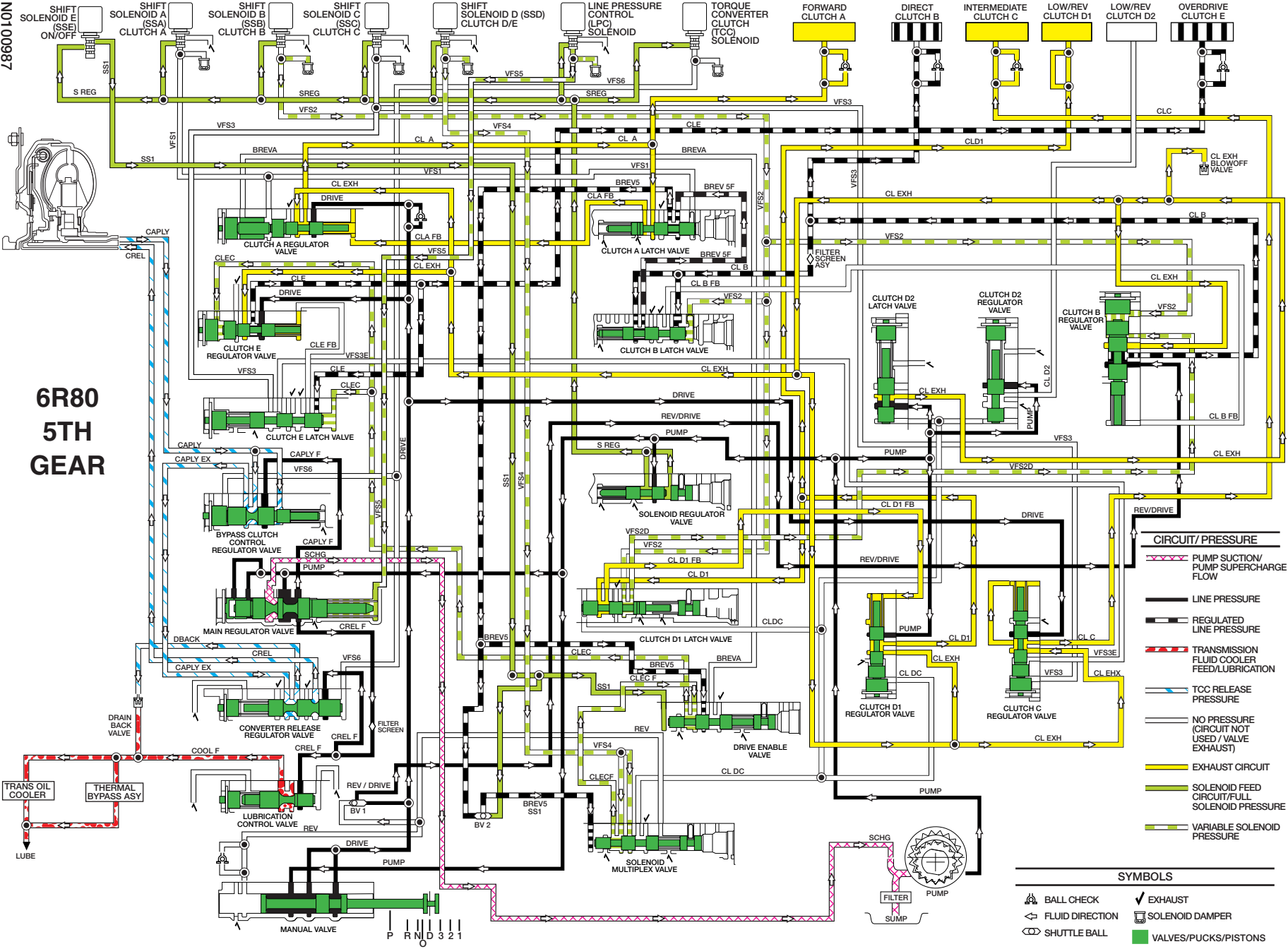

N01009982
6R80
NEUTRAL
POSITION
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
SOLENOID REGULATOR VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CONVERTER RELEASE REGULATOR VALVE
CLUTCH D1 LATCH VALVE
DRIVE ENABLE VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
SOLENOID MULTIPLEX VALVE
LUBRICATION CONTROL VALVE
MANUAL VALVE
DRAIN BACK VALVE
FILTER SCREEN
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
FILTER
SUMP
PUMP
P R N D 3 2 1 O
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS

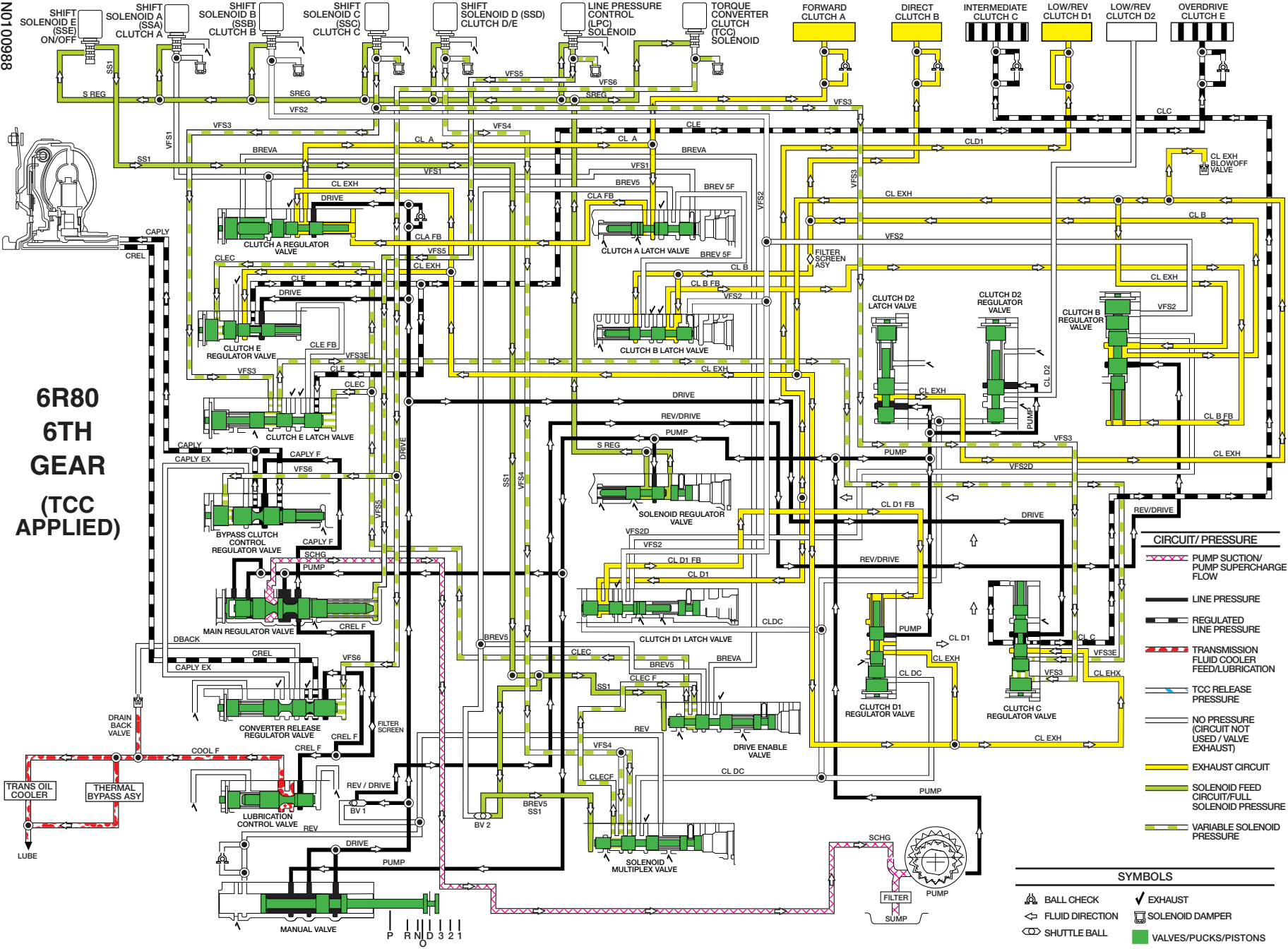

N01009983
6R80
1ST
GEAR
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
SOLENOID REGULATOR VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CONVERTER RELEASE REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
DRIVE ENABLE VALVE
LUBRICATION CONTROL VALVE
SOLENOID MULTIPLEX VALVE
MANUAL VALVE
DRAIN BACK VALVE
FILTER SCREEN
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
FILTER
SUMP
PUMP
P R N D 3 2 1
O
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS

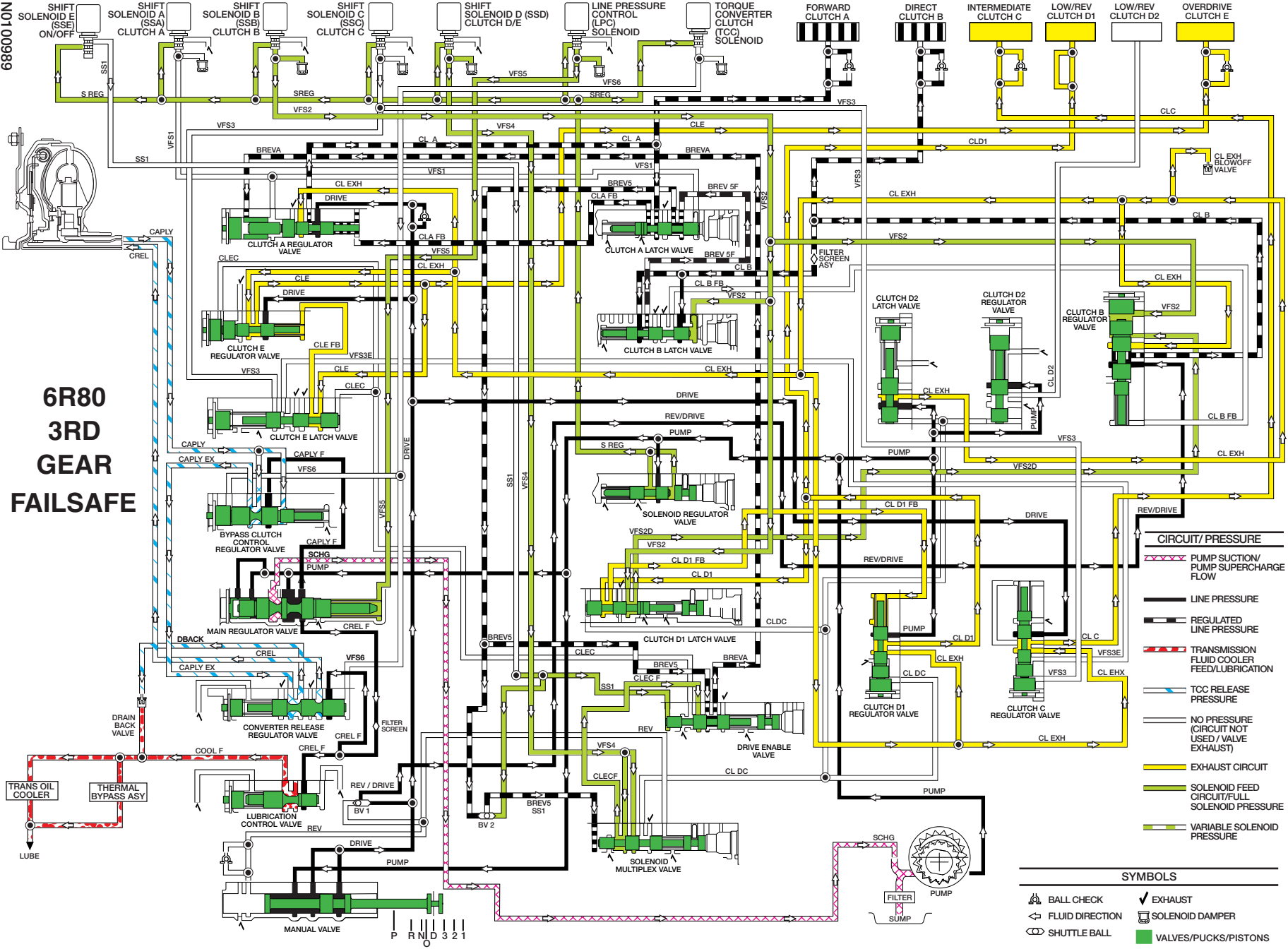

N01109984
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
6R80
2ND
GEAR
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
BYPASS CLUTCH CONTROL REGULATOR VALVE
SOLENOID REGULATOR VALVE
MAIN REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CONVERTER RELEASE REGULATOR VALVE
DRIVE ENABLE VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
DRAIN BACK VALVE
FILTER SCREEN
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
LUBRICATION CONTROL VALVE
SOLENOID MULTIPLEX VALVE
MANUAL VALVE
P R N D 3 2 1 O
FILTER
SUMP
PUMP
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS


N0100985
6R80
3RD
GEAR
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
SOLENOID REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
CONVERTER RELEASE REGULATOR VALVE
DRAIN BACK VALVE
FILTER SCREEN
DRIVE ENABLE VALVE
LUBRICATION CONTROL VALVE
SOLENOID MULTIPLEX VALVE
MANUAL VALVE
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
FILTER
SUMP
PUMP
P R N D 3 2 1
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS


N0109986
6R80
4TH
GEAR
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
S REG
SS1
SREG
VFS1
VFS2
VFS3
VFS4
VFS5
VFS6
CL A
CLE
CLC
CLD1
BREVA
BREV5
BREV 5F
CL EXH BLOWOFF VALVE
CL EXH
CL B
CLA FB
CLB FB
CLE FB
CLD1 FB
CLD2 FB
CLEC
CLEC F
CLDC
CL DC
CL C
CL EHX
DRIVE
REV/DRIVE
REV
PUMP
SCHG
CREL
CREL F
CAPLY
CAPLY F
CAPLY EX
DBACK
COOL F
VFS2D
VFS3E
CLECF
SBV
BV 1
BV 2
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
FILTER SCREEN ASY
SOLENOID REGULATOR VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CONVERTER RELEASE REGULATOR VALVE
DRAIN BACK VALVE
FILTER SCREEN
DRIVE ENABLE VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
LUBRICATION CONTROL VALVE
SOLENOID MULTIPLEX VALVE
MANUAL VALVE
P R N D 3 2 1
O
FILTER
SUMP
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS


N010009B7
6R80
5TH
GEAR
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
SS1
S REG
SREG
VFS1
VFS2
VFS3
VFS4
VFS5
VFS6
VFS2D
VFS3E
BREVA
BREV5
BREV 5F
CL A
CLA FB
CL B
CL B FB
CL C
CL D1
CL D1 FB
CL D2
CL E
CLE FB
CL EXH
CLC
CLD1
CLEC
CLEC F
CLECF
CLDC
CL DC
CL EHX
DRIVE
REV/DRIVE
REV
PUMP
CAPLY
CAPLY F
CAPLY EX
CREL
CREL F
SCHG
DBACK
COOL F
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
SOLENOID REGULATOR VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
DRIVE ENABLE VALVE
SOLENOID MULTIPLEX VALVE
CONVERTER RELEASE REGULATOR VALVE
LUBRICATION CONTROL VALVE
DRAIN BACK VALVE
FILTER SCREEN
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
BV 1
BV 2
MANUAL VALVE
P R N D 3 2 1
O
FILTER
SUMP
PUMP
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS


N010988
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
6R80
6TH
GEAR
(TCC APPLIED)
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
SOLENOID REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CONVERTER RELEASE REGULATOR VALVE
DRAIN BACK VALVE
FILTER SCREEN
DRIVE ENABLE VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
LUBRICATION CONTROL VALVE
BV 1
BV 2
SOLENOID MULTIPLEX VALVE
MANUAL VALVE
P R N D 3 2 1
O
FILTER
SUMP
PUMP
CAPLY
CREL
CLEC
CL E
CLE FB
CL A
CLA FB
BREVA
BREV5
BREV 5F
CL B
CL B FB
CL D1
CL D1 FB
CL D2
CL C
CL DC
CL EHX
CLA
CLB
CLC
CLD1
CLE
VFS1
VFS2
VFS2D
VFS3
VFS3E
VFS4
VFS5
VFS6
SS1
S REG
SREG
DRIVE
REV/DRIVE
REV
CL EXH
CAPLY F
CAPLY EX
DBACK
SCHG
CREL F
COOL F
CLECF
BREV5 SS1
REV / DRIVE
CLEC F
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS


N010089
6R80
3RD
GEAR
FAILSAFE
SHIFT SOLENOID E (SSE) ON/OFF
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID D (SSD) CLUTCH D/E
LINE PRESSURE CONTROL (LPC) SOLENOID
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
FORWARD CLUTCH A
DIRECT CLUTCH B
INTERMEDIATE CLUTCH C
LOW/REV CLUTCH D1
LOW/REV CLUTCH D2
OVERDRIVE CLUTCH E
CLUTCH A REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CL EXH BLOWOFF VALVE
FILTER SCREEN ASY
SOLENOID REGULATOR VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CLUTCH D1 LATCH VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH C REGULATOR VALVE
DRIVE ENABLE VALVE
SOLENOID MULTIPLEX VALVE
CONVERTER RELEASE REGULATOR VALVE
LUBRICATION CONTROL VALVE
DRAIN BACK VALVE
FILTER SCREEN
TRANS OIL COOLER
THERMAL BYPASS ASY
LUBE
MANUAL VALVE
P R N D 3 2 1 O
FILTER
SUMP
PUMP
BV 1
BV 2
CAPLY
CREL
CLEC
CLE
CL A
CLA FB
CL B
CL B FB
CL D1
CL D1 FB
CL D2
CLD1
CLC
CL C
CL DC
CLDC
CLECF
CL EXH
CL EXHX
CAPLY F
CAPLY EX
CREL F
CLEC F
COOL F
DBACK
SCHG
SREG
S REG
REV
REV/DRIVE
DRIVE
PUMP
BREVA
BREV5
BREV 5F
VFS1
VFS2
VFS2D
VFS3
VFS3E
VFS4
VFS5
VFS6
SS1
CIRCUIT/ PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
FLUID DIRECTION
SHUTTLE BALL
EXHAUST
SOLENOID DAMPER
VALVES/PUCKS/PISTONS

INTRODUCTION

NOTE: Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring any obligation.

REPAIR TECHNIQUES

Appropriate service methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions for performing service with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedure, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts.

NOTE, NOTICE, CAUTION AND WARNING

As you read through this manual, you may come across a **NOTE**, **NOTICE**, or **WARNING**. Older Manuals may also include a **CAUTION**. Each one is there for a specific purpose. A NOTE calls attention to unique, additional, or essential information related to the subject procedure. A **NOTICE** or **CAUTION** identifies a hazard that could damage the vehicle or property. A **WARNING** identifies a hazard that could result in severe personal injury or death to yourself or others. Some general **WARNINGS** that you should always follow when you work on a vehicle are listed below.

- **ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.**
- **KEEP SOLVENTS AWAY FROM IGNITION SOURCES. SOLVENTS MAY BE FLAMMABLE AND COULD IGNITE OR EXPLODE IF NOT HANDLED CORRECTLY.**
- **USE SAFETY STANDS WHENEVER A PROCEDURE REQUIRES YOU TO BE UNDER THE VEHICLE.**
- **MAKE SURE THAT THE IGNITION SWITCH IS ALWAYS IN THE OFF POSITION, UNLESS OTHERWISE REQUIRED BY THE PROCEDURE.**
- **SET THE PARKING BRAKE WHEN WORKING ON THE VEHICLE. IF YOU HAVE AN AUTOMATIC TRANSMISSION, SET IN PARK UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. IF YOU HAVE A MANUAL TRANSMISSION, IT SHOULD BE IN REVERSE (ENGINE OFF) OR NEUTRAL (ENGINE ON) UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. PLACE WOOD BLOCKS (4" X 4" OR LARGER) OR WHEEL CHOCKS AGAINST THE FRONT AND REAR SURFACES OF THE TIRES TO HELP PREVENT THE VEHICLE FROM MOVING.**
- **OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA TO AVOID THE DANGER OF CARBON MONOXIDE POISONING.**
- **KEEP YOURSELF AND YOUR CLOTHING AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE DRIVE BELTS.**
- **TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT METAL PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD, TAIL PIPE, THREE-WAY CATALYTIC CONVERTER AND MUFFLER.**
- **DO NOT SMOKE WHILE WORKING ON A VEHICLE.**
- **TO AVOID INJURY, ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY AND LOOSE CLOTHING BEFORE BEGINNING TO WORK ON A VEHICLE.**
- **WHEN IT IS NECESSARY TO WORK UNDER THE HOOD, KEEP HANDS AND OTHER OBJECTS CLEAR OF THE COOLING FAN BLADES!**

TOOLS

Commercially available hand tools and equipment are used along with Essential Special Service Tools (ESST) and Rotunda equipment. Power tools have become the acceptable industry standard and are used for disassembly only where applicable, unless specified otherwise in the Workshop Manual. The only exception to this policy is installing wheels in conjunction with the use of torque sticks, when possible.

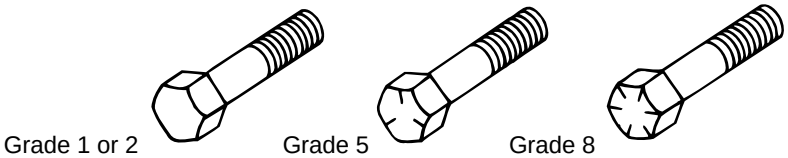
MATERIALS

Throughout this manual, chemicals or materials are specified that must be used to properly complete a service procedure or diagnostic step. In the event a specific material is not readily available, a substitute material meeting the same specification may be used. Substitute materials not meeting Ford specifications may cause degraded performance, premature failures, and/or vehicle component damage.

METRICS

BOLT STRENGTH IDENTIFICATION

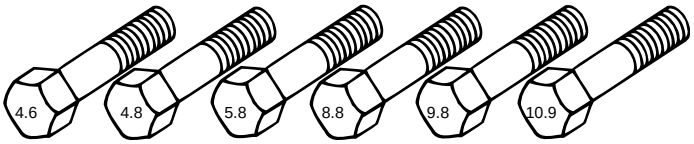
ENGLISH SYSTEM



Grade 1 or 2 Grade 5 Grade 8

English bolts: Identification marks on the bolt head represent Rockwell hardness. Generally, the bolt's grade is equal to the number of marks plus two. The higher the grade, the stronger the bolt.

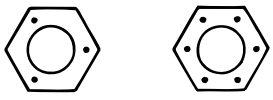
METRIC SYSTEM



Metric bolts: Identification class numbers on bolt heads represent tensile strength. Higher numbers indicate stronger bolts. Common metric fastener bolt strength properties are 9.8 and 10.9.

HEX NUT STRENGTH IDENTIFICATION

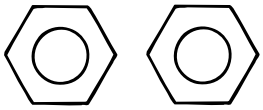
ENGLISH SYSTEM



Grade 5 Grade 8

Identification dots represent Rockwell hardness. The nut's grade is equal to the number of dots plus two. The higher the grade, the stronger the nut.

METRIC SYSTEM



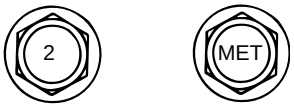
Identification class numbers on nuts represent tensile strength. Higher numbers indicate stronger nuts. Nuts may also have blue finish or paint daub on hex flat.

OTHER TYPES OF PARTS

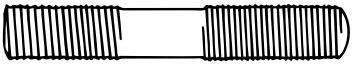
Metric identification schemes vary by type of part, most often a variation of that used for bolts and nuts. Note that many types of English and Metric fasteners carry no special identification if they are otherwise unique.



–Stamped U-Nuts



–Tapping, thread forming and certain other case hardened screws.





CLASS 10.9 CLASS 9.8 CLASS 8.8

–Studs, Large studs may carry the property class number. Smaller studs use a geometric code on the end.

Revision 1, 8/10/2000

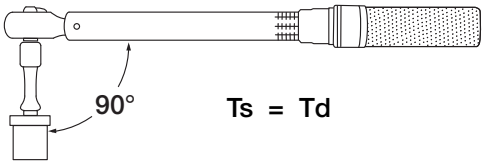
METRICS

ENGLISH/METRIC CONVERSION

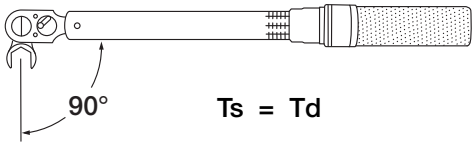
DESCRIPTION	MULTIPLY	BY	FOR METRIC EQUIVALENT
Acceleration	ft/s^2	0.3048	m/s^2
	in/s^2	0.0254	m/s^2
Torque	lb-in	0.11298	N·m
	lb-ft	1.3558	N·m
Power	horsepower	0.746	kW
Pressure or Stress	inches of water	0.2491	kPa
	psi	6.895	kPa
	psi	0.069	bar
Energy or Work	BTU	1055.0	Joules(J)
	lb-ft	1.3558	Joules(J)
	kiloWatt-hour	3,600,000 or 3.6×10^6	Joules(J)
Light	foot candle	10.764	lumens/square meter (lm/m^2)
Fuel Performance	miles/gal	0.4251	kilometers/liter (km/L)
	gal/mile	2.3527	liters/kilometer (L/km)
Velocity	mph	1.6093	kilometers/hour (km/h)
Length	inch	25.4	mm
	foot	0.3048	m
	yard	0.9144	m
	mile	1.609	km
Area	square inch (in^2)	645.2	mm^2
		6.45	cm^2
	square ft (ft^2)	0.0929	m^2
	square yard	0.8361	m^2
Volume	cubic inch (in^3)	16387.0	mm^3
		16.387	cm^3
		0.0164	liters (L)
	quart	0.9464	liters (L)
	gallon	3.7854	liters(L)
	cubic yard	0.7646	m^3
Mass	pound	0.4536	kg
	ton	907.18	kg
	ton	0.9078	tonne (t)
Force	kilogram	9.807	N
	ounce	0.2780	N
	pound	4.448	N
Temperature	degree Farenheit (˚F)	(˚F-32) 0.556	degree Celsius (˚C)

Revision 1, 8/10/2000

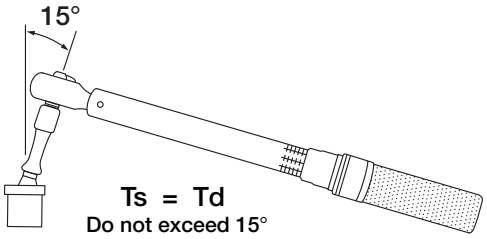
Torque Wrench Adapter Formulas



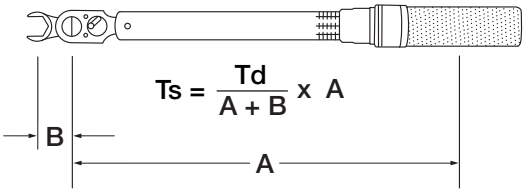
Ts = Td



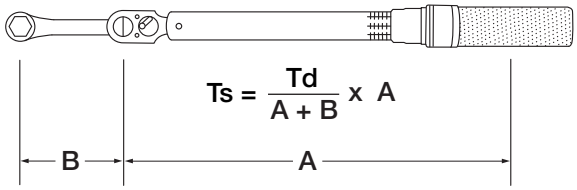
Ts = Td



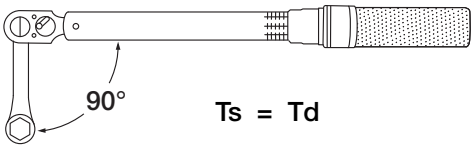
Ts = Td
Do not exceed 15°



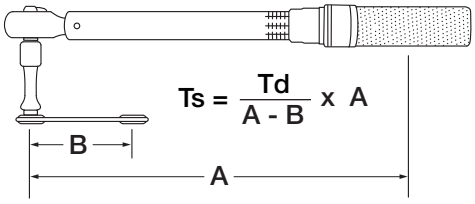
$$Ts = \frac{Td}{A + B} \times A$$



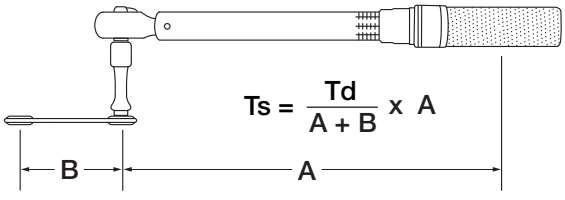
$$Ts = \frac{Td}{A + B} \times A$$



Ts = Td



$$Ts = \frac{Td}{A - B} \times A$$



$$Ts = \frac{Td}{A + B} \times A$$

TORQUE FORMULA LEGEND

Ts = Torque wrench setting
Td = Fastener torque desired
A = Torque wrench length
B = Torque adapter length

10/30/2007